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# Ownership Chains in Multinational Enterprises

Stefania Miricola, Armando Rungi & Gianluca Santoni

## Highlights

- Using a unique global dataset, we document key stylized facts: 54% of subsidiaries are controlled through indirect ownership, and ownership chains can span up to seven countries..
- We develop a structural model in which parent firms compete for control of subsidiaries and, when monitoring is costly, delegate control to an intermediate subsidiary in a strategically chosen location.
- Empirical evidence confirms that the ease of communication significantly affects the location choice of affiliates along ownership chains.
- We provide new insights into how multinational firms optimize their hierarchical ownership structures to balance control, monitoring, and operational efficiency.

## Abstract

This study examines how multinational enterprises (MNEs) structure ownership chains to coordinate subsidiaries across multiple national borders. Using a unique global dataset, we first document key stylized facts: 54% of subsidiaries are controlled through indirect ownership, and ownership chains can span up to seven countries. In particular, we find that subsidiaries further down the hierarchy tend to be more geographically distant from the parent and often operate in different time zones. This suggests that the ease of communication along ownership chains is a critical determinant of their structure. Motivated by these findings, we develop a location choice model in which parent firms compete for corporate control of final subsidiaries. When monitoring is costly, they may delegate control to an intermediate affiliate in another jurisdiction. The model generates a two-stage empirical strategy: (i) a trilateral equation that determines the location of an intermediate affiliate conditional on the location of final subsidiaries; and (ii) a bilateral equation that predicts the location of final investment. Our empirical estimates confirm that the ease of communication at the country level significantly influences the location decisions of affiliates along ownership chains. These findings underscore the importance of organizational frictions in shaping global corporate structures and provide new insights into the geography of multinational ownership networks.

## Keywords

Multinational Firms, Ownership Structure, Corporate Control.

## JEL

F23, L22, L23, G34.

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# Ownership Chains in Multinational Enterprises *

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## 1 Introduction

Multinational enterprises (MNEs) organize their global operations through complex ownership networks, which function as management conduits for subsidiaries across multiple countries. These structures often involve multi-tiered chains of intermediate affiliates, extending well beyond direct parent-subsidiary links. Recent evidence indicates that up to 56% of subsidiaries worldwide are indirectly controlled through an intermediate entity rather than by their immediate parent company (UNCTAD, 2016).

Despite their prevalence, the strategic rationale behind indirect ownership structures and their role in investment decisions remain underexplored. What drives MNEs' decisions on the location of intermediate affiliates along these chains? To what extent do geographic distance, communication frictions, and control mechanisms influence the organization of ownership networks?

This paper addresses these questions by combining new empirical evidence on the prevalence and structure of indirect ownership chains with a structural model explaining their formation. In doing so, we analyze a global database of 226,931 parent firms controlling 1,785,493 subsidiaries in 190 countries in 2019. We document new evidence on the

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geography and organization of indirect ownership chains. Motivated by this evidence, we propose a location choice model to explain the emergence of these structures. Our model is based on the premise that effective corporate governance requires efficient communication between parent and subsidiary managers. As a result, MNEs incur delegation costs when they use intermediate affiliates in strategically located jurisdictions to monitor distant subsidiaries.

The theoretical model provides a formal framework for understanding the geographic and hierarchical organization of ownership chains. Specifically, we estimate a system of two simultaneous equations: i) one equation that models the choice of intermediate affiliate locations, given the placement of newly acquired subsidiaries; and ii) another equation that explains the geographic distribution of newly acquired subsidiaries, incorporating factors that influence firms' control and coordination costs. Our results indicate that communication frictions play a fundamental role in determining the structure of ownership chains. The model's predictions remain robust when tested against alternative explanations, including tax optimization, labor market comparative advantage, and cultural proximity.

In our dataset on global parent-subsidiary relationships in 2019, indirect control emerges as the dominant strategy, with 54% of subsidiaries worldwide controlled by intermediate affiliates.[1] Complex MNEs - those that develop chains of ownership - account for 95% of global sales in our sample, underscoring the economic importance of this organizational structure. Exploring firm heterogeneity, we find that large MNEs with more than 100 subsidiaries make up only 1.2% of the global sample, but they operate in over 19 countries and span more than 15 industries, highlighting their outsized international footprint. Building on this heterogeneity, we examine the hierarchical depth and geographic structure of MNEs' ownership chains. Our findings show that hierarchical organization is indeed a defining characteristic of global firms. Nearly 80% of subsidiaries are located within three hierarchical levels of the parent, implying that two intermediate affiliates typically mediate between the parent and the ultimate subsidiary. In some cases, however, ownership chains extend over more than twelve levels, illustrating the remarkable depth of some corporate networks.

[1] This figure closely matches the 56% reported by UNCTAD (2016).

Interestingly, there is a strong correlation between the hierarchical position of subsidiaries and geographic distance. Subsidiaries further down the ownership chain tend to be further away from their parent companies. This suggests that the ease of communication plays a role in shaping the ownership structure. To measure this, we analyze the overlap of working hours between countries along the chain, using time zone differences as a proxy for communication frictions, following Stein and Daude (2007) and Bahar (2020). In particular, our results show that subsidiaries that are located deeper in the hierarchy have progressively less overlap in working hours with the managers of the parent company. Meanwhile, subsidiaries closer to the parent in the hierarchy experience more synchronous work schedules, which facilitate direct managerial supervision and coordination.

Building on this empirical evidence, we develop a structural model in which ownership chains emerge from a two-step investment decision. First, parent firms compete in a global auction for corporate control of new subsidiaries. Their bids take into account the option of delegating monitoring of the subsidiary to an intermediate affiliate located in a strategically chosen third country. The core of our model is an inspection game in which corporate control generates value based on the productivity of the parent firm and its network on the one hand, and the performance of newly acquired subsidiaries on the other. The valuation of new subsidiaries depends on managerial effort and monitoring intensity, both of which entail inspection costs. These costs include the option of delegating monitoring to an intermediate subsidiary, which creates a trade-off between direct control and delegated monitoring. In our framework, direct control is a special case of self-delegation, where delegation costs are effectively zero. Second, once the intermediate subsidiary is established, the parent firm makes the final investment decision regarding the placement of the subsidiary.

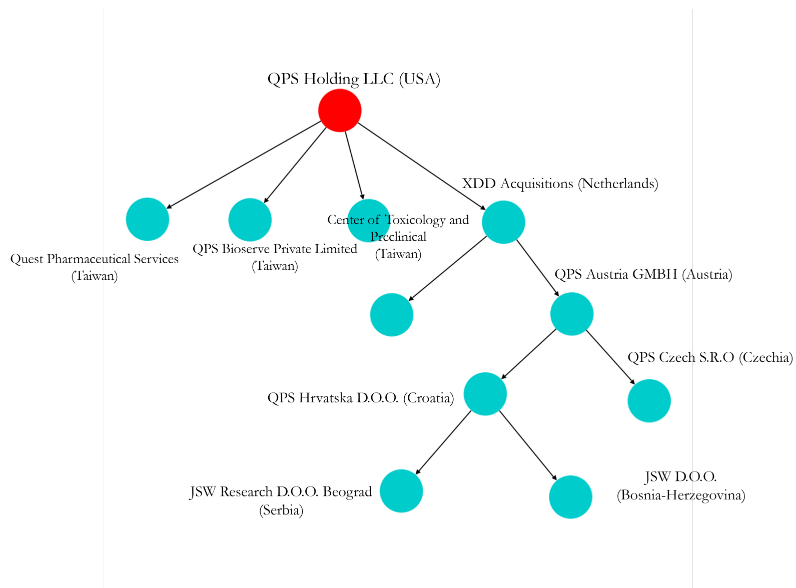
Our first testable equation estimates the likelihood that a parent firm in an origin country chooses a particular intermediate jurisdiction to establish an affiliate that controls a subsidiary in a destination country. Empirically, this corresponds to an aggregate tripartite model, where the dependent variable is the share of origin-intermediate-destination triplets in total origin-destination investment decisions. On the right-hand side, we proxy delegation and monitoring costs by including frictions between origin and intermediate countries and between intermediate and destination countries. Following our initial evidence, we include time zone differences as a proxy for communication frictions and further control for geographic distance, common language, colonial ties, common legal origins, home bias, and regional trade agreements. The second testable equation examines the probability of gaining global market control for subsidiaries in a destination country. Here, the dependent variable is the number of subsidiaries controlled by firms from a source country in a given destination. The right-hand side includes the predicted inspection costs between the source and destination, obtained from the first equation. Together, these two equations form a system of simultaneous equations, where the estimates from the first equation serve as inputs to solve the second equation, capturing the interdependence between delegation decisions and final investment decisions.

Our empirical analysis confirms our predictions regarding inspection costs, with ease of communication playing an essential role. The overlapping hours proxy is consistently positive and significant in all specifications, both for delegation costs between the origin and intermediate countries and for monitoring costs between the intermediate and destination countries. In particular, the relative magnitudes are in line with our theoretical predictions: delegation costs are systematically lower than monitoring costs. This pattern holds even when we examine the distribution of predicted inspection costs, taking into account the full set of bilateral frictions. Finally, when we include estimated inspection costs in the second equation, our model successfully predicts investment decisions between source and destination countries.

We further challenge our results through a series of robustness checks. First, we address the concern that alternative explanations may drive the organization of ownership chains. To test this, we include additional controls for tax differentials, wage differentials, and cultural/language proximity. Our results show mixed evidence for tax and wage effects, while cultural proximity consistently influences the selection of both intermediate and final subsidiary locations. In all cases, however, communication frictions remain a key determinant of ownership structure. We also examine whether our results are driven by sample composition effects. To test this, we conduct separate analyses for manufacturing, services, and financial groups. Across all of the subsamples, our core findings remain robust, confirming that the observed patterns in ownership chains are not driven by characteristics specific to the industry.

To illustrate the structure of ownership chains visually, we present the case of a medium-sized MNE in Figure 1. QPS Holding has a corporate structure that spans three continents: the Americas, Asia, and Europe. QPS Holding is an American multinational active in bioanalytical, preclinical, and clinical research services. The parent company is at the top of the ownership hierarchy, with direct or indirect ownership of subsidiaries through four levels of hierarchy. For example, *JSW Research DOO Beograd*, located in Serbia, is owned by a chain that includes three intermediate subsidiaries: *XDD Acquisition B.V.*, *QPS Austria GMBH* and *QPS Hrvatska DOO*. This case illustrates the multi-tiered organization of multinational corporations that we describe throughout the paper, and the role of intermediate subsidiaries in cross-border corporate structures.

Figure 1: Across the oceans - the corporate tree of QPS Holding




Note: The figure shows the corporate structure of an MNE extracted from our sample. The node on top represents the parent company, other downstream nodes represent subsidiaries, and arrows represent ownership linkages directed from one company to another. The parent company in the USA coordinates a chain across the Atlantic Ocean with an evident orientation from West to East, while directly owned subsidiaries on the other side of the Pacific Ocean are located in Taiwan.

Starting from its headquarters, this chain of ownership crosses four national borders - the United States, the Netherlands, Austria, and Croatia - before reaching its final subsidiary in Serbia. Notably, the chain follows a geographic trajectory that extends across the Atlantic Ocean, with affiliates located progressively farther from the United States. In the following sections, we provide evidence that this relationship between hierarchical position and geographic distance is statistically significant when analyzing the entire dataset.

The rest of the paper is organized as follows. Section 2 reviews the relevant literature. Section 3 introduces the data set and presents stylized facts on the heterogeneity, economic relevance, and geographic distribution of ownership chains. Section 4 outlines our structural model, while Section 5 describes the empirical strategy. The results are presented in Section 6 and further verified by robustness checks in Section 7. Finally, Section 8 provides concluding remarks.

## 2 Literature review

A central question in the study of the network of multinational enterprises (MNEs) is why firms establish complex hierarchical ownership structures. Previous economic literature has identified several drivers, including: knowledge transfer, governance and control, tax optimization, and production optimization. These factors interact to shape ownership chains, as firms must balance efficiency, control, and regulatory arbitrage when structuring their global operations. This paper contributes to the literature in two ways. First, we document the widespread presence of hierarchical ownership structures in MNEs' networks, highlighting their organizational complexity. Second, we examine how communication frictions - resulting from geographical, institutional, and contractual barriers - contribute to the formation of such structures. We argue that beyond tax motives and production efficiency, the need to maintain control, monitor subsidiaries, and reduce coordination costs plays a crucial role in shaping ownership chains.

One of the fundamental explanations for the emergence of hierarchical structures is knowledge transmission and management efficiency. Garicano (2000) conceptualizes firms as knowledge-based hierarchies in which managers' hierarchical differentiation optimizes knowledge allocation. Routine problems are handled at lower levels, while complex problems are escalated. This framework has been extended to multinational firms, emphasizing the importance of structuring the organization to facilitate knowledge flows across geographically dispersed units (Antràs et al., 2006; Caliendo and Rossi-Hansberg, 2012). Gumpert (2018) shows that firms face heterogeneous communication costs when transferring knowledge from headquarters to foreign affiliates, reinforcing the need for hierarchical complexity.[2] However, knowledge transfer alone

[2]Other authors have used a similar theoretical framework. Altomonte et al. (2021) propose and

does not fully explain organizational complexity. Beyond efficiency gains, firms must also retain control over dispersed operations, especially when facing institutional and contractual frictions. Gumpert et al. (2022) show that when the CEO's ability to oversee operations is limited, firms introduce intermediate layers of management to optimize control. Similarly, Aghion and Tirole (1997) highlight the trade-off between corporate control and decentralized decision-making, shaping governance structures within firms. Management literature has also emphasized that intermediate subsidiaries can serve as conduits for managerial coordination and knowledge flows within MNEs. Subsidiaries often act as critical nodes for internal knowledge transfer and coordination (Asmussen et al., 2011; Gupta and Govindarajan, 2000). Andersson et al. (2002) further highlight the strategic role of subsidiaries in developing capabilities and facilitating cross-unit learning within the group.

Indeed, governance concerns extend to the case of global ownership structures. Aminadav and Papaioannou (2020) examine patterns of corporate control around the world, focusing on ultimate controlling shareholders, and show that control is strongly correlated with shareholder protection, the stringency of labor contracts, and the power of unions. Fonseca et al. (2023) show that baseline gravity models are effective in predicting bilateral country linkages, with more populous, wealthy, and proximate countries more likely to have control relationships. They also highlight the role of shared legal traditions, cultural ties, and historical connections. Our paper builds on existing work by examining the internal mechanisms of corporate control, in particular how control is exercised within multinational firms through ownership chains, the role of intermediate affiliates, and the challenges posed by communication frictions and geographic distance. In practice, parent firms must decide how much control to exert over their foreign affiliates. They must balance internal monitoring with external contractual relationships. This decision is even more important when communication frictions and institutional weaknesses are taken into account. Giroud (2013) shows that headquarters prefer investing in subsidiaries that are geographically closer due to lower monitoring costs, which in turn enhances productivity. Chauvin et al. (2024) reveal that time-zone misalignment disrupts real-time coordination, increasing intra-firm communication costs. The role of

test a model in which problem-solving efficiency helps determine the optimal hierarchical form of a corporate group, with parent firms supervising subsidiaries and managing communication among them. Altomonte and Rungi (2013) examine the relationship between hierarchical complexity and vertical integration and find consistencies with predictions from knowledge-based models.

contractual incompleteness is equally important. Ottaviano and Turrini (2007) show that weak contract enforcement significantly influences firms' decisions on whether to own foreign affiliates or rely on arm's-length relationships. When contracts are incomplete, MNEs prefer direct ownership over outsourcing to reduce hold-up risks, leading to more hierarchical structures. This perspective extends previous governance theories by showing that firms internalize operations not only to improve knowledge flows but also to mitigate legal uncertainties and transaction risks. Additionally, Bloom et al. (2012) provide empirical evidence that firms with high internal trust are more likely to delegate decision-making, which affects hierarchical organization.

While corporations use hierarchical structures to maintain control and mitigate contractual risks, ownership chains are also shaped by regulatory considerations. The ability to shift profits across jurisdictions with different corporate tax rates provides a strong incentive for multinationals to create multi-layered ownership networks that facilitate the tax-efficient allocation of income. Unlike knowledge spillovers, which primarily improve internal efficiency, or control concerns, which focus on monitoring and governance, tax-motivated ownership complexity minimizes regulatory costs rather than operational coordination. Grubert (2003), highlighting the role of tax-motivated affiliate networks, shows that a substantial amount of income shifting by US MNEs occurs through intermediate holding companies that facilitate the routing of profits through conduit entities in tax-advantaged jurisdictions. More recently, Ferrari et al. (2022) develop a general equilibrium framework to analyze the impact of international tax rate differentials on corporate structuring. Their results show that the elasticity of shifted profits to tax rates is nearly three times larger than that of the tax base, underscoring how MNEs actively design ownership networks to minimize tax burdens rather than merely responding to production or operational needs. Empirical evidence confirms the large-scale impact of tax optimization on MNEs' structuring. Laffitte and Toubal (2022) document how firms strategically shift both sales and profits to tax havens, often disproportionately reporting revenues in low-tax jurisdictions while real economic activity remains elsewhere. Although tax optimization is a central driver of ownership complexity, other factors also play a role.[3] Recent tax policy efforts, including

[3] For example, Lewellen and Robinson (2013) and Dyreng et al. (2015) show that US multinationals often establish intermediate holding companies to facilitate regulatory arbitrage. See also Francois and Vicard (2023) for recent evidence that complex ownership chains are associated with treaty shopping and tax-efficient investment routing.

the OECD's Global Minimum Tax initiative, aim to reduce tax incentives for complex ownership networks by limiting tax rate differentials across jurisdictions (Ferrari et al., 2022). As global tax enforcement evolves, understanding the interplay between regulatory frameworks, tax planning, and deal structuring remains critical.

A key driver of multinational ownership is the need for hierarchical coordination of production and supply chains. Global companies structure their ownership networks to accommodate cross-jurisdictional interdependencies and ensure operational efficiency while maintaining management control over dispersed operations. Tintelnot (2017) develops a general equilibrium model showing that MNEs optimize production networks through trade-offs between the fixed costs of maintaining multiple locations and the efficiency gains from consolidating operations. Similarly, Arkolakis et al. (2018) and Wang (2021) show that MNEs make interdependent decisions about plant location, managerial control, and supply chain structure that are driven by economies of scale and coordination efficiencies. To facilitate technology transfer, sourcing, and logistics, firms often rely on intermediary subsidiaries that help bridge geographic and institutional gaps. Head and Mayer (2019) highlight how MNEs design supply chains to ensure brand consistency across markets, thereby reinforcing hierarchical control. These structures enhance continuity and efficiency in global value chains by reducing transaction costs associated with contractual incompleteness, supplier risk, and regulatory barriers.[4]

Against this background, our paper investigates the role of communication frictions in the formation and organization of multinational ownership networks. We document the widespread diffusion of such structures and provide a simple theoretical framework, based on Head and Ries (2008), to rationalize the role of intermediary subsidiaries in managing and monitoring foreign affiliates in the presence of heterogeneous communication frictions. In doing so, we contribute to the growing literature on global firm organization and provide new insights into the determinants of multinational ownership structures.

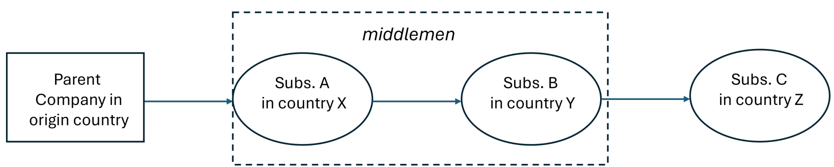
[4]A related framework by Keller and Yeaple (2013) models firms' decisions to embed technological knowledge in traded intermediates or to transfer it directly to foreign affiliates.

# 3 Mapping multinational ownership networks

We construct a global dataset of multinational enterprises (MNEs) and their ownership structures using firm-level data from the Orbis database[5] Additional country-level covariates complement our analyses as needed, and they are described in Appendix Table C1.

When we refer to ownership structures, we mean the hierarchical control perimeter established by a parent company over its affiliates, which may be organized in ownership chains. The hypothetical chain of ownership in Figure 2 illustrates this concept. A subsidiary is directly controlled if the parent company holds an absolute majority of the voting rights in its shareholders' meeting (e.g. parent company directly controls subsidiary A in Figure 2). Indirect control occurs when a subsidiary is owned through an intermediate affiliate that is itself controlled by the parent (e.g. Parent indirectly controls Subsidiaries B and C through an intermediary in Figure 2).

Figure 2: A fictional ownership chain




Note: Each node in the fictional graph represents a formally independent company, and each link is a stake that allows control of voting rights to the immediate upstream node. The parent company is a corporate shareholder on top of any ownership chain, while one or more *middlemen* subsidiaries connect the parent company with a final subsidiary. Companies can be active in different countries.

To extract ownership structures from raw data, we apply the framework developed by Rungi et al. (2017). This approach reconstructs ownership chains from the bottom up, starting from a global ownership matrix that includes all firms and their shareholders, without imposing a control threshold. Whenever a corporate shareholder appears in a firm's shareholder list, the algorithm initiates the detection of ownership chains.[6] For this study, we focus on multinational enterprises (MNEs), defined as parent firms that

[5]The Orbis ownership database, a product of Moody's, has been widely used in research on MNEs. See, for example, Fonseca et al. (2023), Del Prete and Rungi (2017), and Cravino and Levchenko (2016).

[6]In brief, the procedure identifies the parent company by tracing ownership structures from the bottom up, considering: (i) direct control, where a firm holds an absolute majority stake (50%+1); (ii) indirect control by transitivity, where majority stakes align to form an ownership chain; and (iii) consolidated control, where fragmented stakes across subsidiaries collectively exceed the control threshold. Further details on the extraction of corporate control are provided in Appendix 8.

control at least one subsidiary located in a country other than their own.

Our final dataset includes 226,931 parent firms active in 2019 that collectively control 1,785,493 subsidiaries in 190 countries. Table 1 provides a geographic breakdown of parent companies and subsidiaries by host economy. The European Union (EU) accounts for 42% of parent enterprises and 33% of subsidiaries, reflecting the region's high degree of economic integration and geographical proximity. Within the EU, the Netherlands, Germany, Italy, France and Spain host the largest number of both parent enterprises and subsidiaries. Asia is the second most important region with 14.7% of parent enterprises and 19.3% of subsidiaries. Among the Asian economies, China and Japan account for the largest shares of MNEs in our data set.

Table 1: Geographic distribution of MNEs by host economy in 2019: Parent companies, intermediate affiliates, and final subsidiaries

| | Parent Companies | % | Total Subsidiaries | % | *of which* Intermediate Affiliates | % |
|---|---|---|---|---|---|---|
| **EU27** | **94,780** | **41.77%** | **590,017** | **33.05%** | **105,376** | **39.22%** |
| *of which* | | | | | | |
| Netherlands (the) | 11,060 | 4.87% | 64,656 | 3.62% | 17,215 | 6.41% |
| Germany | 10,608 | 4.67% | 107,659 | 6.03% | 16,856 | 6.27% |
| Italy | 7,729 | 3.41% | 41,617 | 2.33% | 7,192 | 2.68% |
| France | 6,980 | 3.08% | 51,774 | 2.90% | 9,163 | 3.41% |
| Spain | 5,654 | 2.49% | 43,425 | 2.43% | 6,928 | 2.58% |
| **Asia** | **33,395** | **14.72%** | **344,736** | **19.31%** | **38,693** | **14.40%** |
| *of which* | | | | | | |
| China | 5,915 | 2.61% | 127,154 | 7.12% | 14,583 | 5.43% |
| Japan | 5,109 | 2.25% | 33,360 | 1.87% | 2,241 | 0.83% |
| Singapore | 1,498 | 0.66% | 35,547 | 1.99% | 6,416 | 2.39% |
| South Korea | 1,341 | 0.59% | 5,353 | 0.30% | 323 | 0.12% |
| **Other Europe** | **30,495** | **13.44%** | **204,749** | **11.47%** | **40,188** | **14.96%** |
| *of which* | | | | | | |
| UK | 14,856 | 6.55% | 133,366 | 7.47% | 30,363 | 11.30% |
| Switzerland | 8,790 | 3.87% | 13,047 | 0.73% | 2,873 | 1.07% |
| Norway | 2,191 | 0.97% | 17,273 | 0.97% | 3,308 | 1.23% |
| **USA** | **24,507** | **10.80%** | **389,691** | **21.83%** | **51,520** | **19.18%** |
| **Latin America** | **22,805** | **10.05%** | **80,875** | **4.53%** | **8,015** | **2.98%** |
| *of which* | | | | | | |
| The Caribbean | 17,831 | 7.86% | 29,814 | 1.67% | 4,552 | 1.70% |
| Brazil | 447 | 0.20% | 11,786 | 0.66% | 793 | 0.30% |
| Mexico | 312 | 0.14% | 11,895 | 0.67% | 583 | 0.22% |
| Argentina | 134 | 0.06% | 3,448 | 0.19% | 197 | 0.07% |
| **Africa** | **6,100** | **2.69%** | **43,656** | **2.45%** | **4,022** | **1.50%** |
| *of which* | | | | | | |
| South Africa | 725 | 0.32% | 16,297 | 0.91% | 2,351 | 0.88% |
| Nigeria | 115 | 0.05% | 1,374 | 0.08% | 60 | 0.02% |
| Egypt | 154 | 0.07% | 2,381 | 0.13% | 114 | 0.04% |
| **Oceania** | **6,034** | **2.66%** | **57,071** | **3.20%** | **11,589** | **4.31%** |
| *of which* | | | | | | |
| Australia | 4,336 | 1.91% | 41,371 | 2.32% | 9,418 | 3.51% |
| **Canada** | **4,587** | **2.02%** | **33,725** | **1.89%** | **4,272** | **1.59%** |
| **Russia** | **3,178** | **1.40%** | **37,313** | **2.09%** | **4,170** | **1.55%** |
| **Rest of the World** | **1,050** | **0.46%** | **3,660** | **0.20%** | **804** | **0.30%** |
| **Total** | **226,931** | **100.00%** | **1,785,493** | **100.00%** | **268,649** | **100.00%** |

Note: The table reports the number of parent companies, intermediate affiliates, and final subsidiaries across different regions. Intermediate affiliates are subsidiaries that both control other entities and are themselves controlled within an ownership chain. The last columns highlight the number and share of intermediate affiliates, which serve as linking entities between parent companies and final subsidiaries.

The United States has fewer parent firms than the European Union and Asia, but these firms control a larger number of firms. In particular, when we combine the United States and Europe, they account for about two-thirds of both parent firms and subsidiaries in our dataset. This pattern is consistent with aggregate FDI statistics, which show that developed economies attract the majority of global FDI inflows (UNCTAD, 2016).

Turning to intermediate affiliates, shown in the rightmost columns of the table 1, we find that they are present in all economies, with no country hosting exclusively directly controlled affiliates. In general, their distribution closely follows that of parent enterprises. Two notable exceptions emerge, however. The United States and Australia host subsidiaries that are typically positioned within longer ownership chains, as indicated by their high ratios of intermediate affiliates to parent firms (1.78 and 1.62, respectively). This suggests that MNEs based in these countries rely more heavily on third countries and intermediate affiliates to structure their global operations, probably due to their geographical remoteness. In contrast, Caribbean countries have shorter ownership chains, with the lowest ratio of intermediate affiliates to parent companies (0.22) in our dataset. This suggests that firms operating there tend to minimize the number of intermediate layers in their corporate networks.

In the following sections, we further investigate the role of tax avoidance strategies observed in the Caribbean. Meanwhile, the reliance on longer chains in the US and Australia supports the hypothesis that geographic distance increases the use of intermediate affiliates, a finding consistent with our later empirical analysis.

## 3.1 Stylized facts I: heterogeneity and relevance

The role of indirect control relationships and ownership chains in MNEs has been largely overlooked in the economic literature, most likely due to data limitations. To fill this gap, we first present some stylized facts about complex ownership chains. Then, we turn to the theoretical and empirical framework that explains why such chains can arise.

- *Most subsidiaries of multinational enterprises are indirectly controlled through ownership chains.*

A key observation is that most subsidiaries of MNEs are controlled indirectly through ownership chains. Table 2 classifies all subsidiaries in our dataset based on the type of control exercised by the parent companies, regardless of geographic location or firm size. We find that 54% of subsidiaries are indirectly controlled, underscoring the prevalence of multi-tiered corporate structures. Referring to the hypothetical ownership chain in

Figure 2, directly controlled subsidiaries maintain a direct link to the parent company, while indirectly controlled subsidiaries are linked through other subsidiaries, forming multilevel ownership chains.

Table 2: Direct and indirect control of subsidiaries

| Type of control | N. subsidiaries | % |
|---|---|---|
| Direct control | 827,516 | 45.81 |
| Indirect control | 978,952 | 54.19 |
| Total | 1,806,468 | 100.00 |

Note: a parent company exerts direct control over a subsidiary when it holds the majority of voting rights. Indirect control occurs when the parent company controls a subsidiary through an intermediate affiliate within an ownership chain.

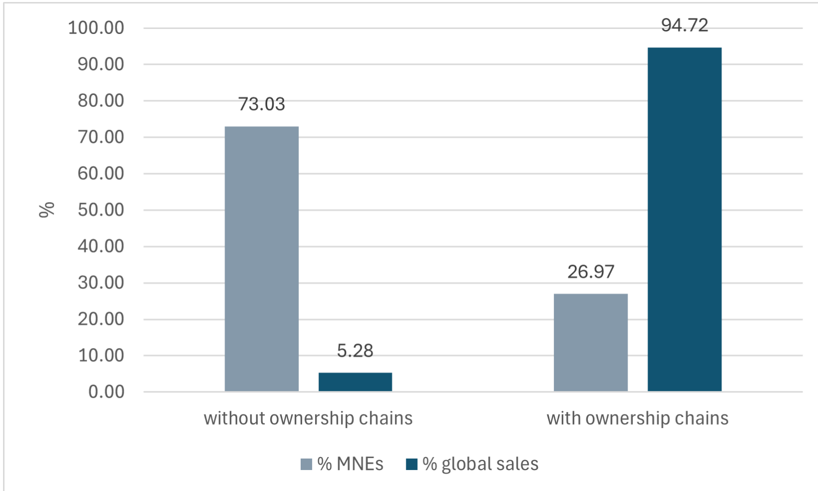
- *Complex multinational enterprises with ownership chains have a relevant economic weight, as they represent the lion's share (95%) of global sales by multinational enterprises.*

Complex multinational enterprises that operate through ownership chains account for a disproportionate share of global economic activity, accounting for 95% of total MNE revenues, despite representing only 27% of the firms in our dataset. In Figure 3, we distinguish between MNEs that exclusively use direct control over subsidiaries (left panel) and MNEs that include at least one ownership chain (right panel). While the latter group is numerically smaller, it dominates global sales, reinforcing the idea that larger corporate networks tend to be structured through multi-tiered ownership chains.[7] This pattern emerges because MNEs without ownership chains tend to be smaller in size. On average, they generate 0.107 billion USD in revenue, compared with 1.782 billion USD for complex MNEs with chains of ownership.[8]

[7] Our findings are consistent with previous studies by Rungi et al. (2017); Altomonte and Rungi (2013), which show that the largest percentile of MNEs by corporate perimeter accounts for approximately 75% of global sales.

[8] Ownership data tend to be more comprehensive than financial accounts because tax authorities require full disclosure of shareholding structures, while financial reporting requirements vary across jurisdictions. As a result, financial data may be incomplete due to exemptions and reporting discrepancies. In our analysis, we assume that missing sales data are not systematically correlated with firm size. Alternative imputation methods do not significantly alter our results, as confirmed in Table 3. Appendix Figure C1 illustrates that sample selection bias is often driven by geographic coverage rather than firm size.

Figure 3: MNEs, ownership chains, and their economic weight

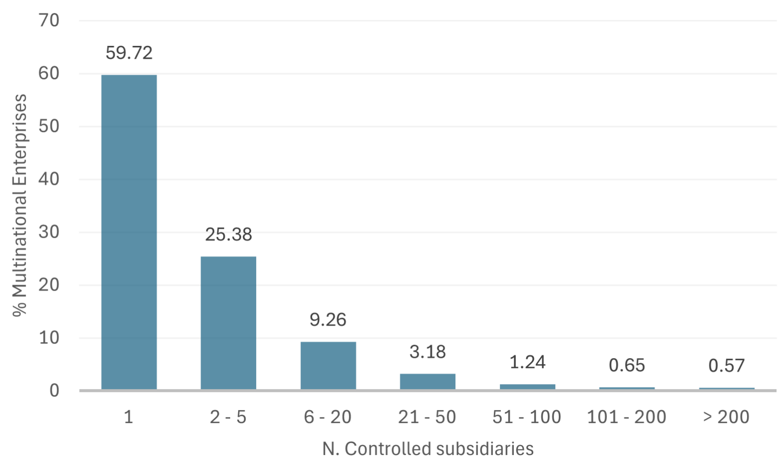



Note: On the left, we represent MNEs that have only direct control of subsidiaries, hence no ownership chain. On the right, we represent MNEs with ownership chains. The first bars represent percentages of the total sample by number of parent companies. The second series represents sums of operating revenues generated by the subsidiaries and their parent companies in 2019.

- *MNEs are heterogeneous by number of subsidiaries, number of ownership chains, number of countries in which they locate subsidiaries, and number of industries in which subsidiaries operate.*

MNEs exhibit considerable heterogeneity in their organizational structure, varying in the number of subsidiaries, ownership chains, host countries, and industries in which they operate. In Figure 4, we classify MNEs according to the number of subsidiaries they control (x-axis) and report their frequency distribution (y-axis). The first bar represents the simplest MNEs, which control only one subsidiary. More complex MNEs, owning at least two subsidiaries, can choose to structure them along an ownership chain. The distribution is highly skewed, with a long right tail, indicating that only 1.2% of MNEs control more than 100 subsidiaries. This heterogeneity goes beyond the number of subsidiaries controlled. MNEs also vary significantly in the number of countries in which they operate and the diversity of industries in which their subsidiaries operate, further highlighting the complexity of global corporate structures.

Figure 4: MNEs' corporate perimeters




Note: Number of controlled subsidiaries per MNE on the x-axis and the frequency of MNEs on the y-axis. The first bar indicates the simplest MNEs, consisting of one parent and one subsidiary. Complexity of ownership structure is possible only with more than two subsidiaries.

Table 3 provides further evidence of the heterogeneity of MNEs' corporate structures. Looking first at the number of subsidiaries controlled, we find an average of 7.93 subsidiaries per parent company. But this masks a highly skewed distribution. The median MNE controls only one subsidiary, while the third quartile of MNEs reaches three subsidiaries per parent company. Moving to the right tail, we find that MNEs at the 90th percentile have more than 10 subsidiaries, and only at the 99th percentile do we reach the most complex MNEs, which control more than 120 subsidiaries, with a maximum of 5,075 subsidiaries worldwide.[9] [10] A similarly skewed pattern is observed when focusing on intermediate affiliates. The median MNE has zero intermediate affiliate, but the right tail expands sharply, with a jump from 2 to 20 subsidiaries between the 90th and 99th percentiles.

Looking at geographic dispersion, Table 3 shows that the average MNE operates in 2.81 countries. Since our definition of an MNE requires at least one foreign subsidiary, the minimum number of countries is two. However, the 90th percentile includes firms operating in four countries, while at the 99th percentile the number jumps to 19 coun-

[9]This is the case of Berkshire Hathaway, the largest multinational conglomerate holding company in the United States, ultimately owned by Warren Buffett.

[10]In Appendix Figure C2, we estimate the distribution of controlled subsidiaries using a negative binomial regression, which yields a mean of 1.882 and an overdispersion parameter of 0.581. The figure visually represents a log-log plot of the frequency distribution of subsidiaries per parent.

tries and reaches a maximum of 147.[11] Finally, industry diversification follows a similar pattern. The most complex MNEs, those in the right tail of the distribution, operate in more than 15 industries at the 99th percentile, reaching a maximum of 64 industries.[12]

Table 3: Heterogeneous distributions of MNEs

| Variable | Mean | st. dev. | Min | p50 | p75 | p90 | p99 | Max |
|---|---|---|---|---|---|---|---|---|
| N. controlled subsidiaries | 7.93 | 50.09 | 1 | 1 | 3 | 10 | 120 | 5,075 |
| N. middlemen | 1.18 | 7.72 | 0 | 0 | 1 | 2 | 20 | 688 |
| N. of industries | 2.19 | 3.01 | 1 | 1 | 2 | 4 | 15 | 64 |
| N. of countries | 2.81 | 3.92 | 2 | 2 | 2 | 4 | 19 | 147 |

Note: The table reports moments of distributions of MNEs. Industries are considered at the 2-digit NACE rev. 2 level. Countries and territories follow the ISO code 2-digit classification.

- *Bigger multinational enterprises have more subsidiaries and, on average, longer ownership chains.*

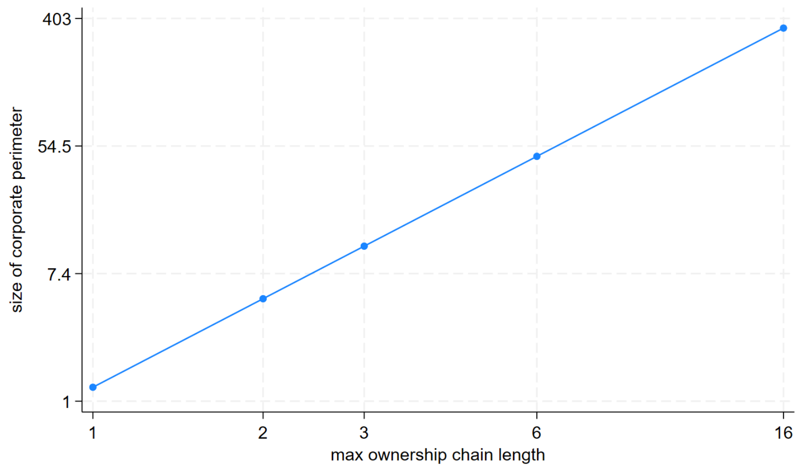
The relationship between the number of subsidiaries controlled by an MNE and the maximum length of its ownership chains is illustrated in Figure 5. The plot represents the predicted ranges of a regression model in which the dependent variable is the logarithm of the firm's scope and the maximum chain length (also in logs) is the key explanatory variable. The relationship appears to be non-linear, with an estimated elasticity of 2.01, suggesting that ownership chains tend to lengthen disproportionately as firms grow. However, large MNEs do not always adopt deep hierarchical structures. Some firms maintain flat ownership networks in which all subsidiaries remain directly controlled by the parent company.[13]

[11] This extreme case corresponds to DHL, the globally recognized logistics and courier group.

[12] According to our data, this is the case of HSBC Holdings PLC, originally founded as the Hongkong and Shanghai Banking Corporation and now a British banking group headquartered in London.

[13] For example, Assyce Fotovoltaica SL, a Spanish provider of solar energy equipment, directly controls approximately 300 subsidiaries without intermediate affiliates.

Figure 5: Number of controlled subsidiaries and maximum ownership chain length




Note: The figure shows predicted margins after a log-log regression model where the dependent variable is the number of controlled subsidiaries, the regressor is the maximum length of ownership chains by MNE, and whose coefficient indicates an elasticity equal to 2.01.

## 3.2 Stylized facts II: hierarchical positions and geographical distances

So far, we have presented key stylized facts describing MNEs and their ownership chains. In this section, we want to highlight two key patterns linking ownership and geography that underlie the analysis presented in the remainder of this paper. We begin with a measure of the length of ownership chains.

- *On average, an ownership chain consists of three subsidiaries, with 80% of subsidiaries positioned within three hierarchical layers of the parent company. This implies that, in most cases, two intermediate affiliates separate the parent from the final subsidiary.*

A defining feature of the organizational complexity of multinational firms is their vertical structure, in which subsidiaries are arranged at multiple levels of the hierarchy, allowing the parent company to coordinate management decisions. This implies that ownership chains can extend over a number of levels and shape the way in which firms manage their global operations.

To illustrate these patterns, we present the geography of the ownership chain in Table 4, with domestic affiliates listed separately at the bottom. Columns 1 to 3 report the hierarchical distance of foreign affiliates from their parents, i.e. the number of

Table 4: How distant are subsidiaries from parent companies? Complex MNEs

| Hierarchy (1) | N. subs. (2) | % (3) | Countries (4) | N. subs. (5) | % (6) | Distance (th. km) (7) | N. subs. (8) | % (9) |
|---|---|---|---|---|---|---|---|---|
| 1 | 350,228 | 39.00 | 1 | 475,491 | 52.95 | ≤ 5.0 | 413,546 | 47.29 |
| 2 | 247,358 | 27.55 | 2 | 335,588 | 37.37 | 5.0 - 7.5 | 202,758 | 23.18 |
| 3 | 133,535 | 14.87 | 3 | 67,892 | 7.56 | 7.5 - 10.0 | 105,782 | 12.1 |
| 4 | 73,380 | 8.17 | 4 | 15,461 | 1.72 | 10.0 - 12.5 | 66,684 | 7.62 |
| 5 | 40,893 | 4.55 | 5 | 2,683 | 0.3 | 12.5 - 15.0 | 37,441 | 4.28 |
| 6 | 21,949 | 2.44 | 6 | 687 | 0.08 | 15.0 - 17.5 | 39,891 | 4.56 |
| 7 | 13,204 | 1.47 | 7 | 158 | 0.02 | >17.5 | 8,458 | 0.97 |
| 8 | 7,395 | 0.82 | | | | | | |
| 9 | 4,292 | 0.48 | | | | | | |
| 10 | 2,545 | 0.28 | | | | | | |
| 11 | 1,377 | 0.15 | | | | | | |
| 12 | 908 | 0.10 | | | | | | |
| >12 | 896 | 0.10 | | | | | | |
| domestic | 774,484 | 46.31 | domestic | 774,484 | 46.31 | domestic | 774,484 | 46.31 |
| Total | 1,672,444 | 100.00 | Total | 1,672,444 | 100.00 | Total | 1,672,444 | 100.00 |

Note: The table reports descriptive evidence on foreign subsidiaries controlled by multinational enterprises. The simplest MNEs with only one direct subsidiary are excluded. Columns 1, 2 and 3 on the left indicate the position in the ownership hierarchy, i.e. how many control links run from the HQs to the single subsidiary. Columns 4, 5, and 6, in the centre, count how many national borders are crossed along an ownership chain to reach a final subsidiary from the headquarters. Columns 7, 8, and 9 on the right report the geographic distance (thousands km) separating final subsidiaries from parent companies. Distance is measured between the most populated cities of hosting countries.

ownership links required to reach a subsidiary from the headquarters. While a relative majority (39%) of foreign subsidiaries are directly controlled by the parent enterprise (hierarchical level 1, with no intermediate enterprises), the majority are located further down the hierarchy, at level 2 or above. However, as ownership chains lengthen, longer structures become increasingly rare, with only a small fraction of affiliates beyond the tenth hierarchical level.[14]

Beyond hierarchical structure, we also examine geographic distance along ownership chains, considering two complementary distance measures. Columns 4 to 6 capture the number of national borders crossed before reaching a subsidiary. Our findings show that most foreign subsidiaries (53%) are located only one country away from their parent. Nevertheless, 37% of the final subsidiaries are integrated into ownership chains that span at least two countries, while 7.6% are located three countries away. Only in exceptional cases do parent firms establish ownership chains that extend up to seven countries (0.02%) from the parent's home country.

Finally, we take a more classical approach by measuring the physical distance in

[14] The longest hierarchical distance observed in our dataset is 21 levels, indicating an ownership chain where 20 intermediate affiliates separate the headquarters from the final subsidiary.

kilometers between headquarters and subsidiaries, as reported in columns 7 to 9 of Table 4. These data, obtained from Conte et al. (2022) (CEPII database), represent the distance between the main cities in the countries where the headquarters and subsidiaries are located. One could hardly expect that 47.3% of the subsidiaries are located within 5,000 km of the parent company, a somewhat narrower range than expected. Beyond this threshold, the distribution has a long right tail, with subsidiaries located at increasing distances from the parent.[15]

- *Subsidiaries situated at more distant hierarchical levels in ownership chains are, on average, geographically farther from the parent company.*

We illustrate these patterns in Figures 6 and 7, where we analyze the relationship between the affiliate's position in the ownership chain and its geographic distance from the parent. The relationship is estimated by means of the following equation:

$$Y_{p(i)s(j)} = \beta_0 + \beta^l hier_{p(i)s(j)} + \beta_1 X_{s(j)} + +\delta_{p(i)} + \epsilon_{p(i)s(j} \quad (1)$$

where $Y$ represents either the geographical distance (in thousands of km) or the number of overlapping working hours between the parent in country $i$ and its affiliate in country $j$. The main coefficient of interest, $\beta^l$, corresponds to a categorical variable measuring the hierarchical distance ($l$), i.e. the number of ownership links separating the subsidiary from the parent. The model also includes affiliate-level controls such as size and age ($X_{s(j)}$), while parent-level fixed effects ($\delta_{p(i)}$) allow us to capture variation within MNEs.

In Figure 6, we present the estimated coefficients ($\beta^l$) with confidence intervals, showing the relationship between hierarchical position and geographic distance. We find a positively increasing and statistically significant distance premium relative to the base category (first-tier subsidiaries). In other words, subsidiaries positioned further down the hierarchy tend to be geographically further away from the parent company. However, the degree of variation is not negligible, as the confidence intervals widen at lower hierarchical levels where there are fewer affiliates.

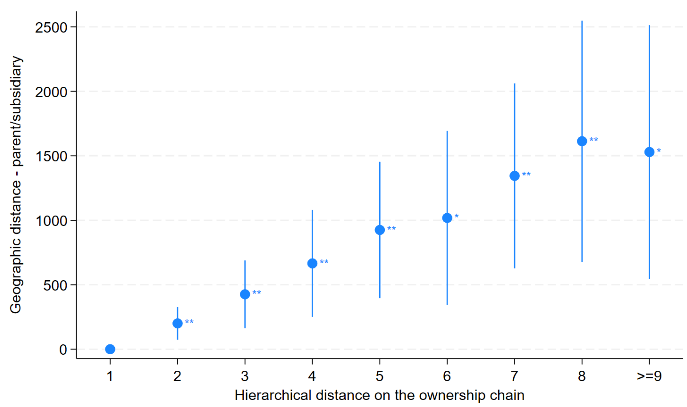
A complementary pattern emerges in Figure 7, where we analyze the association between hierarchical position and overlapping working hours between the parent and its subsidiaries. Results suggest that as subsidiaries move further down the ownership chain, the number of overlapping hours with the parent systematically decreases. This

[15] The longest observed distance in our dataset is 19,950 km, between Paraguay and Taiwan.

has critical implications for managerial coordination: subsidiaries at the bottom of longer ownership chains are more likely to operate outside the working hours of parent managers, implying that corporate decisions may need to be delegated to intermediate subsidiaries.

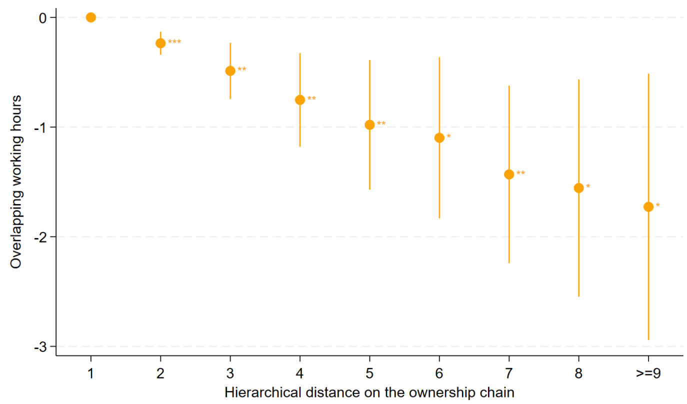
This finding is central to our structural model presented in Section 4. The core intuition is that parent firms structure ownership chains to facilitate efficient managerial coordination. When subsidiaries are geographically distant, direct supervision becomes impractical, necessitating delegation. If this hypothesis holds, then the observed structure of ownership chains reflects the communication needs of managers at different hierarchical levels, providing a rationale for the relationships documented in Figures 6 and 7.

Figure 6: Geographical distance vs hierarchical distance between a parent and its affiliates




Note: The figure presents the estimated coefficients from an econometric analysis regressing the geographical distance between parent companies and their affiliates on a categorical variable representing hierarchical distance. A parent-company fixed effect is included to capture within-MNE variation, along with controls for the size and age of intermediate affiliates. The base category corresponds to hierarchical distance 1, where the parent directly controls the subsidiary. Consequently, all coefficients represent the variation in geographical distance relative to this base category. Hierarchical distances of 9 or greater are grouped into a single category. Standard errors, clustered at the parent-company level, are reported in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Figure 7: Overlapping working hours and hierarchical distance of a parent and its affiliates




Note: The figure presents the estimated coefficients from an econometric analysis regressing overlapping working hours—used as a proxy for communication frictions—on a categorical variable representing hierarchical distance between parent companies and their subsidiaries. A parent-company fixed effect is included to capture within-MNE variation, along with controls for subsidiary size and age. The base category corresponds to hierarchical distance 1, where the parent directly controls the subsidiary. Consequently, all coefficients represent the variation in overlapping working hours relative to this base category. Hierarchical distances of 9 or greater are grouped into a single category. Standard errors, clustered at the parent-company level, are reported in parentheses (*** $p<0.01$, ** $p<0.05$, * $p<0.1$).

Finally, in Appendix B, we provide additional evidence using naive unstructured models to analyze the relationship between MNEs' investment decisions and geography. This exercise also highlights the empirical challenges that researchers and policymakers may face when network information about ownership chains is not taken into account.

# 4 A structural model for ownership chains

Motivated by previous empirical evidence, we present a simple model to explain location strategies along ownership chains in multinational enterprises (MNEs). Inspired by Head and Ries (2008), we assume a competitive contest in which headquarters compete to invest in new subsidiary assets worldwide while incurring monitoring costs. Specifically, in the case of ownership chains, each headquarters faces a choice: it can either directly monitor a final target subsidiary or delegate monitoring to an intermediate managerial unit - an intermediate affiliate (sometimes referred to as a middleman). These intermediate affiliates are subsidiaries that are already part of the corporate structure before the auction takes place. A subsidiary is added to an ownership chain when the headquarters delegates or self-delegates monitoring, i.e. when the cost of delegation is effectively zero. In the latter case, we have the special case of direct control.

The investment decision process unfolds in two steps. First, the headquarters bids in an auction for a new target subsidiary, conditional on the inspection costs given the location of the target. Second, if it wins at the auction, it delegates the unit located in an intermediate jurisdiction that minimizes inspection costs. As a result, inspection costs affect the bidding strategy in the auction. Importantly, the headquarters always retains the option to monitor subsidiaries directly, in which case no intermediate affiliate is necessary.

Our model abstracts from production processes between headquarters and subsidiaries. While our setup does not exclude the possibility of supply chain coordination, it also applies to conglomerates and diversified business portfolios, where monitoring remains crucial for governance and managerial control.[16]

[16] To assess whether the length of ownership chains is associated with increasing distance in the production space, we ran a regression in which the hierarchical distance of an affiliate from its parent served as the dependent variable, including, among other controls, the "production distance", i.e. $upstreamness_{ij}$, a measure from Alfaro et al. (2019). While the coefficient was statistically significant, its magnitude was negligible. This suggests that an implausibly long ownership chain would be required for an economically meaningful difference in production stages between parent and subsidiary. In our data, these results suggest that ownership chains are primarily shaped by organizational considerations rather than sequential production optimization. Results are available upon request.

## 4.1 The inspection game

To formalize the decision-making process, we introduce a classical inspection game between the headquarters (Hq) and a target subsidiary (Sub). This framework helps headquarters determine the maximum bid they can offer in auctions for new subsidiaries. The possible strategies and corresponding payoffs for both players are summarized in Table 5.[17]

In this corporate governance game, profits arise from the value generated by the headquarters (Hq) and its existing perimeter of subsidiaries ($A$),[18] as well as by the additional subsidiary ($b$), conditional on the effort exerted by the subsidiary's manager ($e$). Headquarters can choose to monitor $q$ or trust $1-q$ the subsidiary. Similarly, the subsidiary's manager can work $(1-p)$ or shirk $(p)$. If the subsidiary works, headquarters pays a wage $w$; however, if headquarters monitors and discovers shirking, the wage and the value of the subsidiary default to zero ($w = b = 0$).

Table 5: The inspection game

| | | | **Sub** | |
|---|---|---|---|---|
| | | | *Work* $(1-p)$ | *Shirk* $p$ |
| **Hq** | *Trust* | (1-q) | $A+b-w, w-e$ | $A-w, w$ |
| | *Monitor* | $(q)$ | $A+b-w-C, w-e$ | $A-C, 0$ |

The headquarters (Hq) bears an inspection cost ($C$) to verify the activities of the subsidiary (Sub), a concept that we elaborate on in the next section. In the classical version of this game, we assume $b \geq w \geq e \geq C \geq 0$, which results in no pure-strategy Nash equilibrium. Therefore, in a mixed-strategy equilibrium, the expected payoffs for Hq and Sub are:

$$v = A + b(1-p) - Cq - w(1-pq)$$

$$u = w(1-pq) - e(1-p)$$

[17] A textbook version of this inspection game was originally introduced by Fudenberg and Tirole (1991) and later adapted to the FDI context by Head and Ries (2008). We adapt their framework by incorporating the possibility of an intermediate monitoring unit within the multinational firm's ownership network.

[18] The existence of a corporate perimeter before new acquisitions implies that $A = \sum_f a_f$, meaning that the total value is generated by both Hq and all existing subsidiaries, regardless of new acquisitions.

The first-order conditions for Hq and Sub are given by:

$$v_q = -C + wp = 0 \quad \text{and} \quad v_p = -wq + e = 0$$

From these, we derive the equilibrium mixing probabilities:

$$p = C/W \quad \text{and} \quad q = e/w$$

Substituting these into Hq's expected payoff, we obtain an initial expression for the valuation of Sub by Hq:

$$v = A + b(1 - C/w) - w$$

Substituting this into Equation 4.1, we obtain the final valuation function that Hq assigns to Sub:

$$v = A + b - 2\sqrt{bC} \tag{2}$$

Since corporate control operates in a global market, all Hqs play the same inspection game when evaluating subsidiaries that are available for acquisition. Consequently, competition ensures that the winning Hq is the one offering the highest valuation, determined by equation 2. It is important to note that, compared to the classical literature on delegation and monitoring in hierarchical structures (Holmstrom and Tirole, 1989), our framework relies on a number of simplifying assumptions regarding the contractual environment. First, we assume no information asymmetry between Hqs and intermediate affiliates (Mids), i.e. each party perfectly observes the other's effort. Second, we exclude the possibility of side contracting, thus eliminating potential collusion between Mids and Subs. Finally, we treat the effort made by Mids as exogenous. In the next section, we examine how these assumptions shape Hq's decision process and monitoring cost design.

## 4.2 Monitoring and delegation costs

When acquiring a subsidiary (Sub), headquarters (Hq) can choose between two monitoring strategies: (i) direct monitoring, where Hq monitors the subsidiary itself; or (ii) delegated monitoring, where Hq delegates the monitoring task to an intermediate affiliate (Mid). There are costs associated with both monitoring and delegation. More specifically, a Hq in country $i$ that wants to monitor a Sub in country $j$ wants to minimize the following composite cost function:

$$C_{ikj} = \delta_{ik} + \delta_{kj} - \epsilon_{ikj} \quad (3)$$

where: $\delta_{kj}$ represents the cost incurred by a Mid in country $k$ to monitor a Sub in country $j$; $\delta_{ik}$ represents the cost incurred by Hq in country $i$ to delegate monitoring to a Mid in country $k$; $\epsilon_{ikj}$ is a stochastic unobservable factor specific to the $ikj$-th ownership chain that captures idiosyncratic variations in the business environment that may increase or decrease monitoring costs. Notably, we assume, realistically, that delegated monitoring is always less expensive than direct monitoring, such that: $\delta_{kj} \geq \delta_{ik} > 0$.

In addition, the inspection game also applies to domestic targets. Each headquarters competes in a global auction for all available subsidiaries, including those in its home country. Thus, this framework accounts for ownership chains composed of both foreign and domestic subsidiaries.

#### 4.2.1 The case of domestic subsidiaries

Domestic subsidiaries require a separate discussion because they introduce three different location strategies within ownership chains:

1. Headquarters (Hq) and an intermediate affiliate (Mid) are both located in the same home country ($i$) and control a foreign subsidiary (Sub) in country ($j$). This scenario creates a domestic segment within the ownership chain, where the cost structure follows: $\delta_{kj} \geq (\delta_{ik} = \delta_{ii}) > 0$. This implies that delegating monitoring to a domestic Mid remains cheaper than direct monitoring by Hq, even within the same country.

2. All three entities — Hq, Mid, and Sub — are located within the same home country ($i$). In this case, the composite cost function simplifies to: $2\delta_{ii} > 0$. Here, monitoring and delegation costs are identical but remain greater than zero because domestic frictions − although smaller than foreign frictions − are still present. Since internal distances differ between countries, geography alone does not determine the chain structure. In the absence of other cost factors, Mid and Sub could theoretically swap positions within the ownership chain without affecting total costs, meaning that only the sequence of acquisitions determines their relative placement.

3. In rare cases, the Hq in country $(i)$ delegates monitoring to a foreign Mid in country $(k)$, which then monitors a domestic Sub in $(i)$. This results in a roundtripping strategy, where an offshore intermediate affiliate is placed in the chain even though the final subsidiary is located in the same country as the parent. One possible explanation is that domestic investors use offshore intermediaries to shelter their investments from the public authorities through foreign shell companies. However, our model did not account for these cases.[19]

#### 4.2.2 The case of direct control

The simplest strategy for Hq is to retain full corporate control and not delegate monitoring to a Mid. In this case, Hq self-delegates, which means that delegation costs are effectively zero. More formally, in our model, direct control is treated as a valid location choice without delegation, represented as a $ikj$-th triplet where the intermediate jurisdiction $(k)$ is null, i.e. $k = \emptyset$.

### 4.3 A two-step investment decision

Building on the framework introduced in the previous sections, we derive a system of two equations that model the two-step investment decision process: (i) a triangular equation that determines the location of an intermediate affiliate (Mid), conditional on the location of final subsidiaries (Subs); and (ii) a bilateral equation that determines the location of final subsidiaries (Subs).

#### 4.3.1 Locations of the chain

We assume that $\epsilon_{ikj}$ is independently and identically distributed (i.i.d.) following a Type I extreme value distribution. The probability that Hq in country $i$ selects country $k$ as the monitoring location, conditional on investing in country $j$, corresponds to the probability that $C_{ikj}$ is minimized. This yields:

$$\begin{aligned}
\pi_{ik|j} = \mathbb{P}(\mathcal{M}_{ik} = 1) &= \mathbb{P}(C_{ikj} \leq C_{i\ell j}, \forall \ell \neq k) \\
&= \mathbb{P}(\delta_{ik} + \delta_{kj} - \epsilon_{ikj} \leq \delta_{i\ell} + \delta_{\ell j} - \epsilon_{i\ell j}, \forall \ell \neq k) \\
&= \mathbb{P}(\epsilon_{i\ell j} \leq \delta_{i\ell} + \delta_{\ell j} - \delta_{ik} - \delta_{kj} + \epsilon_{ikj}, \forall \ell \neq k)
\end{aligned}$$

[19] According to our data, we observe 21,624 cases of roundtripping, where at least one intermediary is located abroad, but the final subsidiary remains in the same country as the parent. These cases represent about 0.01% of all final subsidiaries.

which we can write:

$$\mathbb{P}(\mathcal{M}_{ikj} = 1) = \int_{-\infty}^{+\infty} F[\delta_{i\ell} + \delta_{\ell j} - \delta_{ik} - \delta_{kj} + \epsilon_{ikj}, \forall \ell \neq k] f(\epsilon_{ikj})\, d\epsilon_{ikj} \tag{4}$$

where $\mathcal{M}_{ikj} = 1$ if Hq in country $i$ willing to invest in country $j$ chooses its monitoring unit in country $k$. F[•] is the joint cumulative distribution function, conditional on the value of $\epsilon_{ikj}$. By integrating $F[\bullet]$ with respect to the marginal probability density function $f(\epsilon_{ikj})$, we obtain the unconditional probability - the probability that country $k$ is chosen as the monitoring location for any given realization of $\epsilon_{ikj}$.

Since $f(\epsilon_{ikj})$'s are iid, the conditional probability is the product of $K-1$ univariate cumulative density functions:

$$\begin{aligned}\mathbb{P}(\mathcal{M}_{ikj} = 1) &= \int_{-\infty}^{+\infty} \prod_{\ell \neq k} F_\ell[\delta_{i\ell} + \delta_{\ell j} - \delta_{ik} - \delta_{kj} + \epsilon_{ikj}] f(\epsilon_{ikj})\, d\epsilon_{ikj} \\ &= \int_{-\infty}^{+\infty} e^{-\epsilon_{ikj}} exp(-e^{-\epsilon_{ikj}}) \prod_{\ell \neq k} exp(-exp(-(\delta_{i\ell} + \delta_{\ell j} - \delta_{ik} - \delta_{kj} + \epsilon_{ikj}))\, d\epsilon_{ikj}\end{aligned} \tag{5}$$

Using the change of variable $z_k = e^{-\epsilon_{ikj}}$ and $y_\ell = e^{-(\delta_{i\ell}+\delta_{\ell j})}$ integrating by substitution:

$$\begin{aligned}\mathbb{P}(\mathcal{M}_{ikj} = 1) &= \int_0^{+\infty} e^{-z_k} \prod_{\ell \neq k} e^{-\frac{y_\ell}{y_k} z_k}\, dz_k \\ &= \int_0^{+\infty} e^{-z_k} e^{-z_k \sum\limits_{\ell \neq k} \frac{y_\ell}{y_k}}\, dz_k \\ &= \int_0^{+\infty} e^{-z_k \sum\limits_{\ell} \frac{y_\ell}{y_k}}\, dz_k \\ &= -\frac{y_k}{\sum\limits_\ell y_\ell} \left[ e^{-z_k \sum\limits_{\ell=1}^{N} \frac{y_\ell}{y_k}} \right]_0^{+\infty} \\ &= \frac{y_k}{\sum\limits_\ell y_\ell} \\ &= \frac{e^{-(\delta_{ik}+\delta_{kj})}}{\sum\limits_\ell e^{-(\delta_{i\ell}+\delta_{\ell j})}}\end{aligned}$$

We now derive the first testable equation, which characterizes the location choice for ownership chains.

**I. Locations of ownership chains** *The probability that Hqs in country $i$ select country $k$ as the monitoring location for a Sub in country $j$ is given by:*

$$\pi_{ik|j} = \mathbb{P}(\mathcal{M}_{ikj} = 1) = \frac{e^{-(\delta_{ik}+\delta_{kj})}}{\sum\limits_{\ell} e^{-(\delta_{i\ell}+\delta_{\ell j})}} \tag{6}$$

where we can define $\mathcal{C}_{ij} = -ln[\sum\limits_{\ell} e^{-(\delta_{i\ell}+\delta_{\ell j})}]$ as the expected aggregate cost of locations $j$ for Hqs in country $i$, whatever the intermediate country $k$.

### 4.3.2 Probability of winning the auction for corporate control

Headquarters (Hqs) compete for control of new subsidiaries (Subs) by participating in an auction. Each Hq places a bid for each Sub based on its valuation function: $v = A + b - 2\sqrt{bC}$.

The highest valuation wins the auction, i.e. the marginal probability of a Hq in country $i$ gaining control over a Sub in country $j$ is given by the probability that the highest valuation for a given Sub in $j$ comes from an Hq located in $i$, i.e. the maximum valuation in $i$ is the highest among the maxima of all competing countries. This probability is:

$$\pi_{ij} = \mathbb{P}(\mathcal{N}_{ij} = 1) =$$

$$= \mathbb{P}(a_n^{max} \leq a_i^{max} - 2\sqrt{bC_{ij}} + 2\sqrt{bC_{nj}}, \forall n \neq i)$$

where $\mathcal{N}_{ij} = 1$ if an Hq in country $i$ wins control of a Sub in country $j$. We denote by $m_i$ the number of Hqs in country $i$. $A_i$ is distributed as a Gumbel with parameters $\mu$ and $\sigma$ and the maximum of $m$ Gumbel draws is distributed as a Gumbel with the same $\sigma$ and $\mu$ right-shifted by a quantity $\sigma \ln(m)$.

Following the same steps as in equations 4 and 5, and integrating by substitution, we derive the second testable equation.

**II. Probability of controlling subsidiaries** *The probability that a Hq located in country i wins the auction for the control of a Sub located in j is given by:*

$$\pi_{ij} = \frac{m_i \ \exp\Big( - (2\sqrt{bC_{ij}})/\sigma + \mu_i/\sigma \Big)}{\sum_n m_n \exp\Big( - (2\sqrt{bC_{nj}})/\sigma + \mu_n/\sigma \Big)} \tag{7}$$

# 5 Empirical strategy

In this section, we connect theory and empirics to identify the structural parameters of equations 6 and 7. The first equation describes the parent's strategy for locating new subsidiaries along ownership chains, while the second characterizes the probability that the parent will gain control of a subsidiary in a given location.

We assume that $\pi_{ik|j}$ is identical across parents, which allows us to derive an aggregate form of the testable equation. By summing individual location choices, we define $M_{ikj}$, which represents the number of parents in country $i$ that delegate monitoring responsibilities to an intermediate affiliate in country $k$ for final subsidiaries located in country $j$.[20] We obtain the expected value of $M_{ikj}$ as:

$$\mathbb{E}[M_{ikj}] = \pi_{ik|j} M_{ij} = exp(-\delta_{ik} - \delta_{kj} + \mathcal{C}_{ij} + \ln M_{ij})$$

Given the previous empirical equation, we now provide an interpretation for the costs of delegation ($\delta_{ik}$) and monitoring ($\delta_{kj}$), building on the evidence presented in Section 3 and Appendix B. Following the arguments of Stein and Daude (2007) and Bahar (2020), we proxy for organizational frictions using communication barriers between the country of the parent ($i$) and the country of the intermediate affiliate ($k$), and between the country of the intermediate affiliate ($k$) and the country of the ultimate subsidiary ($j$). We assume that time zone differences serve as an important source of friction, as they make it difficult to communicate in real time along the chain of ownership. Considering a 10-hour working day, we compute the number of overlapping working hours between firms based on their respective country locations. Thus, we denote by

[20] Note that direct control is a special case of an ownership chain in which the parent self-delegates monitoring. In this case, $k$ represents a null country and the delegation cost is zero.

$wh_{ik}$ and $wh_{kj}$ the number of overlapping hours between the parent and the intermediate affiliate on the one hand, and between the intermediate affiliate and the final subsidiary on the other hand. Using this framework, we derive the following structural triangular equation:

$$\mathbb{E}\left[\frac{M_{ikj}}{M_{ij}}\right] = exp(\beta wh_{ik} + \rho wh_{kj} + \alpha_1 X_{ik} + \alpha_2 X_{kj} + FE_{ij}) \tag{8}$$

where the result represents the share of triplets $(ijk)$ among all observed triplets, and $\beta$ and $\rho$ represent our coefficients of interest. Beyond organizational frictions, we introduce two vectors of geographic and institutional control variables - $X_{ik}$ and $X_{kj}$ - that account for additional factors that may hinder coordination along ownership chains. These controls include bilateral geographic distance, common borders, common language, common legal origin, colonial ties, and participation in regional trade agreements. Finally, we include the bilateral fixed effect $(FE_{ij})$, which captures the expected aggregate cost index, $\mathcal{C}_{ij}$, as from the denominator of Equation 6.
Having established the triplet structure, we turn to the final investment decision, described in equation 7. We assume that the probability of choosing destination $j$ is constant across parent firms in a given country $i$. Investment decisions are then aggregated into the variable $M_{ij}$, which represents the total number of new subsidiaries in $j$ held by parents in $i$, either through direct or indirect control paths. The expression for the expected value of $M_{ij}$ is given by:

$$\begin{aligned}\mathbb{E}[M_{ij}] &= \pi_{ij} M_j \\ &= exp\left(\ln\left(\frac{m_i}{\sum_n m_n}\right) + \frac{\mu_i}{\sigma} + \ln M_j - \ln S_j - (2\sqrt{bE[C_{ikj}]})/\sigma\right)\end{aligned}$$

where $S_j$ is the weighted average productivity level of competing firms from other countries, adjusted for the cost they incur in overseeing activities in $j$. This makes $S_j$ a measure of the degree of competition to acquire assets in market $j$. Meanwhile, $M_j$ is the total number of subsidiaries operating in $j$, and $E[C_{ikj}]$ is the expected value of the inspection cost of a Hq in country $i$ that controls a Sub in country $j$, having chosen a representative $k$.
To control for country-specific factors, we include fixed effects for source and destination countries in equation 7. The home country fixed effect $(FE_i)$ captures the share of parent companies headquartered in $i$, along with their average productivity. The destination market fixed effect $(FE_j)$ reflects the size and competitiveness of the market,

including both the number of affiliates and the degree of competition from other firms. After substituting $E[C_{ikj}] = \frac{\hat{\mathcal{C}}_{ij}}{K}$, where $\hat{\mathcal{C}}_{ij}$ is the estimate of the bilateral fixed effect from the first step, and imposing $\theta = \frac{2\sqrt{b}}{\sigma}$, we obtain the structural equation for final investments:

$$\mathbb{E}[M_{ij}^{A}] = exp(-\theta\sqrt{\frac{\hat{\mathcal{C}}_{ij}}{K}} + FE_i + FE_j) \tag{9}$$

where $\theta$ is our coefficient of interest, and $FE_i$ and $FE_j$ represent origin and destination fixed effects, respectively. Finally, equations 8 and 9 form a system of two testable equations, which we estimate using a Pseudo-Poisson Maximum Likelihood (PPML) estimator, following Silva and Tenreyro (2006).

# 6 Results

The baseline results are reported in Table 6. The first column presents estimates for the triangular equation specified in equation 8. Our results confirm that ease of communication has a significant impact on delegation and monitoring decisions, thereby influencing the location choices of intermediate affiliates. An increase of one overlapping working hour between the parent and intermediate affiliates increases the expected fraction of final subsidiaries controlled by the intermediate $k$ by 5.6%, calculated as $(e^{0.055} - 1) \times 100$. Similarly, an increase of one overlapping work hour between the intermediary and the location of the final subsidiary increases the expected share of subsidiaries controlled by the intermediate $k$ by 10.5%, calculated as $(e^{0.1} - 1) \times 100$. Importantly, the relative magnitudes of these effects match expectations. As anticipated, delegation costs are less binding than monitoring costs, meaning that a reduction in the second coefficient (monitoring) has about twice the effect of a reduction in the first (delegation).

Table 6: Baseline results

| **Location of:** | **Middlemen** | **Final subsidiaries** |
| --- | --- | --- |
| Dep. var. | $M_{ikj}/M_{ij}$ | $M_{ij}$ |
| **N. of overlapping working hours**$_{ik}$ | **0.055*** ** (0.006) | |
| **N. of overlapping working hours**$_{kj}$ | **0.100*** ** (0.006) | |
| Distance (arcsin)$_{ik}$ (km) | -0.030*** (0.010) | |
| Distance (arcsin)$_{kj}$ (km) | -0.172*** (0.013) | |
| RTA$_{ik}$ | 1.261*** (0.028) | |
| RTA$_{kj}$ | 0.807*** (0.026) | |
| Language$_{ik}$ | 0.685*** (0.030) | |
| Language$_{kj}$ | 0.419*** (0.033) | |
| Colony dependence$_{ik}$ | 1.534*** (0.048) | |
| Colony dependence$_{kj}$ | 1.520*** (0.048) | |
| Legal origins$_{ik}$ | 0.236*** (0.028) | |
| Legal origins$_{kj}$ | 0.225*** (0.026) | |
| Home$_{ik}$ | 5.392*** (0.048) | |
| Home$_{kj}$ | 3.597*** (0.057) | |
| Direct control$_{ikj}$ | 0.836*** (0.057) | |
| $\sqrt{\frac{\hat{\mathcal{C}}_{ij}}{K}}$ | | –140.892*** (14.004) |
| Observations | 1,718,840 | 9,712 |
| Fixed effects | $i \times j$ | i,j |

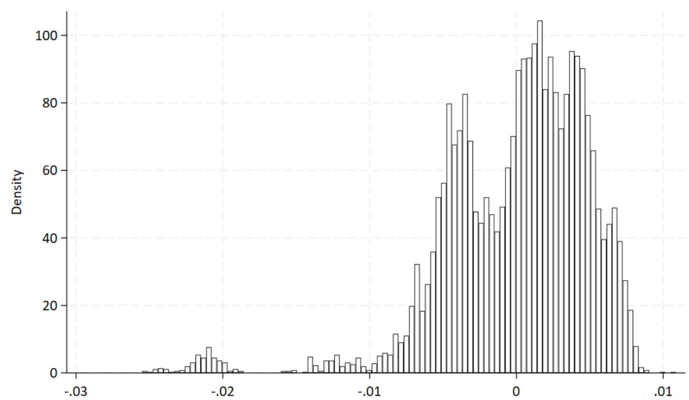
Note: Given the presence of zeros in the case of direct control, we scale the distances in km by using the hyperbolic sine transformation ($ln(x + \sqrt{x^2 + 1})$), which allows approximating to the natural logarithm while retaining the zeros (Bellemare and Wichman, 2020). Standard errors are double-clustered by origin and destination in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

In addition to organizational costs, we assumed that other controls capture both geographic and institutional frictions that affect delegation and monitoring decisions.

Interestingly, the coefficients on geographic distance follow a pattern similar to that of overlapping hours. An increase in the distance between the parent and the intermediate affiliate reduces the share of subsidiaries controlled by country $k$ by 2.9% ($(e^{0.03} - 1) \times 100$). Similarly, increasing the distance between the intermediate firm and the subsidiary reduces the share of subsidiaries controlled by country $k$ by 15.8% ($(e^{0.172} - 1) \times 100$).

Finally, the last column of Table 6 presents the coefficient of the vector of the expected cost of corporate control ($E[C_{ikj}]$), obtained from previous estimates. The coefficient obtained corresponds to $\theta$ in equation 9, and its sign and magnitude are as expected: an increase in the cost index reduces the number of subsidiaries in country $j$ controlled by parents in country $i$. Figure 8 shows the distribution of the expected inspection cost for each origin $i$ and destination $j$, which is a useful byproduct of our structural model.

Figure 8: Distribution of the inspection cost




Note: The figure shows the distribution of the expected cost of corporate control estimated after Eq. 8. The value can be negative or positive depending on the prevalence of gravity components (overlapping working hours, geographical distance, regional trade agreements, common language, colony dependence, legal origins) that proxy frictions with a negative or positive coefficient.

# 7 Robustness and sensitivity checks

In this section, we conduct a number of robustness checks to support our main conclusions. First, we examine whether tax optimization, rather than organizational costs, drives the location choice of intermediate jurisdictions. In the first column of Table 7, we introduce controls for corporate tax differentials, calculated as the ratio of the average profit tax in the destination to the origin, using data from the World Bank's

Doing Business (2019). The profit tax measures the total burden on a typical firm as a percentage of commercial profits. These additional results confirm that investment shares in the $ikj$ triplet increase when country $k$ offers a relatively more favorable tax environment. However, while corporate tax differentials play a role, they do not diminish the importance of organizational costs in shaping ownership chains.

A second concern is whether labor costs, which are particularly important for multinational firms that coordinate global supply chains, are the most important determinant of the choice of the intermediate jurisdiction. In column 2, we extend our baseline model by incorporating labor cost differentials, measured as the ratio of employee compensation in the destination to the origin, using data from the World Bank's Doing Business (2019). Not surprisingly, we find a negative and significant relationship between labor costs and investment decisions, but only in the bilateral relationship between countries $k$ and $i$. Higher labor costs in country $k$ discourage investment through that country, but the main findings on overlapping working hours remain significant, with estimated coefficients consistent in magnitude with the baseline results.

A third concern is that overlap in working hours may not be the only factor that facilitates communication. In column 3, we include an alternative proxy for ease of communication, the Common Language Index (CLI) proposed by Gurevich et al. (2021). This index captures the linguistic similarity between countries, taking into account several dimensions of language, including translation ease and interpretability. While CLI has a strong positive impact on investment decisions, it does not eliminate the importance of overlapping working hours, confirming that real-time communication remains a distinct channel influencing delegation decisions.

In an additional set of robustness checks, we examine possible sample composition effects. Table 8 reports new estimates of the triangular equation across different industry groups. We split the results into three sub-samples: (i) parent companies in manufacturing (column 1), (ii) parent companies in services (excluding financial) (column 2), and (iii) cases where the parent, intermediary, and ultimate subsidiary are all in the financial sector (column 3).[21]

[21] A company's industry is identified using the 2017 NAICS classification at the 2-digit level. A firm is classified as financial if it is in "*Finance and Insurance*" (code 52) or "*Real Estate, Rental, and Leasing*" (code 53).

Table 7: Robustness: alternative stories

| **Control for** | Tax differentials | | Wage differentials | | Culture and language | |
|---|---|---|---|---|---|---|
| **Dep Var.** | $M_{ikj}/M_{ij}$ | $M_{ij}$ | $M_{ikj}/M_{ij}$ | $M_{ij}$ | $M_{ikj}/M_{ij}$ | $M_{ij}$ |
| **N. of overlapping working hours$_{ik}$** | 0.087*** | | 0.088*** | | 0.052*** | |
| | (0.007) | | (0.008) | | (0.006) | |
| **N. of overlapping working hours$_{kj}$** | 0.134*** | | 0.125*** | | 0.101*** | |
| | (0.008) | | (0.009) | | (0.006) | |
| $\frac{CT_k}{CT_i}$ | 0.001 | | | | | |
| | (0.001) | | | | | |
| $\frac{CT_j}{CT_k}$ | 0.008*** | | | | | |
| | (0.000) | | | | | |
| $\frac{LC_k}{LC_i}$ | | | -0.638*** | | | |
| | | | (0.034) | | | |
| $\frac{LC_j}{LC_k}$ | | | -0.049* | | | |
| | | | (0.029) | | | |
| CLI$_{ik}$ | | | | | 1.519*** | |
| | | | | | (0.057) | |
| CLI$_{kj}$ | | | | | 1.187*** | |
| | | | | | (0.056) | |
| Distance (arcsin)$_{ik}$ (km) | -0.125*** | | -0.124*** | | -0.00633 | |
| | (0.012) | | (0.015) | | (0.010) | |
| Distance (arcsin)$_{kj}$ (km) | -0.201*** | | -0.207*** | | -0.137*** | |
| | (0.015) | | (0.018) | | (0.013) | |
| RTA$_{ik}$ | 1.204*** | | 1.080*** | | 1.217*** | |
| | (0.033) | | (0.041) | | (0.028) | |
| RTA$_{kj}$ | 0.797*** | | 0.681*** | | 0.731*** | |
| | (0.030) | | (0.037) | | (0.027) | |
| $Home_{ik}$ | 5.168*** | | 4.693*** | | 4.453*** | |
| | (0.055) | | (0.064) | | (0.054) | |
| $Home_{kj}$ | 3.587*** | | 3.354*** | | 2.906*** | |
| | (0.065) | | (0.070) | | (0.060) | |
| Language$_{ik}$ | 0.659*** | | 0.809*** | | | |
| | (0.0359) | | (0.0412) | | | |
| Language$_{kj}$ | 0.380*** | | 0.550*** | | | |
| | (0.038) | | (0.044) | | | |
| Colony dependence$_{ik}$ | 1.674*** | | 1.590*** | | 1.526*** | |
| | (0.051) | | (0.055) | | (0.048) | |
| Colony dependence$_{kj}$ | 1.631*** | | 1.386*** | | 1.431*** | |
| | (0.052) | | (0.059) | | (0.048) | |
| Legal origins$_{ik}$ | 0.166*** | | 0.222*** | | 0.124*** | |
| | (0.032) | | (0.035) | | (0.029) | |
| Legal origins$_{kj}$ | 0.190*** | | 0.308*** | | 0.145*** | |
| | (0.030) | | (0.033) | | (0.027) | |
| Direct$_{ikj}$ | 0.220*** | | 0.156* | | 0.966*** | |
| | (0.073) | | (0.088) | | (0.056) | |
| $\sqrt{\frac{\hat{c}_{ij}}{K}}$ | | -135.109*** | | -135.218*** | | -141.157*** |
| | | (16.139) | | (17.558) | | (13.547) |
| Observations | 1,224,038 | 8,000 | 641,648 | 5,386 | 1,718,840 | 9,712 |
| Fixed effects | $i \times j$ | i,j | $i \times j$ | i,j | $i \times j$ | i,j |

Note: Ratios $CT_k/CT_i$ and $CT_j/CT_k$ control for relative advantage in corporate taxation. Ratios $LC_k/LC_i$ and $LC_j/LC_k$ control for the relative advantage in labor costs. Given the presence of zeros in the case of direct control, we scale the distances in km by using the hyperbolic sine transformation ($ln(x + \sqrt{x^2+1})$), which allows approximating to the natural logarithm while retaining the zeros (Bellemare and Wichman, 2020). Standard errors are double-clustered by origin and destination in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 8: Sensitivity to sample composition

| **Sample** | Manufacturing | | Service | | Finance | |
|---|---|---|---|---|---|---|
| **Dep Var.** | $M_{ikj}/M_{ij}$ | $M_{ij}$ | $M_{ikj}/M_{ij}$ | $M_{ij}$ | $M_{ikj}/M_{ij}$ | $M_{ij}$ |
| **N. of overlapping working hours**$_{ik}$ | 0.023*** | | 0.059*** | | 0.141*** | |
| | (0.008) | | (0.008) | | (0.024) | |
| **N. of overlapping working hours**$_{kj}$ | 0.108*** | | 0.102*** | | 0.176*** | |
| | (0.009) | | (0.008) | | (0.024) | |
| Distance (arcsin)$_{ik}$ | -0.172*** | | -0.085*** | | 0.024 | |
| | (0.017) | | (0.012) | | (0.029) | |
| Distance (arcsin)$_{kj}$ | -0.200*** | | -0.200*** | | -0.010 | |
| | (0.020) | | (0.016) | | (0.032) | |
| RTA$_{ik}$ | 1.176*** | | 1.279*** | | 1.212*** | |
| | (0.042) | | (0.037) | | (0.086) | |
| RTA$_{kj}$ | 0.874*** | | 0.840*** | | 0.954*** | |
| | (0.038) | | (0.034) | | (0.084) | |
| Home$_{ik}$ | 4.702*** | | 5.586*** | | 5.788*** | |
| | (0.078) | | (0.062) | | (0.142) | |
| Home$_{kj}$ | 3.408*** | | 3.567*** | | 5.380*** | |
| | (0.089) | | (0.074) | | (0.157) | |
| Language$_{ik}$ | 0.594*** | | 0.855*** | | 0.546*** | |
| | (0.0450) | | (0.0414) | | (0.102) | |
| Language$_{kj}$ | 0.274*** | | 0.497*** | | 0.596*** | |
| | (0.046) | | (0.044) | | (0.107) | |
| Colony dependence$_{ik}$ | 1.087*** | | 1.483*** | | 1.008*** | |
| | (0.080) | | (0.064) | | (0.157) | |
| Colony dependence$_{ik}$ | 1.342*** | | 1.614*** | | 1.222*** | |
| | (0.081) | | (0.063) | | (0.157) | |
| Legal origins$_{ik}$ | 0.196*** | | 0.150*** | | 0.371*** | |
| | (0.040) | | (0.037) | | (0.100) | |
| Legal origins$_{kj}$ | 0.268*** | | 0.129*** | | 0.220** | |
| | (0.039) | | (0.034) | | (0.098) | |
| Direct$_{ikj}$ | 0.434*** | | 0.158** | | 0.860*** | |
| | (0.095) | | (0.072) | | (0.169) | |
| $\sqrt{\frac{\hat{c}_{ij}}{N_K}}$ | | -89.573*** | | -158.517*** | | -118.742*** |
| | | (21.185) | | (12.226) | | (7.564) |
| Observations | 836,425 | 4,715 | 1,083,901 | 6,110 | 301,731 | 1,671 |
| Fixed effects | $i \times j$ | i,j | $i \times j$ | i,j | $i \times j$ | i,j |

Note: Sectors are defined according to the NAICS 2017 classification at the 2-digit level. Given the presence of zeros in the case of direct control, we scale the distances in km by using the hyperbolic sine transformation ($ln(x + \sqrt{x^2 + 1})$), which allows approximating to the natural logarithm while retaining the zeros (Bellemare and Wichman, 2020). Standard errors are double-clustered by origin and destination in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

In particular, there is an increase in the gap between the first and second coefficients in the manufacturing sector with respect to the baseline results. In the services sector, this gap remains similar to the baseline, while it disappears completely in the financial groups. This pattern is in line with our theoretical framework. The difference between the costs of delegating and monitoring is expected to be most pronounced in manufacturing, where coordination often involves complex but fragmented global supply chains. In contrast, the contractual environment of financial firms differs from that of manufacturing and service firms, even though they also require cross-border communication and delegation. This difference is particularly relevant for firms operating in publicly traded markets, where financial transactions must be coordinated with the opening and closing hours of markets in different time zones.

A final concern is whether ownership chains are systematically structured around tax havens. The global coverage of our database allows us to quantify the prevalence of intermediate subsidiaries in recognized tax havens, based on the classifications of Hines Jr and Rice (1994); Hines Jr (2010). Across all parent and subsidiary locations, we find that 7.4% of intermediate affiliates are located in tax havens. While this share is not negligible, it does not imply that tax havens are fully determinants of the ownership chain structure.

# 8 Conclusions

This study examines how multinational enterprises (MNEs) structure complex hierarchical ownership networks, where control is often exercised through multi-tiered chains of subsidiaries spanning multiple national borders. Although these structures play a crucial role in the global organization of MNEs, they have been largely overlooked in the literature, likely due to data limitations. Using a unique global database, we first document stylized facts on ownership chains and then develop a theoretical framework to explain their geography and structure.

Our findings reveal that most affiliates are controlled through ownership chains and that complex multinational enterprises with extensive corporate structures play a dominant economic role. In the upper tail of the distribution, large corporate networks control more than 100 subsidiaries, operate in more than 19 countries, and span more than 15 industries.

Beyond their economic significance, we examine the geographic organization of complex ownership chains, finding that ownership chains can span up to seven national borders and that their complexity increases with firm size. In particular, we find a correlation between the hierarchical position of subsidiaries and their geographic distance from headquarters. Subsidiaries positioned further down the hierarchy tend to be located farther from the parent company. Furthermore, using overlapping working hours across time zones as a proxy for the ease of managerial communication, we find that subsidiaries at the bottom of the hierarchy share fewer working hours with managers at the top.

Building on these empirical patterns, we propose a location choice model in which parent firms compete in a global auction to acquire new subsidiaries. In formulating their bids, parents weigh the option of delegating monitoring responsibilities to an intermediate affiliate in a third country. The model yields two testable equations: the first is a trilateral equation that determines whether monitoring is delegated to an intermediate affiliate and where it is located, while the second is a bilateral equation that predicts the location of newly acquired final subsidiaries.

Crucially, we find that communication frictions are a key determinant of delegation and monitoring decisions. Even after subjecting our results to extensive robustness checks, our main findings remain intact. The impact of communication costs persists even after controlling for alternative explanations such as tax differentials, tax haven status, wage differentials, and cultural/linguistic proximity.

Our results highlight how little is still known about the ownership structures of multinational firms. While official statistics often fail to fully capture global ownership networks, the increasing standardization of national business registries is improving data availability. Looking ahead, we see promising opportunities for future research on the determinants and consequences of multinational ownership chains, a field that remains ripe for deeper exploration.

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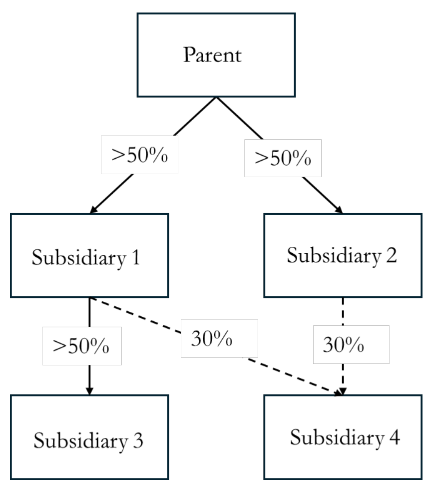
# Appendix A: Ownership chains and corporate control networks

In this Appendix, we provide an understanding of how raw shareholding data are used to extract corporate trees developed by MNEs. For further details, we refer to Rungi et al. (2017). An MNE is made of a unique parent company and its subsidiaries. If we look at their ownership data, they represent a corporate network in the form of a hierarchical tree, where nodes are legally autonomous companies. Please consider the simplified fictional corporate tree in Figure A1. On top of the hierarchy, we find the parent company, which exerts control over subsidiaries by means of direct and indirect shareholding links. In principle, an MNE can develop much more complex patterns than the ones depicted in Figure A1, as it can include cross-holdings when shareholding relationships run two-way between companies. They can also entail ownership cycles, i.e. when the firm holds a share of its equity stakes. Given a fragmentation of shareholding, companies can indirectly connect through multiple sequences of ownership links. The solution is to start with a full ownership matrix of all firms and their shareholders in the data. Thus, a control relationship is detected iteratively on a transformation of the ownership matrix. In line with international accounting standards (OECD, 2005; UNCTAD, 2009; Eurostat, 2007), one can assume that corporate control is present when there is an absolute majority of equity stakes. Yet, one cannot exclude that lower thresholds still allow the parent company the ability to influence and contribute to the decision-making of another company.

Figure A1: A fictional corporate tree of an MNE




Note: The figure represents a fictional corporate tree where Subsidiaries 1 and 2 are directly controlled, Subsidiary 3 is indirectly controlled by transitivity, and Subsidiary 4 is controlled by consolidation of fragmented equity stakes.

In Figure A1, we easily attribute direct control of Subsidiary 1 to the Parent because the latter holds an absolute majority of voting rights in the first. Besides this most elementary case of direct control, there are two other ways for the Parent to exert control: (i) *by transitivity*, when successive majority links form an ownership chain, and subsidiaries align on it, as in the case of Subsidiary 3; (ii) *by consolidation*, when equity is fragmented, no direct majority path can be detected from the Parent, and yet other subsidiaries hold minority links in a firm, like Subsidiary 4, which can be consolidated and allow the unique Parent to finally reach out to the management of Subsidiary 4.

**Ownership chains.** Figure A1 shows an MNE that has two ownership chains. One starts from the Parent and reaches out to Subsidiary 3 through Subsidiary 1. A second one starts from the Parent and reaches out to Subsidiary 4 thanks to either Subsidiary 1 or Subsidiary 3. To solve uncertainty, we will assume that the final subsidiary is on the shortest ownership chain. If ownership chains are of equal length, then we discriminate on shares. When shares are equal, we discriminate by firm size, giving priority to the middleman that is bigger.

**Middlemen subsidiaries.** As evident from Figure A1, we have a category of subsidiaries that is peculiar because they are controlled by the Parent, but they also hold controlling stakes in other subsidiaries. Economic literature has neglected this category of subsidiaries. We call them middlemen, with reference to their intermediary role between the management of the Parent and the management of the downstream subsidiary. Middlemen subsidiaries can present themselves in a sequence over longer ownership chains.

# Appendix B: Naïve empirical models of parent-subsidiary relationships

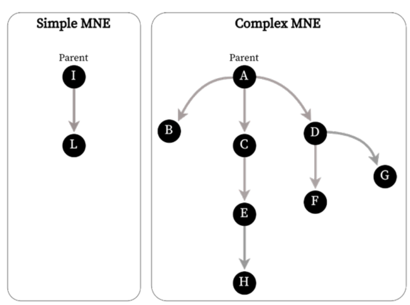
In the following paragraphs, we introduce three naïve unstructured applications of gravity models to observe correlations, which are informative for the setup of our theoretical model, and to discuss what the analyst misses when not considering information on ownership chains. We argue that this section is important to identify empirical problems from previous literature. In each case, we test the following general Pseudo-Poisson specification at the country level:

$$N_{ij} = exp(\boldsymbol{\beta}\mathbf{X}_{ij} + \gamma_i + \gamma_j)\epsilon_{ij} \tag{10}$$

where $N_{ij}$ counts the number of companies in country $j$ controlled by companies in country $i$. We include bilateral frictions in matrix $\mathbf{X}_{ij}$. Notably, besides classical gravity controls sourced from the CEPII Gravity dataset (Conte et al., 2022) $wh_{ij}$, we include a measure of overlapping working hours between countries $i$ and $j$ as a proxy of the common working schedule across time zones. See further details in Section 3. Finally, $\gamma_i$ and $\gamma_j$ capture origin and destination country fixed effects.[22]

At this point, we are ready with the empirical model, but how do we treat ownership chains? We will show that each of the three following cases is wrong. Or, we could say that they are reduced forms of the real model. Let us introduce the issue starting from a fictional sample, including two kinds of MNEs most common in our data set, whose fictional structures are represented in Figure B1.

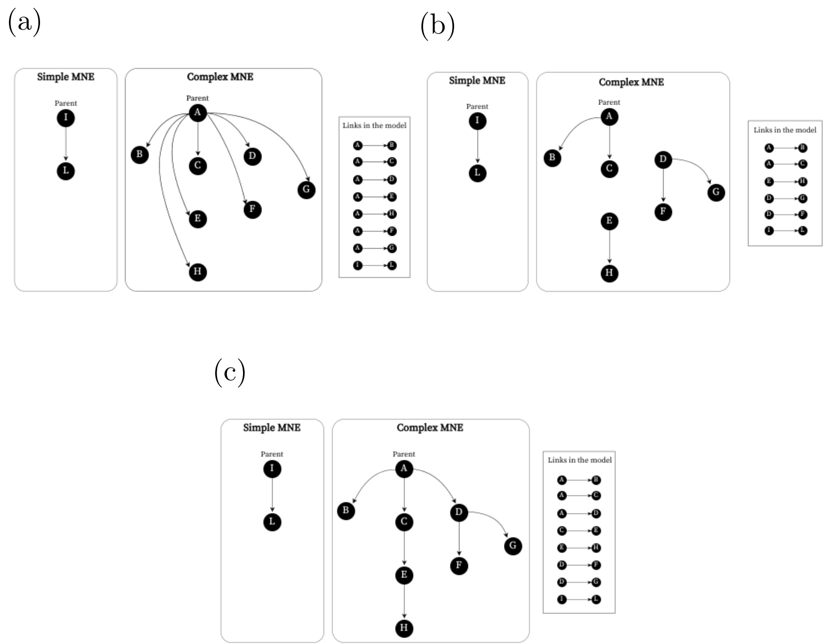
Figure B1: A fictional dataset




Note: This fictional dataset includes a simple and a complex MNE. Each node represents a company, and each link represents a company's controlling voting rights in another company.

[22]Please note that our information on MNEs' perimeters is cross-sectional. Therefore, we can focus on the between-variation and cannot observe the within-variation.

Figure B2: Implementations of naïve bilateral gravity




Notes: The figure shows three fictional cases of ownership chains included in bilateral gravity models. The legends on the right report the (directed) links one would include in each application.

More specifically, in Figure B1, we draw one simple MNE controlling only one subsidiary, which we know is the most common case, although we also know that, on aggregate, these MNES have a small economic weight (see Figures 3 and 4 ). A second complex MNE on the right controls seven subsidiaries organized along four ownership chains: i) A → B; ii) A → C → E → H; iii) A → D → F; iv) A → D → G.

Now, how would an analyst include this sample in a bilateral gravity model?

Let us first assume that linkages are not disclosed, but the set of subsidiaries is known. In this case, the analyst will count the parents in country $i$ and the subsidiaries in country $j$. This is the case (a) in the fictional sample redrawn in Figure B2. We guess this is the case that most scholars have in mind when testing gravity models with firm-level data on MNEs. See, for example, Mutti and Grubert (2004), which reports an empirical analysis using data on the location choices of US parent companies.

A second alternative is that ownership chains are only partially disclosed because the statistician has problems collecting them. S/he falsely attributes the ultimate control of a subsidiary to its immediately controlling corporate shareholder. Hence, our fictional complex MNE will appear fragmented into three smaller pieces. The information included in Eq. 10 is false. This is the second case in Figure B2, where the list of links on the right does not include $C \rightarrow E$. Indeed, full disclosure of the corporate structure of MNEs is a long-standing problem for national and international statistics offices. The necessity to identify ultimate controlling entities is required by several guidelines (OECD, 2005; UNCTAD, 2009; IFRS, 2011), seldom complied with.

A third alternative is that the analyst knows the entire ownership chain but does not know how to fit in a bilateral gravity. S/he might consider every pairwise link connecting two firms. As from

Figure B2, it would imply an inflation of linkages. The analyst breaks the unity of ownership linkages, while every middlemen subsidiary is technically considered as a parent company originating its own investment choice. Please note that this setup reflects the common approach of using FDI data to proxy MNE relationships. See Bénassy-Quéré et al. (2007); Stein and Daude (2007); Egger and Pfaffermayr (2004); Blonigen et al. (2003). FDI data provided by the OECD is collected following the 4th edition of the Benchmark Definition of FDI (BMD4), which primarily attributes inward FDI stocks to the immediate partner country in the transaction.

In Table B1, we report the results of our three naïve applications. The main coefficients are consistent with the magnitude and sign we would expect from these frictions, except in case a), where the coefficient on the *N. of overlapping working hours* is not statistically significant. In either case, findings might be irrelevant because we know that each application misses a point, and they are wrong overall because they neglect the existence of ownership chains, which are an essential ingredient in the organization of MNEs.

Table B1: Naïve bilateral gravities

| Dep. var. | $N_{ij}$= # of companies country i controls in country j | | |
|---|---|---|---|
| Sample: | Case (a) | Case (b) | Case (c) |
| N. of overlapping | 0.015 | 0.056** | 0.058** |
| working hours | (0.023) | (0.024) | (0.023) |
| | (0.186) | (0.150) | (0.154) |
| (log of) distance | -0.340*** | -0.264*** | -0.252*** |
| | (0.077) | (0.090) | (0.088) |
| Home | 2.377*** | 3.324*** | 3.355*** |
| | (0.295) | (0.245) | (0.251) |
| Language | 0.741*** | 0.772*** | 0.780*** |
| | (0.090) | (0.104) | (0.102) |
| Colony dependence | 0.312** | 0.326** | 0.304** |
| | (0.124) | (0.132) | (0.130) |
| Legal origins | 0.289*** | 0.373*** | 0.377*** |
| | (0.089) | (0.082) | (0.084) |
| RTA | 0.188 | 0.319** | 0.292* |
| Observations | 39,585 | 39,786 | 39,786 |
| Fixed effects | i,j | i,j | i,j |

Note: The figure shows results from three applications of naïve gravity models, where the information on ownership chains is absent in Case (a), it is only partially reconstructed in Case (b), or it is considered but breaking the ownership chains in bilateral segments in Case (c). Standard errors clustered by origin country in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

# Appendix C: Tables and graphs

Table C1: Country-level covariates and sources

| Variable | Description | Source |
|---|---|---|
| Number of overlapping working hours | An integer variable counting the number of working hours during which offices in two countries are simultaneously open. Assuming a standard 10-hour workday, this is calculated by subtracting the time zone difference (in hours) between the origin and destination countries from the total of ten hours. | Bahar (2020) |
| Corporate Taxation (CT) | Profit tax calculated by the World Bank as the total amount of taxes paid by the business as a percentage of commercial profits. | WorldBank (2019) |
| Cost of Labour (CL) | Compensation of employees calculated by the World Bank as the total of cash payments, as well as in kind (such as food and housing), to employees in return for services rendered, and government contributions to social insurance schemes such as social security and pensions that provide benefits to employees. | WorldBank (2019) |
| Common Language Index (CLI) | A continuous measure of linguistic similarity both within and between countries, that captures three aspects: shared official languages, common native languages, and linguistic proximity. | Gurevich et al. (2021) |

Table C2: Sample coverage by industry

| ISIC | NACE | Industry description | N. subsidiaries | % | N. middlemen | % |
|---|---|---|---|---|---|---|
| A | 01 -03 | Agriculture, forestry and fishing | 11,967 | 0.94% | 1,846 | 0.69% |
| B | 05 - 09 | Mining and quarrying | 17,969 | 1.41% | 4556 | 1.71% |
| C | 10 - 33 | Manufacturing | 239,091 | 18.74% | 53,809 | 20.19% |
| D | 35 | Electricity, gas, steam and air conditioning supply | 33,982 | 2.66% | 4,235 | 1.59% |
| E | 36-39 | Water supply; sewerage, waste management | 8,728 | 0.68% | 1,477 | 0.55% |
| F | 41 - 43 | Construction | 52,971 | 4.15% | 8,750 | 3.28% |
| G | 45 - 47 | Wholesale and retail trade | 207,516 | 16.27% | 30,182 | 11.33% |
| H | 49 - 53 | Transportation and storage | 48,223 | 3.78% | 7,698 | 2.89% |
| I | 55 - 56 | Accommodation and food service activities | 23,366 | 1.83% | 2,982 | 1.12% |
| J | 58 - 63 | Information and communication | 80,985 | 6.35% | 16,618 | 6.24% |
| K | 64 - 66 | Financial and insurance activities | 187,421 | 14.69% | 63,538 | 23.84% |
| L | 68 | Real estate activities | 87,961 | 6.89% | 12,205 | 4.58% |
| M | 69 - 75 | Professional, scientific and technical activities | 130,179 | 10.20% | 33,222 | 12.47% |
| N | 77 - 82 | Administrative and support service activities | 87,332 | 6.85% | 16,803 | 6.31% |
| O | 84 | Public administration and defense | 835 | 0.07% | 212 | 0.08% |
| P | 85 | Education | 6,542 | 0.51% | 953 | 0.36% |
| Q | 86 - 88 | Human health and social work activities | 22,795 | 1.79% | 3,289 | 1.23% |
| R | 90 - 93 | Arts, entertainment and recreation | 9,292 | 0.73% | 1551 | 0.58% |
| S | 94 - 96 | Other service activities | 16,418 | 1.29% | 2,236 | 0.84% |
| T | 97 - 98 | Activities of households as employers; etc. | 2,044 | 0.16% | 278 | 0.10% |
| U | 99 | Activities of extraterritorial organizations | 149 | 0.01% | 25 | 0.01% |
| | | Total | 1,275,766 | 100.00% | 266,465 | 100.00% |

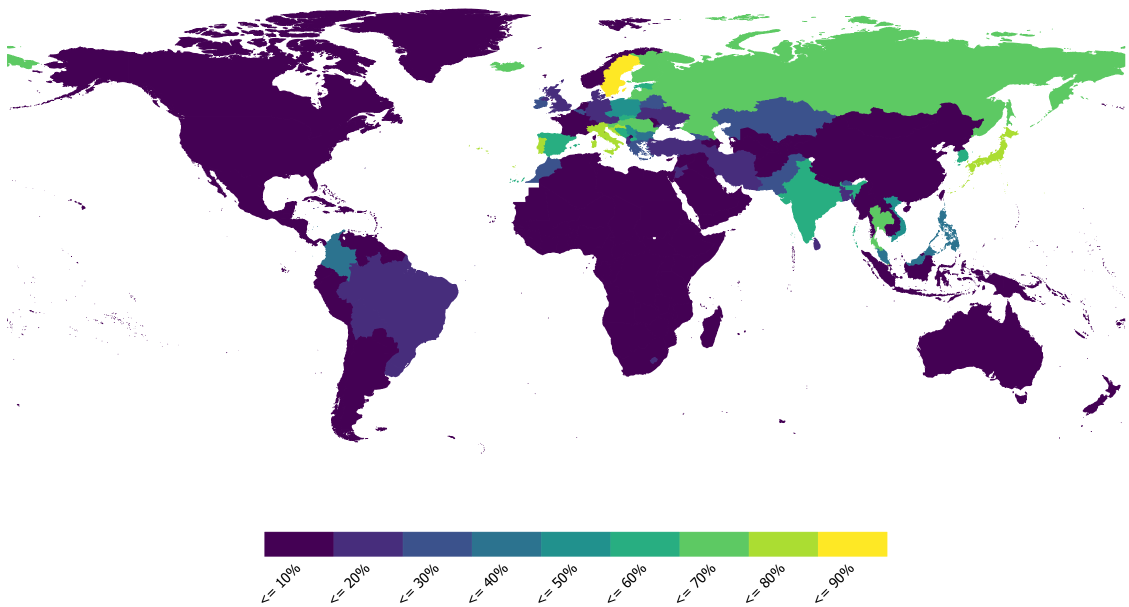
Note: We report the industry coverage of our sample by adopting the main aggregates of the NACE rev. 2 and ISIC rev. 4 classifications. First, we report the salience of subsidiaries (columns 4 and 5) and then we separate among them the number of middlemen subsidiaries (columns 6 and 7).

Table C3: Sample coverage by size

| Size category | N. subsidiaries | % | N. middlemen | % |
|---|---|---|---|---|
| Small | 1,205,973 | 67.33% | 127,535 | 40.85% |
| Medium | 283,541 | 15.83% | 50,063 | 16.04% |
| Large | 204,956 | 11.44% | 63,563 | 20.36% |
| Very large | 96,543 | 5.39% | 71,048 | 22.76% |
| Total | 1,791,013 | 100.00% | 312,209 | 100.00% |

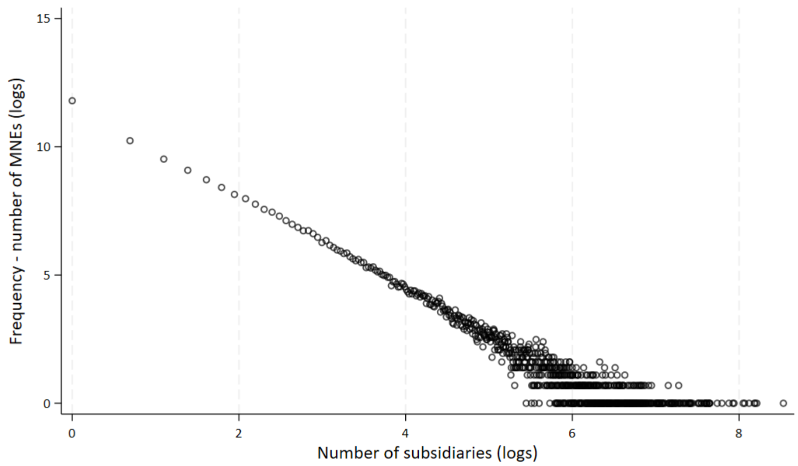
Note: The table presents sample coverage of all subsidiaries and, among them, middlemen subsidiaries based on a combination of criteria: A) Large or very large companies report more than 10 million EUR revenues, or more than 20 million EUR total assets, or more than 150 employees, or over 0.5 million EUR capitalization, or they are listed at a stock exchange; B) Medium-sized companies register more than 1 million EUR revenues, or more than 2 million EUR total assets, or more than 15 employees, or over 50 thousand EUR capitalization; C) Small companies includes the residual, i.e. they are not in the medium or the large and very large categories.

Figure C1: Financial accounts - geographic coverage in 2019




Note: The map displays the sample coverage of financial accounts in different countries. Percentages indicate the availability of basic information on operating revenues/turnover for the total number of firms for which ownership data are available.

Figure C2: Size distribution - (log of) number of controlled subsidiaries




Note: The size of MNEs is measured as the logarithm of the number of controlled subsidiaries. By assuming that a negative binomial distribution can represent the data-generating process, we obtain an overdispersion parameter of 0.58 and a mean of 0.63.

Table C4: Lengths of ownership chains

| | | N. of country borders crossed | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **N. of subsidiaries** | | Domestic | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total |
| Simple MENs | 1 | 51,680 (3.406%) | 222,186 (14.645%) | | | | | | | 273,866 (18.051%) |
| Complex MNEs | 1 | 223,995 (14.764%) | 191,138 (12.599%) | | | | | | | 415,133 (27.363%) |
| | 2 | 181,428 (11.959%) | 174,195 (11.482%) | 41,266 (2.720%) | | | | | | 396,889 (26.160%) |
| | 3 | 94,778 (6.247%) | 80,172 (5.284%) | 30,602 (2.017%) | 5,522 (0.364%) | | | | | 211,074 (13.913%) |
| | 4 | 42,333 (2.790%) | 37,480 (2.470%) | 19,856 (1.309%) | 6,037 (0.398%) | 1,081 (0.071%) | | | | 106,787 (7.039%) |
| | 5 | 17,663 (1.164%) | 18,363 (1.210%) | 11,407 (0.752%) | 5,189 (0.342%) | 961 (0.063%) | 205 (0.014%) | | | 53,788 (3.545%) |
| | 6 | 7,177 (0.473%) | 8,010 (0.528%) | 6,558 (0.432%) | 3,865 (0.255%) | 1,014 (0.067%) | 203 (0.013%) | 7 (0.000%) | | 26,834 (1.769%) |
| | >=7 | 5,595 (0.369%) | 8,375 (0.552%) | 8,622 (0.568%) | 6,273 (0.413%) | 2,869 (0.189%) | 810 (0.053%) | 196 (0.013%) | 27 (0.002%) | 32,767 (2.160%) |
| Total | | 624,649 (41.173%) | 739,919 (48.771%) | 118,311 (7.798%) | 26,886 (1.772%) | 5,925 (0.391%) | 1,218 (0.080%) | 203 (0.013%) | 27 (0.002%) | 1,517,138 (100.000%) |

Note: The observation unit of this table is the unique ownership chain running from the parent to a subsidiary, therefore including the middlemen and the third jurisdictions crossed on the way. The y-axis indicates the length of the hierarchy, while the x-axis indicates the number of countries encountered along the chain. In row 1, we separate simpler MNEs whose subsidiaries are foreign or domestic but are all controlled by direct links, i.e., no middleman exists. The first column reports domestic subsidiaries by MNEs at varying lengths, where at least one middleman exists. In the grey area, we highlight ownership chains crossing more than one country where middlemen can be encountered.