Why Do Firms Prefer the US over the EU?*

Hugo Reichardt† Ricardo Reis‡

June 2026

Abstract

When a European firm moves its headquarters to the United States, when a US firm expands by hiring across many states, or when a Japanese firm raises funding from US investors, these choices reveal what makes the United States attractive to firms. This paper builds a model in which firms make location choices across multiple activities—where to hire production workers, where to expand their sales staff, where to raise funding, where to place the headquarters—and these choices reveal the sources of a region's attractiveness. It constructs a new global database that tracks where firms locate these activities and it develops an econometric strategy to separately estimate the contribution of each source. Applying the framework to the EU–US comparison, it finds that the productivity gap between them is driven by higher efficiency of the US's funding markets, higher costs of operating across the EU's fragmented internal market, and a scale-dependent penalty on profits of larger EU firms.

*We are grateful to many colleagues for inspiring discussions and to Nicholas Tokay for excellent research assistance. This work was supported by the UK Research and Innovation grant number EP/Eo25039/1. First draft: February 2026.

†CREi and Barcelona School of Economics. hreichardt@crei.cat

‡London School of Economics. r.a.reis@lse.ac.uk

1 Introduction

Between 2007 and 2024, labor productivity grew 18% more in the United States (US) than in the European Union (EU). The Draghi (2024) report concluded that part of this gap is due to the EU not being a good environment to start and scale up firms, especially in the most innovative sectors, because of skill shortages (Draghi, 2024), management practices (Bloom et al., 2012), technology adoption (Schivardi and Schmitz, 2020), depth of integration within the single market (Letta, 2024), or a weaker financing environment (Lagarde, 2024). Quantifying which of these matters the most is as difficult as it is important.

A widely reported symptom of the EU–US gap in competitiveness is that some successful European start-ups have relocated their headquarters (HQ) to the US. Which firms relocate, and where they hire workers and obtain financing afterward, reveals what these firms perceive makes the US a more attractive place to do business than the EU. This paper explores this insight. It uses revealed preference by firms to identify the relative importance of the factors behind productivity differences across regions.

Building on the Ricardian principle that trade flows reveal comparative advantage, we show that the share of workers and funding that firms choose across regions reveals the relative efficiency per unit cost of these regions. Further, the extent to which firms spread their activity across locations within their economic area reveals how fragmented is the internal market. Finally, when firms relocate their HQ, they reveal the advantage of this region in coordinating operations in other regions and how this varies with the scale of the firm. Combining all of these firm choices decomposes the productivity differences across regions into their underlying sources.

We take the following steps to operationalize this approach. First, we compile a new global database that tracks where firms hire production workers and sales-and-management workers, where they obtain funding from, and where they have their headquarters. Second, we build a model of multi-region firms making decisions on where to locate their inputs by taking into account differences across regions in their efficiency per unit cost, their fixed costs of operation, and the advantage across operations from the nationality of their HQ. Third, we develop an econometric strategy to quantitatively estimate the attractiveness of a region for production, sales and management, and financing. Applying our method to the EU–US comparison, we find that the US advantage is mostly explained by three factors: higher efficiency of US funding markets, more fragmentation of markets across EU member states, relative to US states, that holds across all activities, and a size penalty for firms with an EU HQ.

Outline. In Section 2, we describe the data, which have information on the location of firms' production workers, sales-and-management personnel, funding sources, and HQ. Standard firm-level data rarely disaggregates the geographic allocation of the firm's inputs across regions and input types. We overcome this deficiency by combining data from two main sources: LinkedIn and Crunchbase. The first reveals where a firm's workers are located from their personal histories in the LinkedIn database. The second reveals the firm's sources of external funding. Merging the two, we have 2.1 million firms and 193.4 million workers. Then, using historical snapshots from Crunchbase, we data on firms relocating the region of their HQ. Within this large sample, there are any firms that operate in multiple regions across at least one dimension, and that change HQ at least once, providing the variation we use to reveal each region's attractiveness.

Section 3 lays out a model of firms' choices on the sourcing of inputs—production, sales-and-management, and finance—from different regions. On the intensive margin, holding fixed the set of locations that the firm operates in, the share of inputs from each region reveals the firms' perception of each region's efficiency per unit cost for each type of input.

On the extensive margin, firms decide which regions to source inputs from, trading off the decrease in marginal cost that comes from being able to shift inputs across one more region against a fixed cost of adding that region to its operations. The share of firms operating in multiple states within an economic area reveals how integrated markets are within that area.

Finally, firms choose whether to relocate their HQ for a cost depending on the advantage of a region. This advantage depends on how a HQ can efficiently manage production in other regions, on how the HQ affects the fragmentation costs faced by the firm, and on how taxes, innovation, immigration and other policies in the HQ region introduce a wedge in the expected profits across all locations. This HQ nationality wedge depends on firm size, capturing how some regions may be especially attractive to larger firms.

Section 4 develops an efficient estimation strategy for these different dimensions of a region's attractiveness. First, we show that the relative efficiency of an input across regions can be estimated using linear regressions over firms' worker shares across regions. This requires correcting for selection on the extensive margin (where to locate) when estimating regions' efficiency on the intensive margin (how much to source from each region). We develop a new method to do so by deriving a selection control function that is useful in discrete-choice settings with many complementary options.

Second, we show that a conditional logit regression over the sets of regions that the firms operate in delivers estimates both of the fixed costs of adding another region to source from, as well as of the elasticity of profits to each dimension of efficiency per unit cost. Since evaluating the millions of possibilities is computationally prohibitive, we show how to get consistent estimates by sampling over a smaller set of alternatives and correcting the likelihood function appropriately. Because the key elasticity parameters enter the logit regression non-linearly, we introduce a two-step procedure to maximize first a conditional likelihood and then a profile likelihood over the key elasticity parameters.

Finally, given the estimates of the intensive and extensive margin, we calculate the expected profits for a firm from having its HQ in one region. We show that the frequency and direction of relocating identify the benefits and costs of moving HQ and that these benefits can be estimated via a conditional logit that takes the current HQ region as the benchmark.

Section 5 applies our framework to the comparison of the EU with the US. Starting with the intensive margin, we find that there is little difference in the efficiency per unit cost of employing production or sales workers in either region. There is, however, a large US relative advantage in financing. These sharp estimates come from the observation that firms that have their HQ in neither Europe nor the United States, but employ workers in these two regions, on average have similar shares of workers in both. When they get funding from both regions, instead, they obtain a much larger share of funding in the United States.

Turning to the extensive margin, we find that the costs of opening operations in a region away from the HQ are high in both the EU and the US. The main difference between EU and US firms is that the former face higher costs form locating activity in regions within the EU. The model and data identify a large difference in the integration of US *vis-á-vis* EU markets, and this holds across production, sales-and management, and funding.

Finally, in the data, firms moved their HQ from the EU to the US at much higher rates than the reverse, and there is a strong positive selection on size only in the EU-to-US direction. While for smaller firms, having an EU or US location for their HQ makes little difference, for the largest firms there is a pronounced EU disadvantage.

Section 6 concludes.

Related literature. There is a rapidly growing literature that focuses on one possible cause of the US-EU productivity differences, and tries to quantify its relevance: see, for instance, Bergeaud (2024); Gutiérrez and Philippon (2018); Bloom et al. (2012); Schoefer (2025); Colombo et al. (2025), on innovation, competition, management, labor markets, and venture capital funding, respectively. Our contribution is to consider multiple factors simultaneously, and to quantify their relative importance.

More broadly, a rich literature uses firm outcomes to learn about productivity differences across countries (Hsieh and Klenow, 2009; Bartelsman et al., 2013). Our approach is quite different. Instead of measuring the allocation of inputs across firms within a region, we measure the within-firm allocation of inputs across regions.

Even more broadly, the questions in this paper fall into the general study of why some countries are richer and more productive than others (Smith, 1776; Lucas, 1988). A classic approach is to measure the quantity and quality of inputs available within each region and their allocation across firms (Jorgenson, 2009). This paper offers a somewhat different approach. It asks instead *within* firms, where they *choose* to get their inputs *across* regions.

Our measurement strategy is to use firms' location choices to reveal different dimensions of a region's productivity. This is partly inspired by the quantitative trade literature that uses trade flows to infer patterns of comparative advantage (Costinot et al., 2012; Levchenko and Zhang, 2016) in Ricardian models of trade (Dornbusch et al., 1977; Eaton and Kortum, 2002). Instead of data on trade across regions and firms, we use data on the location of inputs within a firm. Our model brings together the key ingredients from the literature on trade (Eaton and Kortum, 2002), sales and management (Lucas, 1978; Arkolakis, 2010), and finance (Brunnermeier and Sannikov, 2014). Our contribution is to explore common features across these models and to integrate them to generate an empirical strategy that is common across these three choices.

More closely related, there is a rich literature on multinationals and how they organize activity along global value chains (Muendler and Becker, 2010; Antras and Chor, 2013), as well as how their firm-specific productivity affects the country's income (Alfaro-Ureña et al., 2022; Alviarez et al., 2023). Our focus is not on the chain of production activities and the trade flows between regions that result, but rather on what firms' location choices reveal about a region's attractiveness.

Explicitly focusing on migration of firms and what it reveals about the comparative advantage of regions, Conti and Guzman (2023) focuses on Israeli startups that move to the United States, while Weik et al. (2024) documents choices of HQ location for venture-capital backed firms. Our contribution is more methodological and general, our model has multiple dimensions where regions are different, and our application is broader in coverage. In this sense, we answer a challenge raised by the entrepreneurship literature: what makes an ecosystem attractive (Cavallo et al., 2026)? Closer to our paper is Colonnelli et al. (2026), which studies startups in Africa, and also finds an important role for funding and a migration of firm's HQ to the United States associated with this funding.

Finally, at an econometric level, we provide some tools for the spatial economics literature. We provide a global dataset on the within-firm geographic allocation of workers and funding, as well as location of the HQ, as an alternative to datasets using financial statements and company registers that are commonly used. We derive a formula for controlling for selection across regions in the style of Heckman (1979) and Dubin and McFadden (1984) for models in which agents choose sets of complementary options. We sample alternatives as part of a two-step maximum likelihood procedure to efficiently evaluate structural conditional logit models with large combinatorial choice sets. This approach is distinct from the method used in Jia (2008); Antras et al. (2017); Alfaro-Urena et al. (2023); Arkolakis et al. (2023), among others, which finds lower and upper bounds on the optimal set by iteratively adding and removing the best and worst possible alternative, starting from the empty/full set, until they overlap. Our approach of selective sampling is more efficient for estimation, although it is less convenient for simulating counterfactual economies.

2 A global database on firms' location choices

Our two main sources of data are LinkedIn and Crunchbase. We discuss each in turn before describing other series that complement them.

2.1 LinkedIn: data on workers and firms

We use data on the near-universe of LinkedIn profiles of individuals and companies from the snapshots taken by the company Revelio Labs downloaded in January 2025.

There are about 700 million unique LinkedIn worker profiles. They have comprehensive data on individuals' educational and employment histories, including locations, job titles, salary (as estimated by Revelio Labs), and identifiers that link to the company profiles of their employers. There are also approximately 26 million unique company profiles with information on the location of the headquarters, the industry, the type of ownership (public or privately held), the founding year, and total employment. Linking firms and workers produces roughly 1.5 billion worker–job spells.

We compute the total number of people by job type and by location within a company in a given year. We aggregate the job roles into two types: production workers (like "admin", "engineers", "operations", or "scientist"), or sales and management workers ("finance", "marketing", "sales"). The panel starts in 2008, the first year for which coverage of the LinkedIn data is large enough. In constructing the company-level data, we weight employees by the inverse probability of them having a LinkedIn profile as estimated by Revelio. Likewise, we use sampling weights for firms so that they match the distributions across size and sector in the census.

To our knowledge, LinkedIn is the only global and large-scale source of data on how employment within firms is located across the world. Data on the activity of multi-region firms typically come from financial statements, which only rarely report how employment is distributed globally. Further, financial data are often only available for large public firms and are subject to tax-driven distortions in reporting. The LinkedIn database covers a much larger set of firms, and employment can be broken down by both location and job type.

A drawback of our data is the selection into the sample. For instance, less qualified workers and smaller firms in less developed countries may be less likely to have LinkedIn profiles. Some of this selection is dealt with by using sample weights. More importantly, for our purposes, the identification of the different parameters comes from firms that operate across multiple regions and, for a subset of the parameters, from firms that move their headquarters. Missing the many small firms whose workers are all in a single location has little impact on our estimates. Moreover, the firms that drive the EU–US productivity differences are in sectors that we expect to be well covered by LinkedIn, most prominently in information and communication technologies (Draghi, 2024).

2.2 Crunchbase: data on funding

Crunchbase is a large database with detailed information on firms' HQ location, total employment, year founded, founders, and external funding received broken down by source and location. It includes private and public companies across the world, with a focus on start-ups and the technology sector. We obtained a snapshot of the universe of this database in July of 2024, which included roughly 4 million businesses.

The Crunchbase data includes the company's social media usernames, and for 74 per-

TABLE 1: Summary statistics for LinkedIn and Crunchbase data

	LinkedIn	Crunchbase	LI ∩ CB
Firms			
Total number (millions)	17.9	3.4	2.1
Median age (years)	10.0	17.0	17.0
% w/ workers in multiple regions	15.1		37.0
% tech	31.2		38.0
% w/ funding information		9.6	8.9
% HQ in the US	29.8	44.9	43.4
% HQ in the EU27 or UK	31.2	27.1	26.8
Employees			
Total number (millions)	367.5		193.4
% production	57.1		57.6
% management/sales	33.5		31.6
% in firms w/ workers in multiple regions	76.6		89.5
% in firms with US HQ	33.2		40.6
% in firms with HQ in EU27 or UK	27.5		27.4

Notes: This table reports summary statistics for our two main data sources, LinkedIn and Crunchbase, and the intersection of the two, LI∩CB. Summary statistics on employment are computed using sample weights provided by Revelio Labs.

cent of its firms, there is a LinkedIn profile. These profiles included LinkedIn usernames in an older format that was not easily matched to the one in our database. Ultimately, we matched 2.1 out of 3.4 million Crunchbase firms to their respective LinkedIn data.

Table 1 reports summary statistics for the LinkedIn data, the Crunchbase data, and the matched sample. LinkedIn contains more firms, and younger firms, than Crunchbase. Moreover, LinkedIn firms that appear in Crunchbase are more likely to be US tech firms. In general, firms in Crunchbase are more positively selected than firms in LinkedIn.

For the purpose of our exercise, this selection into our sample is unlikely to bias our results. Since our identification will come from firms operating in multiple regions, it is an advantage that our database covers large firms well. Likewise, over-representing fast-growing firms that obtain funding from multiple sources has the information that identifies our parameters. Importantly, our identification strategy uses variation within firms. Since we do not rely on differences in outcomes across firms that operate in different regions, the concerns with sample selection are muted.

2.3 Historical snapshots: identifying movers

The LinkedIn and Crunchbase datasets include information on firms' current HQ location. However, we do not directly observe whether each firm's HQ was elsewhere in the past. In turn, commonly used datasets like Orbis update location when there is a change in the legal entity but do not keep the past locations on record.

We measure HQ migration rates using a snapshot of the Crunchbase data in December 2013, which included almost 200,000 companies. Around 80% of the firms at this earlier date could be matched to firms in the 2024 Crunchbase snapshot by using their usernames. We complemented this information by scraping and parsing 2014 snapshots from individual Crunchbase profiles that were saved in the Wayback Machine, an internet archive. Finally, we obtained a database of 173,712 firms in Crunchbase for which we observe the HQ locations in both 2024 and 2014.[1]

Figure 1 shows the rate of HQ relocation between the US and the EU grouped by total external funding.[2] Movement from Europe to the US is several times higher than the reverse flow across all funding categories. Moreover, larger firms are more likely to move from the EU to the US: among European firms with no external funding, fewer than 2% moved, while more than 10% of the ones that had raised more than $100 million did so. In the other direction, from the US to the EU, there is no size gradient.

3 A model of firms locating their inputs across regions

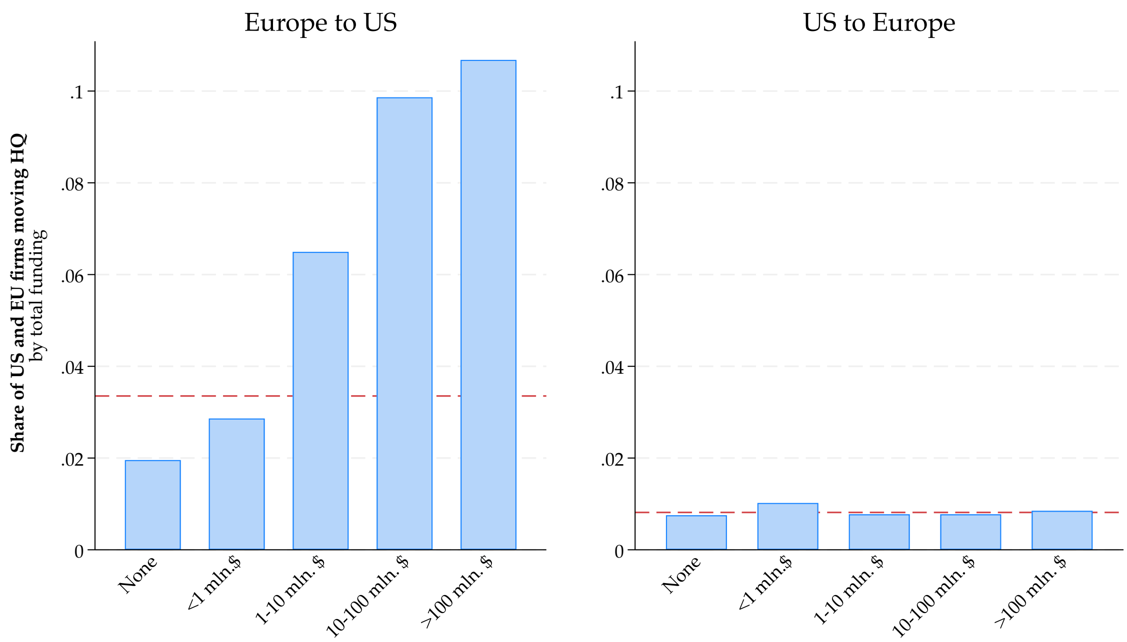
The model in this section formalizes how firm's location choices across regions reveal the attractiveness of regions, defines the separate dimensions of attractiveness, and guides the empirical strategy in the next section.

The world is made up of many regions that are indexed by $i \in \mathcal{I}$. A firm makes three levels of choices. First, it chooses where to locate its HQ $h \in \mathcal{I}$. Then, it chooses in which regions to locate its production, management and financing activities, respectively $I = (I^y, I^m, I^v) \subset \mathcal{I} \times \mathcal{I} \times \mathcal{I}$. Finally, it chooses how many production workers to hire ℓ_i, salespeople and managers to employ m_i, and funding to get v_i, in each of the regions. We

[1] The HQ region in this approach is what the firm states it is on Crunchbase and LinkedIn. This avoids the thorny issues of firms setting up legal structures to minimize their tax payments.

[2] Since technology startups are overrepresented in Crunchbase, the migration rates in Figure 1 are likely higher than those in the broader firm distribution. Figure D.1 in the appendix shows similar patterns when dividing firms by employment size.

FIGURE 1: HQ migration rates between the US and Europe by size of firm



Notes: This figure shows the share of firms under ten years old that moved their headquarters from Europe to the US and from the US to Europe between 2014 and 2024, based on the matched Crunchbase snapshots. The rates are broken down by the level of the funding the firm had received by 2024. The dashed lines show the unconditional average. Europe is classified as the 27 European Union countries and the UK.

discuss these choices, one by one, by backward induction. Firms are defined with respect to their state variables, which we will gradually introduce.

3.1 The intensive margin and regions' efficiency per unit cost

With its HQ in region h and activities set up in regions I, the firm will choose how much to produce, sell, and borrow in each of these regions.

3.1.1 Technology for production

Following a large literature in labor and trade (Acemoglu and Zilibotti, 2001; Eaton and Kortum, 2002; Grossman and Rossi-Hansberg, 2008), we assume that a firm must combine a series of tasks (or intermediate goods) $y(\tau) \geq 0$ in the unit interval $\tau \in [0,1]$ in order to produce its final good $Y \geq 0$. These tasks can be substituted for one another with elasticity $\sigma_y > 1$ according to the function:

$$Y = \left[\int_0^1 y(\tau)^{\frac{\sigma_y - 1}{\sigma_y}} d\tau \right]^{\frac{\sigma_y}{\sigma_y - 1}} . \tag{1}$$

The combination of tasks that are potentially located in different regions of the world captures the decentralized production structures that we see in modern firms.

The firm offshores these tasks by following Ricardian comparative advantage. Each task can be produced by hiring labor in each region, $\ell_i(\tau)$, taking as given the product of three factors. The first is a firm-specific productivity z^y, which is common across the regions in which it operates. The second is a region-specific efficiency $a_i^y(h)$, common across firms, but that may depend on where the firm's headquarters is located. For instance, if the HQ and the region of production are very far apart, this efficiency may be lower. The third is an i.i.d. firm-specific task-shock in that region $\varepsilon_i(\tau)$, which has mean 1. Therefore:

$$y(\tau) = z^y \sum_{i \in I^y} a_i^y(h) \varepsilon_i(\tau) \ell_i(\tau) , \tag{2}$$

The firm wants to minimize the costs of producing, which equal the wage w_i times the workers hired in a region $l_i \equiv \int \ell_i(\tau) d\tau$ summed over all the regions. Following a long tradition in international trade, dating back to Eaton and Kortum (2002), we assume that the shocks $\varepsilon_i(\tau)$ are drawn from a Fréchet distribution with scale parameter 1 and shape parameter $\theta_y > 0$. This extreme-value assumption ensures that, in choosing the lowest-cost region to locate each of the production tasks, the firm does so proportionately to the relative efficiency of these regions.

3.1.2 Technology for sales and management

Following the literature on market penetration and management (Lucas, 1978; Arkolakis, 2010), the firm hires a sales force in a region in order to sell its output there. In each region, there is a continuum of identical districts indexed by $\delta \in [0, 1]$. In each district, the firm sets a monopoly price to sell an amount $q_i(\delta)$ of its service, facing a constant price-elasticity ($\sigma_m > 1$) demand function:

$$q_i(\delta) = z^q p_i(\delta)^{-\sigma_m} . \tag{3}$$

The z^q captures the popularity or quality of the service.

The larger is the sales-and-management force in the region, m_i, the larger is the mass of districts s_i that the firm can sell to in the region. A limited span of control generates diminishing returns to managing more workers across a larger mass of districts:

$$s_i = z^s a_i^m(h) m_i^{\theta_m} k^{\psi} \,. \tag{4}$$

Sales depend on firm-specific productivity z^s and region-specific efficiency $a_i^m(h)$, which depends on the headquarters' location. This efficiency potentially also captures the market size of that region and the corresponding economies of scale in selling larger quantities there. The extent of the span of control problem is captured by the positive parameter $\theta_m \in (0, 1)$. Finally, the capital of the firm k is used for market penetration with diminishing returns given by $\psi > 0$, and sales-and-management workers are paid a region-specific wage w_i^m.

It is worth pausing to discuss two assumptions. First, we ignored the use of capital in production, assuming that it is only used for market penetration in sales. Because the scale and profits are multiplicative, this is not important. Including the use of capital in production would lead to the same conclusions, and similar expressions, but with different exponents in how the capital stock affects profits.

Second, we assumed zero trade costs: sales in a region are independent of where the good or service was produced. If we had separate data on production and sales per region for each firm (or data on trade), we could identify the trade costs separately from these two dimensions of efficiency. Without them, we must set the trade costs to some number. By setting them to zero, we perfectly separate the efficiency of production and sales, and let the data speak as to whether they are strongly correlated across firms. At the other extreme, with infinite trade costs, that correlation would be one, since only the product of the joint efficiency in production and sales would matter. Ultimately though, since in our estimates, we will find that the EU–US gap along these two dimensions is small, the assumption on trade costs is likely not so important for our conclusions.

3.1.3 Access to external funding

The firm's capital k is provided by investors from around the world: $k = \sum_{i \in I^v} v_i$. We assume that the more financing the firm gets from region i, the higher is the cost r_i:

$$r_i = \frac{v_i^{\theta_v}}{z^v \, a_i^v(h)} \,, \tag{5}$$

where z^v is the firm-specific access to external finance. The $a_i^v(h)$ are region-specific financing conditions, which depend on HQ location, and capture the advantages or efficiency of that region's financial sector. The parameter $\theta_v > 0$ captures the curvature of financing costs.[3]

Building on a long literature on financial frictions, we provide in Appendix A a microfoundation for the upward sloping supply of funding from each region. The financiers in a region receive only a fraction of the excess return paid by the firm, while the rest is lost to intermediation costs. Moreover, the venture capitalists perceive that these returns are risky because the amount of output the firm gets has an unobserved random component, and they will invest less the higher is the variance. Finally, different regions have different amounts of capital to lend out. All combined, this generates the supply function above, where $a_i^v(h)$ is a composite of region-specific intermediation costs, expertise in assessing a lower risk of the firm, and depth of capital markets. With classic mean-variance financiers, the exponent is one, but generalizing to $\theta_v > 0$ captures different effective risk aversion by the financiers.[4]

3.1.4 Choices along the intensive margin and operating profits

By choosing to locate more workers or funding in a region relative to another, the firm reveals the relative efficiency per unit cost of those two regions. This revealed-preference intuition is captured in the following result that is proven in the appendix:

Proposition 1. *The cost-minimizing choices of locating production workers, sales-and-management workers, and funding, are such that the labor and funding shares per region are proportional to their relative efficiency per unit cost:*

$$\frac{w_i^y \ell_i}{w_j^y \ell_j} = \frac{\tilde{a}_i^y(h)}{\tilde{a}_j^y(h)} \quad , \quad \frac{w_i^m m_i}{w_j^m m_j} = \frac{\tilde{a}_i^m(h_f)}{\tilde{a}_j^m(h_f)} \quad , \quad \frac{v_i}{v_j} = \frac{\tilde{a}_i^v(h)}{\tilde{a}_j^v(h)}, \tag{6}$$

where $\tilde{a}_i^y(h) \equiv (a_i^y(h)/w_i^y)^{\theta_y}$ is the efficiency per unit wage cost of region i's production workers and, likewise, $\tilde{a}_i^m(h) \equiv (a_i^m(h)/(w_i^m)^{\theta_m})^{1/(1-\theta_m)}$ is the efficiency per unit wage cost of region

[3] To ensure an interior solution for capital, we assume $1 + \theta_v > \psi/(1 - \theta_m)$.

[4] In the appendix, we show that earnings or collateral based constraints would complicate the expression for profits, but lead to a similar expression for relative financing across regions, as well as a simila profit function that depends on the same factors with the same complementarities between them. A new element is that the net worth of the entrepreneur would now be part of the firm's productivity, broadening the interpretation of z^v.

i's sales-and-management workers, while $\tilde{a}_i^v(h) = a_i^v(h)^{1/\theta_v}$ *is the efficiency of region i's venture capital environment.*

These relative efficiencies per unit cost $\mathbf{a}(h) = \left\{a_i^y(h), a_i^m(h), a_i^v(h)\right\}_i$ may have multiple factors behind them. They may capture the education of workers in each country, hiring and firing costs, or management practices within a region. All the factors that lead the firm to hire a marginal worker in one region rather than another, because they can produce output more cheaply there, are captured by these terms.

The firm's operating profits (before entry costs) are a function of the location of its activities, of the firm-specific productivity, and of the location of its HQ.

Proposition 2. *The operating profits of the firm (before entry costs) are proportional to:*

$$\Pi(I, h, z) \propto z \left(\sum_{i \in I^y} \tilde{a}_i^y(h)\right)^{\beta^y} \left(\sum_{i \in I^m} \tilde{a}_i^m(h)\right)^{\beta^m} \left(\sum_{i \in I^v} \tilde{a}_i^v(h)\right)^{\beta^v}, \tag{7}$$

where $I = (I^y, I^m, I^v)$ *is the set of regions the firm operates in, h is the firm's HQ region, and the composite firm-specific productivity is:*

$$z \equiv \left[\left((z^y)^{\sigma_m - 1} z^q z^s\right)^{\frac{1}{1-\theta_m}}\right]^{\beta_m} (z^v)^{\beta_v/\theta_v}. \tag{8}$$

The elasticities $\boldsymbol{\beta} \equiv (\beta_y, \beta_m, \beta_v)'$ *are connected to the structural parameters by:*

$$\beta_y = \left(\frac{\sigma_m - 1}{\theta_y(1-\theta_m)}\right)\left(\frac{1+\theta_v}{1+\theta_v - \frac{\psi}{1-\theta_m}}\right), \tag{9}$$

$$\beta_m = \frac{1+\theta_v}{1+\theta_v - \frac{\psi}{1-\theta_m}} \quad \text{and} \quad \beta_v = \frac{\theta_v \frac{\psi}{1-\theta_m}}{1+\theta_v - \frac{\psi}{1-\theta_m}}. \tag{10}$$

The payoff from our restrictive functional assumptions is apparent in this proposition. First, the firm-specific productivity is captured by a single scalar z that summarizes its productivity across the three activities—production, sales and management, and financing. Second, the efficiency per unit cost of each activity enters symmetrically in the profit function. The elasticities in $\boldsymbol{\beta}$ determine how sensitive profits are to each of them, and we will estimate them as well as compare them with what a calibration to the structural parameters would suggest.

A firm's operating profits increase with three factors. First, they increase with firm-specific productivity z. Second, they increase if the firm operates in more regions (larger I^j) across all three activities. And third, they increase if the firm has its HQ in a more favorable region h that allows access to higher region-specific efficiency per unit cost $\mathbf{a}(h)$. These three factors are complementary with each other, and also complementary across the three activities of the firm.[5]

3.2 The extensive margin and the fragmentation of markets

A firm headquartered in region h chooses the regions I in which to locate its operations, taking into account that it will allocate inputs on the intensive margin as described in the previous section.

The benefits of opening an extra location are clear in Proposition 2: the firm can now reap the benefits of the efficiency in that location by tilting some of its workers or funding towards that location. Against this benefit, we assume that opening a location in region i for production entails a fixed entry cost $e_i^y(h) \geq 0$, and likewise for sales and financing, with respective costs $e_i^m(h)$ and $e_i^v(h)$.

These fragmentation costs capture the difficulties of adapting to the local culture, of adjusting processes to comply with regional regulations, and of navigating the local markets in which to hire the workers. A region with an open market, in the sense of this cost being lower, will attract more firms, and this openness may differ across the three activities. The costs depend on the location of the HQ because, if region i is closer to the HQ region h, then conceivably the costs are lower as a result of cultural, legal, or other similarities, in the spirit of gravity equations. More pointedly, if we consider a country as an agglomeration of regions, then the combination of these fixed costs within that country will capture how integrated its internal market is. The vector of fixed costs per HQ region

[5] For our purposes, it is sufficient to discuss the firms' problem and choices while taking the equilibrium input prices as given. Our model follows the structure of the Ricardian model, and the $\tilde{a}_i^j(h)$ map into the efficiency per unit cost in the classical model of Dornbusch et al. (1977). In that model, these efficiencies per unit cost determine the thresholds for which goods are exported and imported by each region, as well as what wages and prices will be in equilibrium. Since we do not use trade data, and our empirical application will difference out regional variables like wages and prices, taking this extra step in the theory would not affect our estimates. All we will use are firm choices conditional on equilibrium, but we do not need to define and solve for that equilibrium.

$\mathbf{e}(h) = \{e_i^y(h), e_i^m(h), e_i^v(h)\}_i$ will capture the fragmentation of that HQ location.[6]

The firm receives an additional random mean-zero shock $\varepsilon^I(I)$ for each possible set of regions to operate in that captures the heterogeneity in firm choices. Therefore, the firm's extensive margin choice is to maximize:

$$\pi(h, z, \varepsilon^I) \equiv \max_{I \in \mathcal{P}(I)} \Pi(I, h, z) - \sum_{i \in I^y} e_i^y(h) - \sum_{i \in I^m} e_i^m(h) - \sum_{i \in I^v} e_i^v(h) + \varepsilon^I(I) \,. \tag{11}$$

where $\mathcal{P}(I)$ are all the possible combinations of (I^y, I^m, I^v) that contain the home location in each dimension. To ensure the firms always earns non-negative profits, we assume that there are no fixed costs associated with operating in the home region, neither the deterministic ones $e_h^j(h) = 0$ for $j \in \{y, m, v\}$, nor the random ones: $\varepsilon^I(I_h) = 0$ (where $I_h \equiv (\{h\}, \{h\}, \{h\})$ indicates the set without any foreign locations).

Assuming that the shocks $\varepsilon^I(I)$ are drawn from a Gumbel (Extreme Value Type 1) distribution with mean zero and shape parameter ζ^I across firms gives a familiar result from discrete choice models:

Proposition 3. *The probability that a firm with productivity z and headquarters h uses location set $I \neq I_h$ within the set $\mathcal{P}(I) \setminus I_h$ is given by the logit:*

$$\Pr(I \mid h, z) \propto \exp\left(\frac{\Pi(I, h, z) - \sum_{j \in \{y,m,v\}} \sum_{i \in I^j} e_i^j(h)}{\zeta^I}\right) \,. \tag{12}$$

For a fixed set of location costs, this optimal behavior generates a distribution of firms across locations. Conversely, an observed empirical distribution of firm choices of locations reveals the fragmentation costs. When a region has more firms from a given HQ-region operating in it, the model explains this in part because the benefits of this region are especially high, and in part because the costs of having a location in it are especially

[6]Recalling our earlier discussion of trade costs, note that these fragmentation costs refer to the internal operation of the firm across regions. A large internal market for the firm's products would be captured by z^s and a region where one can enter easily and sell in large quantities would be captured in $e_i^m(h)$ and $a_i^y(h)$, but cannot be distinguished from the allocation of inputs that is our focus.

low.[7]

3.3 Locating the HQ and the nationality advantage

Finally, consider the firm's choice of where to locate its HQ. A firm is born in a particular region h^0, likely where its entrepreneur happened to be. Then, it chooses whether to relocate to a permanent HQ location h.[8] This location matters because, on the one hand, it affects profits through both the relative efficiency per unit cost $\mathbf{a}(h)$ and the fragmentation costs $\mathbf{e}(h)$.

On the other hand, HQ location also matters because it determines how much of its profits a firm based in h gets to keep, according to:

$$(1 - \tau(h))\pi(h, z, \varepsilon^I)^{1-\kappa(h)}. \tag{13}$$

If $\kappa(h) = 0$ then this tax-like wedge is flat at a rate $\tau(h)$. The higher is $\kappa(h)$, the more progressive the wedge is, up to the extreme where $\kappa(h) \to 1$ and every firm earns the same after-wedge profit regardless of its pre-wedge profit. This formulation of progressivity is common in the literature on household taxation and benefits (Benabou, 2002; McKay and Reis, 2021).

In the context of firms, this wedge captures by how much certain HQ locations reduce profits by hurting the ability of the firm to coordinate their activities across their many regions. This may be due to not just taxes, but also to poor management practices, the existence of a hub of innovation that affects operations across all other regions, or the ease with which living conditions or visa policies attract founders and HQ staff. Overall, it captures the features of a region that make it more or less attractive to have firms' HQs. The progressivity captures the size-dependence of policies towards firms studied in the

[7] The benefits of operating in a location are complementary across the three dimensions. For instance, a firm which produces in many locations will have a lower marginal costs and a higher profit from selling in an additional location. The fixed costs, instead, are additively separable across regions and across activities. We might think that opening production in one location lowers the costs of having sales in that location, perhaps because of transportation costs. Likewise, it may be that opening in one European country for a US company lowers the costs of opening in a second EU location. Since our model is rich in the complementarities in benefits from opening in different locations, all of these will simply be loaded into the profit function. It would be hard to separately identify complementarity across operational profits and fragmentation costs.

[8] We could expand the model to allow firms to relocate more than once, or to choose their initial location. However, in our data, we very rarely see a firm moving more than once, and we have poor data to identify whether an entrepreneur moved across regions in order to start their firm. Therefore, we cannot empirically explore these extensions.

literature on government policies towards firms (Guner et al., 2008; Garicano et al., 2016).

Against the benefits of moving that were laid out in the previous paragraphs is a moving cost equal to a share μ of after-wedge profits. To capture idiosyncratic variation in HQ choices, the firm draws a proportional profit shock $\varepsilon^H(h)$ for each possible destination h where $\log \varepsilon^H(h)$ is i.i.d. Gumbel with mean zero and scale parameter ζ^H.

Finally, since the entrepreneurs behind the firm do not know the draws of the Gumbel shocks on the extensive margin they will later face, they evaluate the profits according to their expected utility over these shocks. We assume that entrepreneurs have log preferences with respect to this risk, and $\mathbb{E}_{\varepsilon^I}[.]$ is their expectations operator.

Combining all of these ingredients, the choices by firms of whether to move their HQ location take the logit form (proven in the appendix):

Proposition 4. *The probability that a firm with productivity z has its HQ in region h conditional on starting in region h_0 is given by:*

$$\Pr(h \mid z, h_0) \propto \exp\left(\frac{\log(1-\tau(h)) + (1-\kappa(h))\mathbb{E}_{\varepsilon^I}\left[\log \pi(h, z, \varepsilon^I)\right] + \log(1-\mu)\mathbf{1}[h \neq h_0]}{\zeta^H}\right). \tag{14}$$

Firms' choices of moving their HQ reveal the relative advantage of nationality captured in $\tau(h), \kappa(h)$ together with the moving costs μ. By observing the share of firms that move, and the direction of those moves, we can estimate them. Firms that have higher productivity z will both be larger and also benefit more from having their HQ located in a more advantageous region. Against this effect, firms with higher z will face a higher tax wedge because of progressivity.

4 Identification and estimation

To map the model to the data, we index firms by f referring to LinkedIn and Crunchbase entries, and index years by t.[9] In the model, a firm was identified by a productivity z so, correspondingly, we write $z_{f,t}$. Likewise, for the choice variables, we have data on production workers in each region $\ell_{f,t,i}$ and locations $I^y_{f,t} \equiv \{i \in \mathcal{I} \mid \ell_{f,t,i} > 0\}$, sales-and-management workers $m_{f,t,i}$ and locations $I^m_{f,t}$, funding $v_{f,t,i}$ and locations $I^v_{f,t}$, wages $w_{t,i}$,

[9]The definition of a firm and its boundaries is not easy, and different papers make different assumptions on how to handle subsidiaries, plants, or holding companies. For us, a firm is its self-declared LinkedIn entry, and it is active in a region if it hires workers or gets funding from an entity in that region.

and finally the HQ at the start of the sample in 2014, h_f^0, and in 2024, h_f.[10]

We define regions i as the United States, the European Union (27 EU member countries together with the UK), and six regions covering the rest of the world: Northern America excluding the US, the remaining European countries, Latin America and the Caribbean (including Mexico), Africa, Asia, and Oceania. For firms headquartered in the US or the EU, we also allow operations to be located outside the firm's HQ location but within the same union, e.g., a Spanish-headquartered firm producing in France, or a New York-headquartered firm receiving finance from California. To keep the model computationally tractable, we represent these within-union alternatives as one additional location option available only to US- and EU-headquartered firms. Because this gives US and EU firms a richer location choice set than firms headquartered elsewhere, we only consider the choice by EU and US firms to relocate their HQ between the two unions.

In principle, and subject to computational limits, we could estimate all of the parameters of the model simultaneously. However, subject to the assumptions we made about when the two Gumbel shocks are realized, the estimation problem has a sequential structure. This structure has the advantage that its earlier-stage estimates rely on fewer structural assumptions and that the source of identification that govern each parameter is transparent. The regressions on the intensive margin to estimate relative efficiencies depend on few functional assumptions, while the estimate of the HQ mobility relies both on the particular production functions we assumed to get the elegant operating profit function in Proposition 2, as well as on the distributional assumptions on shocks that allowed for closed-form choice probabilities.

4.1 Measuring efficiency per unit cost given choices at the intensive margin

Taking as given the firms' HQ region h_f, and regions where it has operations $I_{f,t}$, we start by using their labor and funding shares to measure regions' efficiency per unit cost $\mathbf{a}_t(h)$.

[10]We use the LinkedIn data from the year 2023, the most recent year for which the data is complete. To reduce the role of misreporting, we only include a region i in firm f's location set when there are at least five LinkedIn profiles that indicate someone working for f from region i and the salary-weighted employment share of region i in firm f is over 1 percent. We use this rule both for the intensive and extensive margin estimates. Since the funding data is more sparse than the employment data, we construct the funding measures based on the average over the five years between 2019 and 2023. As Crunchbase reports the amount raised in a funding round and the set of participating investors, but not how much each investor contributed, we split each round's raised amount equally across its participating investors.

4.1.1 Identification assumption and interpretation

Proposition 1 implies that

$$\log w_i^y \ell_{f,t,i} = \log w_i^y \ell_{f,t,h_f} + \log \tilde{a}_i^y(h_f) - \log \tilde{a}_{h_f}^y(h_f)\,. \tag{15}$$

The share of the production wage bill that firm f allocates to region i relative to its HQ-region reveals the relative region-specific efficiency per unit cost: $\log \tilde{a}_i^y(h_f) - \log \tilde{a}_{h_f}^y(h_f)$. However, the headquarter-region specific term of interest, $\tilde{a}_i^y(h_f)$, is not identified. The within-firm variation identifies the efficiency per unit cost of region i relative to the HQ location, but it does not separately identify the component associated with the region the firm operates in and the component associated with the HQ location. There may be unobserved firm characteristics (like productivity z in our model) that are correlated with the HQ choice.

We achieve identification by assuming that the efficiency per unit cost of a region away from the HQ only depends on whether that region is within or outside the same union as the HQ:

$$\log \tilde{a}_i^y(h_f) = \log a_i^y - \eta_{W,h_f}^y \cdot \mathbf{1}^W(i,h_f) - \eta_{O,h_f}^y \cdot \mathbf{1}^O(i,h_f)\,. \tag{16}$$

The parameters a_i^y measure the relative efficiency per unit cost of a region that is common to any firm that hires production workers in that region. The indicator variable $\mathbf{1}^W(i,h_f)$ is equal to one if the location i is not the same as the HQ h_f but is still within the same union (EU or US), while the indicator $\mathbf{1}^O(i,h_f)$ is one when $i \neq h_f$ and i is outside the union.

The effect of the HQ is now captured by two parameters: $\eta_{W,h}^y$ and $\eta_{O,h}^y$. Relative to the benchmark region's efficiency a_i^y, it will be lower by $\eta_{W,h}^y$ log points if the location is not in the HQ but still within the union, and by $\eta_{O,h}^y$ if it is outside the union. We expect these both to be positive and the outside penalty parameter to be higher.

These parameters capture the crux of the questions posed in the introduction. The variation across locations in the a_i^y will tell us if on average across all firms, European, American, or otherwise, putting one's production workers in a EU region comes with lower efficiency per unit cost than in the US. The variation across the two HQ choices in $\eta_{W,h}^y$ and $\eta_{O,h}^y$ instead will capture whether EU firms suffer a bigger decline in the efficiency per unit cost of their production units abroad than US firms do.

4.1.2 Estimation and variation

The estimation equation that results is a linear relation:

$$\log w^{y}_{t,i}\ell_{f,t,i} = \bar{\alpha}_f + \log a^{y}_i - \eta^{y}_{W,h_f} \cdot \mathbf{1}^{W}(i,h_f) - \eta^{y}_{O,h_f} \cdot \mathbf{1}^{O}(i,h_f) + \epsilon^{y}_{f,t,i}\,, \tag{17}$$

where $\bar{\alpha}_f$ are firm fixed effects, a^{y}_i are location fixed effects, and $\epsilon^{y}_{f,t,i}$ captures unobserved firm-region shocks. The same arguments and regressions apply to management and funding as we make analogous assumptions about $a^{j}_i(h_f)$.

Equation (17) shows the variation in the data that identifies a region's efficiency per unit cost and its efficiency penalty for operating abroad. Take the example of an Asian firm. Comparing its choice to have more workers in the US than the EU identifies the relative efficiency per unit cost of these two regions. In turn, comparing the share of workers that a US firm has in the US versus other locations, with the shares in and out of the EU for an EU firm identifies the respective penalty distances for the two regions.

4.1.3 Selection: a problem and a solution

The estimation just described takes as given the set of locations $I_{f,t}$. But, unlike in the model, the firms in the data likely observe their idiosyncratic shocks $\epsilon^{y}_{f,t,i}$ when choosing location regions on the extensive margin. All else equal, a firm's choice of locations will then be tilted towards the regions where it is more efficient to produce. This creates a selection problem. Because we only observe the intensive margin decisions for a region if the firms chose to operate in that region, this will bias the estimates of the region's intensive-margin efficiency per unit cost upward. Conditional on being selected, the expectation of a region's efficiency is higher.

More formally, in equation (17), the firm's input intensity decisions are affected not only by the region's efficiency per unit cost a^{y}_i that we want to estimate, but also by the idiosyncratic shocks $\epsilon^{y}_{f,t,i}$. The firm knows its draw of $\epsilon^{y}_{f,t,i}$, but the econometrician does not. This selection means that $\mathbb{E}_{\epsilon^y}[\epsilon^{y}_{f,t,i} \mid i \in I^{y}_{f,t}, h_f]$ is not the same across the regions. If a particular region i is generally unlikely to be chosen as a production platform, then conditional on it being chosen, the shock $\epsilon^{y}_{f,t,i}$ is high on average. Therefore, the estimates will be biased if selection is stronger for some regions than others.

As in Heckman (1979), the problem can be addressed by including an estimate of $\mathbb{E}_{\epsilon^y}[\epsilon^{y}_{f,t,i} \mid i \in I^{y}_{f,t}, h_f]$ as a control variable in the regression (17). The challenge is that this expectation in our model is a complicated function of all the parameters. To address it, we develop a new method to estimate the control function from observables.

Proposition 5. *If the shocks on the intensive margin are normally distributed and the shocks on the extensive margin follow a logit, then the selection function is, up to a first order, equal to*

$$\mathbb{E}_{\epsilon^j}[\epsilon^j_{f,t,i} \mid i \in I^j_{f,t}, h_f, z_f] \approx \frac{\sigma^2_{\epsilon,j}}{\zeta^I} \cdot \Big(1 - \Pr(i \in I^j_{f,t} \mid h_f, z_f)\Big) \cdot \mathbb{E}_{\epsilon^j}\left[\frac{\partial \Pi_{f,t}(.)}{\partial \epsilon^j_{f,t,i}} \mid i \in I^j_{f,t}, h_f, z_f\right], \tag{18}$$

for $j = y, m, v$, where $\Pr(i \in I^j \mid h, z)$ is the probability of including region i in the regions of operation when the HQ is in h_f with productivity z_f and where $\Pi_{f,t}(.)$ are the firm's profits.

This result shows that the expected value of the unobserved shock conditional on selection can be expressed as a function of: (i) the probability that region i is chosen by firms with headquarters in h_f and productivity z_f and (ii) the marginal contribution of region i to the firm's profits. Intuitively, the more exceptional a region must be to justify entry, the larger the expected upward bias in measured efficiency conditional on entry. We can identify (i) from the empirical share of firms from HQ region h that operate in region i and (ii) from the product of the firm's overall profits and its expenditure share in i.[11]

We expect this selection adjustment to be useful in other discrete-choice models with sets of complementary options.

4.2 Extensive margin

Using Proposition 3, the data on the share of locations in which firms operate allows us to estimate the fragmentation costs using logit regressions. However, as with the intensive margin, we need more information.

4.2.1 Three identification problems and solutions

To separately identify region and HQ effects, we make a similar assumption that entry costs have a region-specific component that depends on whether the region is not the HQ

[11] Formally, equation (7) implies that:

$$\frac{\partial \Pi_{f,t}(.)}{\partial \epsilon^j_{f,t,i}} = \beta^j \Pi_{f,t}(.) \left(\frac{\tilde{a}^y_i(h) \exp\left(\epsilon^j_{f,t,i}\right)}{\sum_{i \in I^j_{f,t}} \tilde{a}^y_i(h) \exp\left(\epsilon^j_{f,t,i}\right)} \right).$$

but is in the union versus if it is outside the HQ's union:

$$e_i^j(h) = \phi^j_{W,\mu(h)} \cdot \mathbf{1}^W(i, h_f) + \phi^j_{O,\mu(h)} \cdot \mathbf{1}^O(i, h_f), \tag{19}$$

for $j \in \{y, m, v\}$, and where the indicator functions are defined as in equation (16). Proposition 3 then implies that the fragmentation costs can be estimated from a conditional logit regression over profits that controls for the number of locations inside and outside the union interacted by the union of the HQ region. The coefficients on the number of locations inside and outside the union capture the segmentation parameters $\phi^{\cdot}_{W,\mu(h)}$ and $\phi^{\cdot}_{O,\mu(h)}$, respectively.[12]

Unfortunately, the profits that enter the logit depend on the firm's productivity $z_{f,t}$. This is unobserved. Equation (7) provides a solution to this second identification problem. Relative to the baseline set of locations observed for a firm f, alternative location choices scale up profits according to the formula:

$$\Pi_f(I', .) = \Pi_f(I_{f,t}, .) \cdot \prod_{j=y,m,v} \left(\frac{\sum_{i \in I^{j\prime}} \tilde{a}_i^j(h_f)}{\sum_{i \in I^j} \tilde{a}_i^j(h_f)} \right)^{\beta^j}. \tag{20}$$

Moreover, while we do not observe the profits net of entry costs in the chosen location $\Pi_f(I_{f,t}, .)$, this is proportional to the total wage bill according to the model, which we do observe. Therefore, we can calculate the relative profit gain from adding more locations for each firm using the estimates of $\boldsymbol{\beta}$ from the profile likelihood, and the estimates of the relative efficiencies $\mathbf{a}(h)$ from the selection-adjusted panel regressions in the intensive margin.

A third and final identification issue is that the contribution of adding a location of each type to profits depends on the elasticities $\boldsymbol{\beta}$ in Proposition 2. Conceptually, maximizing the logit likelihood in Proposition 3 over both the fragmentation costs $\mathbf{e}(h)$ and these elasticities using the empirical choice probabilities is straightforward. However, the Gumbel scale parameter ζ^I and the scale of the three components in $\boldsymbol{\beta}$ are only weakly separately identified.

Intuitively, a lower variance of the Gumbel shocks makes choices more sensitive to profits, while a higher scale of the profit elasticities makes profits more sensitive to loca-

[12] A technical note is that Proposition 3 applies exactly only when comparing sets containing foreign regions, not the home set I_h because we assumed $\varepsilon^I(I_h) = 0$ to guarantee positive profits. However, we show in Appendix C.1 that the logit provides a reasonable approximation for the probability that the home set is chosen.

tions. With only data on the frequency of choices, we cannot separate the two. Appendix C.2 formally shows that, up to a first-order approximation, only the ratio of the $\boldsymbol{\beta}$ and the fragmentation costs $\mathbf{e}(h)$ to ζ is identified in the resulting linear-in-parameter logits. Therefore we calibrate $\zeta = 3$ so that the resulting estimates of the average fixed cost of adding a production location are about 7 million euros, as estimated by Tintelnot (2017). We then verify that, allowing for non-linearities in the logit, raising ζ approximately proportionately scales all of the estimates.

4.2.2 Estimation and variation

We separate the maximization of the likelihood into two steps. We first estimate the entry costs using a conditional logit regression to maximize the likelihood conditional on a given $\boldsymbol{\beta}$. We then obtain estimates of $\boldsymbol{\beta}$ by maximizing over the resulting "profile" likelihood. This procedure is equivalent to joint maximization of the likelihood.

The resulting estimates are $\beta_y = 1.64$, $\beta_m = 1.41$ and $\beta_v = 0.36$. Using Proposition 2, we can compare these empirical estimates with a reasonable calibration of the structural parameters. For instance, using a demand elasticity over goods $\sigma_m = 5$ (Head and Mayer, 2014), a Fréchet shape parameter for production $\theta_y = 8$ (Eaton and Kortum, 2002), a span-of-control parameter $\theta_m = 0.7$ and returns to capital of $\psi = 0.1$ to match a degree of returns to scale of 0.8 (Hsieh and Klenow, 2009; Guner et al., 2008), and the mean-variance curvature $\theta_v = 1$ (Markowitz, 1952), we would get $\beta_y = 2$, $\beta_m = 1.2$, and $\beta_v = 0.2$.

For a given $\boldsymbol{\beta}$, the identification of the fragmentation costs comes from the following variation in the data: if EU firms operate on average in fewer regions within Europe than US firms, then we would identify higher within-EU fixed costs. In turn, if they are less likely to have workers or funding outside the EU relative to US firms outside the US, this identifies a higher penalty for being a European-HQ firm.

4.2.3 Computational hurdles and solutions

Maximizing the joint likelihood over entry costs and elasticities is computationally demanding. The separation into two stages significantly simplifies the problem, because our model delivers analytical solutions for the gradient and Hessian of the profile likelihood. Therefore, we can efficiently maximize the profile likelihood to obtain the estimates of $\boldsymbol{\beta}$ (see Appendix C.3 for the derivations).

Still, in the second step, estimating a conditional logit regression requires evaluating each firm's profits before entry costs $\Pi(I', h_f, z_{f,t})$ using Proposition 2 across all the possible (counterfactual) alternative sets of locations I'. The number of alternative locations is very large. For example, a firm headquartered in Asia can decide whether or not to operate in 7 other regions in each of the 3 dimensions, yielding $2^{7\cdot 3} \approx 2.1 \cdot 10^6$ possibilities in $\mathcal{P}(I)$ that one would have to evaluate the logit function over for each firm.[13]

We address this computational problem by following McFadden (1978) and Daly et al. (2014) in estimating the parameters over a subset $\mathcal{S} \subset \mathcal{P}(I)$ of feasible location combinations. Consistency requires adding a correction term for the inclusion probability to the indirect utility of each alternative i'. Sampling alternatives with replacement (ensuring the chosen alternative is always included) where alternative i' is chosen with probability $p_{i'}$ in each independent draw yields an inclusion probability of $q_{i'} = 1 - (1 - p_{i'})^{|\mathcal{S}|}$ (Daly et al., 2014). We set $p_{i'}$ equal to the share of firms in the HQ region with a presence in each alternative region.

4.3 Locating the HQ: identification, variation, and computation

Proposition 4 suggests estimating the attractiveness of a HQ location $\{\tau(h), \kappa(h)\}$ and the moving cost μ using a conditional logit regression on the observed HQ locations with controls for the expected log profits.

Since the progressivity elasticities $1 - \kappa(h)$ multiply profits in equation (14), they are only identified relative to the scale of the Gumbel shocks ζ^H. Therefore, we set $\kappa(\text{US}) = 0$ so that $\kappa(\text{EU})$ captures the progressivity of scale-dependent policies in the EU relative to the US. In turn, the intercept in the logit only identifies the relative $\tau(h)$, so we likewise set $\tau(\text{US}) = 0$.

With these two assumptions, the variation in the data that identifies the parameters is transparent. The overall frequency of HQ relocations provides information about the relocation cost: if firms rarely move their HQ, then the model attributes this to a high μ. Then, holding fixed the moving frequency, if firms disproportionately move from region h to region h' rather than in the opposite direction, then the model attributes this to a higher value of $\tau(h)$ relative to $\tau(h')$. Finally, if we see a scale gradient on the firms that choose to move in each direction, then the slope of that gradient identifies the progressivity parameter $\kappa(h)$.

[13] One property of the problem is that the probability of choosing a set of locations for one activity conditional on the firm's observed locations in the other two activities also has the logit form. Therefore, we could separately estimate three logit models. Given the combinatorial nature of the alternative locations, this reduces the number of alternatives, even if it is less efficient. Appendix C.4 discusses it further.

The main computational difficulty is that computing $\mathbb{E}_{\varepsilon^I}\left[\log \pi(h, z, \varepsilon^I)\right]$ is conceptually simple given the $\mathbf{a}(h)$ and $\mathbf{e}(h)$ that we estimated before, but it involves summing over a very large set of location choices for each firm-HQ pair. We compute this term for each h over a grid of z-values and use interpolation to evaluate it for each firm, as discussed in Appendix C.5.

5 The sources of EU–US differences

This section presents the main estimates comparing Europe and the United States.

5.1 Regional relative efficiency per unit cost across activities

Figure 2 reports the estimates of the relative efficiency per unit cost $\tilde{a}_i^j$ for the three activities for the EU and the US.[14]

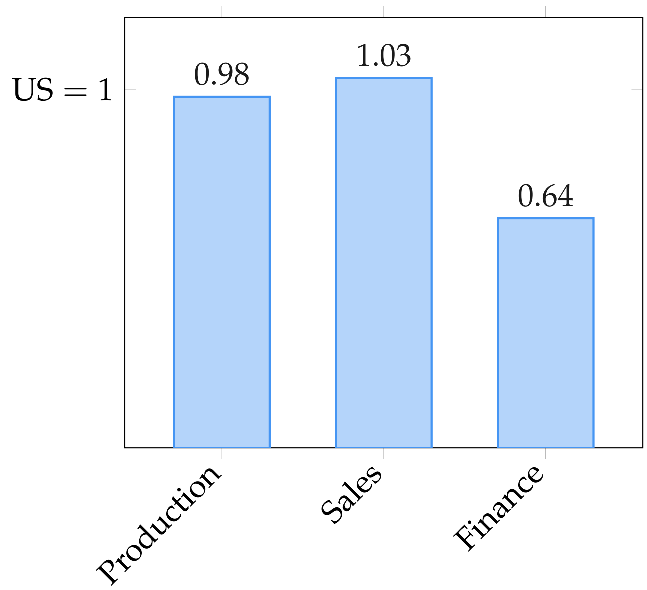
The estimates show that the EU is close to parity with the US in production and almost identical in sales. In contrast, the efficiency per unit cost gap in finance is large. Our first key finding is that it is in capital markets, rather than labor markets, that the main efficiency difference between the EU and the US lies.

What drives this finding in the data is the share of workers (or finance) that firms source from the EU relative to the US, conditional on sourcing from both in the extensive margin. Simply put, when one looks at firms with a HQ outside of the EU and the US, we find that conditional on having workers in both regions, the relative share of workers in these two locations is approximately similar. Instead, when an Asian or South American firm obtains external funding from both the EU and the US, the amount from the latter is much larger relative to the amount from the former. By revealed preference, firms obtain US funding more efficiently than EU funding, but they find US and EU workers, whether in production or sales and management, to be roughly equally efficient.

To interpret these differences, recall that $\tilde{a}_i^j$ measures efficiency per unit cost in activity j undertaken in region i. If wages everywhere were always equal to the marginal product of labor, then $\tilde{a}_i^j = 1$ for production and sales and management. The differences we are estimating are wedges that may be due to regulations, unions, monopolies, and other factors. Our estimates suggest that these EU–US differences are small, which is partly

[14]Table D.1 presents the full set of estimates for all the other regions.

FIGURE 2: The efficiency per unit cost of the EU relative to the US across activities



Notes: Each bar shows the estimate of the relative efficiency per unit cost $\tilde{a}^j_{EU}/\tilde{a}^j_{US}$ for $j = y, m, v$.

a reflection of lower wages in the EU matching lower labor productivity.[15] Instead, in finance, the differences show that firms can get more US funding for the same rate as they can in the EU, which may reflect again regulation, economies of scale in banks and venture capitalists, or ability to diversify by investors.

Figure 3 further unpacks these estimates by repeating the estimation procedure but now treating each state in the US, and each country in the EU, as a separate region. For production and sales, beyond the similar mean efficiency reported in Figure 2, the two distributions are also similar. For finance, we see that the the US advantage is mostly driven by a few states, with California at the top.

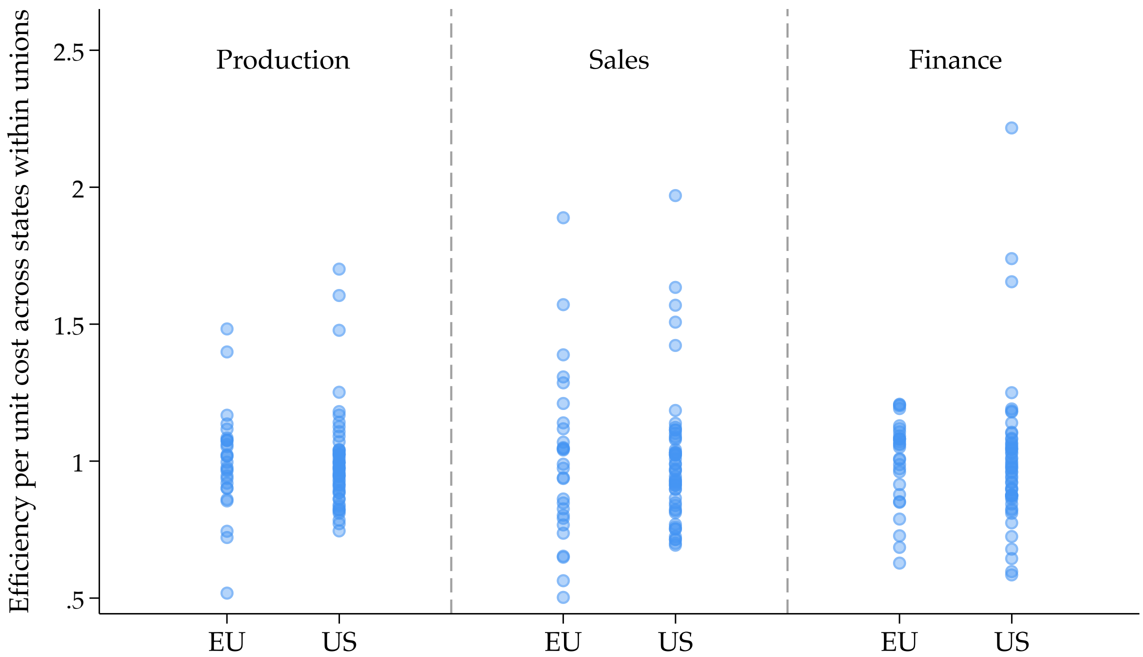
5.2 Efficiency penalties outside and within the union

Table 2 reports the estimated efficiency penalties when firms operate away from their headquarters, whether within their union, or outside of the union, for the EU and the US.[16] As expected, both parameters are positive and, for all, the outside penalty is higher than the within-union one.

[15] In principle, if one had excellent data on wages and confidence in the parameter values for θ_y and θ_m, we could go from our estimates to differences in labor productivity.

[16] Table D.2 in the appendix reports the estimates for the other regions.

FIGURE 3: Distribution of efficiency per unit cost across EU and US regions



Notes: This figure shows the density of the estimates of $\tilde{a}_i^j$ across the i=1,...,50 US states (in red), and the 28 European countries (in blue).

The penalties for operating outside the region of the HQ in panel A are sizable. They are also similar whether that region is in the EU or the US. Panel B shows that US firms operate across states with less efficiency loss than EU firms operate across the member countries. This suggests that the internal market in Europe is more fragmented, and this is true across production, sales and management, and finance. Moreover, and surprisingly, the penalties for an EU firm from operating in a country outside or within the EU are roughly comparable.

In the data, when we see a firm from one European country starting to hire workers in another country, this is almost as likely to be another EU country as a non-EU country. Recall that our data and analysis is for firm inputs. The lack of integration that we are capturing may be due to cultural and language differences in managing workers in different regions or disparities in labor law. These seem to be much higher across EU countries than they are across US states.

TABLE 2: Efficiency penalties from operating outside the region of the HQ

Region	Panel A. Outside the union			Panel B. Within the union		
	Production	Sales	Finance	Production	Sales	Finance
US	1.74	1.67	0.33	0.53	0.37	−0.19
	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)
EU	1.83	1.70	0.81	1.54	1.43	0.39
	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.03)

Notes: This table reports estimates of $\eta^{y}_{O,h}$ in panel A, and $\eta^{y}_{W,h}$ in panel B, for $h = EU, US$ across rows and $j = y, m, s$ across columns. These are the relative drops in efficiency per unit costs when operating outside the HQ union, and when operating outside the HQ country/state but within the union, relative to efficiency per unit cost in the region where the HQ is. Standard errors are reported in parentheses.

5.3 The extensive margin: fragmentation costs across activities

Table 3 has the estimates of the fixed costs of opening operations in a location that is in the same union as the HQ, or away from it, for the EU and the US.[17]

Across activities, and within the union, these fixed costs are smaller for firms with a HQ in the US than for those with a HQ in the EU. Opening locations outside the union is instead approximately equally costly for EU and US firms. The difference is in the internal fragmentation, and it is especially pronounced in production and sales, where the cost is almost 6 times smaller across US regions than it is across EU regions. Together with the efficiency penalties in Table 2, this is our second finding: the EU internal market is significantly more segmented than the US one.

Intuitively, in the data, US firms are more likely to spread out their workers across more regions than EU firms are to spread them across EU countries. There are many more EU firms that operate only within their country than there are US firms that only hire workers within their state. This could reflect in part lower labor mobility within the EU, as workers are unwilling to move to offices or subsidiaries in other countries, raising the cost the firm must pay to either convince them or to find local substitutes. Likewise, the result on funding suggests that US firms are more likely to obtain funding from a state that is not the one in their HQ, pointing to a more integrated capital market within the US than within the EU.

[17] Table D.3 in the appendix has the estimates for all the other regions.

TABLE 3: Fixed costs per foreign location (in mln $) by HQ region

Region	Panel A. Outside the union			Panel B. Inside the union		
	Production	Sales	Finance	Production	Sales	Finance
US	9.97	10.18	16.26	1.07	1.31	10.17
	(0.05)	(0.06)	(0.16)	(0.03)	(0.03)	(0.10)
EU	9.27	9.47	16.59	6.16	6.13	13.57
	(0.06)	(0.06)	(0.20)	(0.07)	(0.07)	(0.22)

Notes: This table reports estimates of $\phi^{y}_{O,h}$ in panel A, and $\phi^{y}_{W,h}$ in panel B, for $h = EU, US$ across rows and $j = y, m, s$ across columns. These are the fixed costs of opening a location for an activity in a region within and outside the union. Standard errors are reported in parentheses.

5.4 The HQ location: attractiveness of regions

Table 4 shows the estimates of the attractiveness of locating the HQ in the EU versus the US that are identified from the migration patterns of firms.[18]

The positive estimate of κ implies that the penalty wedge from having the HQ in the EU relative to the US is greater for large firms. The elasticity of net profits with respect to gross profits is 0.46 lower in the US than in the EU. This implies that an EU firm in the 90$^{\text{th}}$ percentile of the productivity (and size) distribution gets to keep a 29% smaller share of its gross profits than the median productivity firm.[19]

To understand the joint role of τ and κ in determining the overall size of the wedge and its impact on moving, Figure 4 shows probabilities of moving from the US to the EU in two distinct ways. The left panel shows the odds ratio implied by the estimates. These are all below 1, since firms of all sizes are more likely to move from the EU to the US than vice versa (recall Figure 1). The model is able to fit the scale gradient of moving in Figure 1 through two mechanisms: one is endogenous, as profits increase with productivity and productivity is complementary with the benefits in efficiency and lower entry costs of being in a better HQ, while the other is exogenous as the progressivity in the

[18] The counterfactual expected profits are calculated on the basis of firms' productivity $z_{f,t}$ that is estimated from the firm size in 2024 (after any potential moving). In Table D.4 in the Appendix, we show estimates based instead on firms' productivity z estimated in 2014-15, before the move. The estimates are similar.

[19] This follows from evaluating $\left(\mathbb{E}_{\varepsilon^I}\left[\pi(EU, z_{90}, \varepsilon^I)\right] / \mathbb{E}_{\varepsilon^I}\left[\pi(EU, z_{50}, \varepsilon^I)\right]\right)^{-\kappa(EU)}$, the ratio in expected "keep-rates" between the 90$^{\text{th}}$ and 50$^{\text{th}}$ percentile. Note that it ignores the variance due to ε^I.

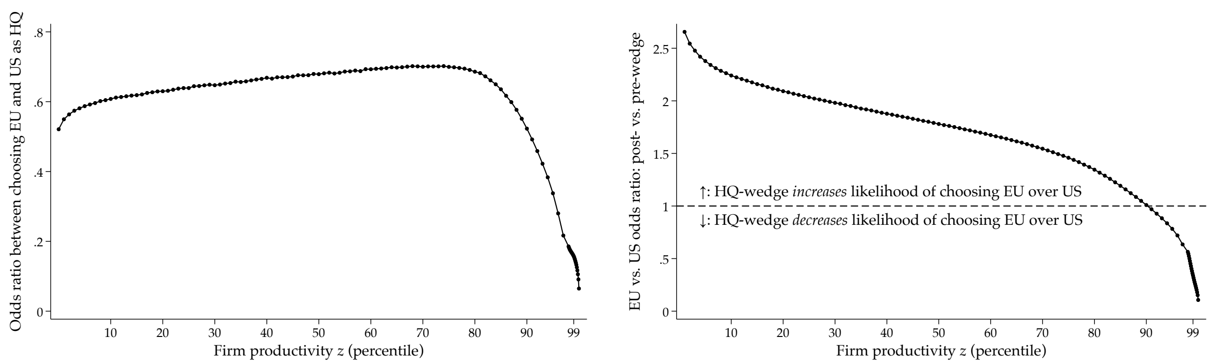
TABLE 4: The relative HQ-wedge of being in the EU and moving costs

$\tau(\text{EU})$	$\kappa(\text{EU})$	μ	ζ^H
−0.817	0.455	0.999	1.731
(0.447)	(0.080)	(0.002)	(0.446)

Notes: This table reports estimates of the parameter associated with choosing the HQ and migration patterns in the data. Standard errors are reported in parentheses.

FIGURE 4: Probability of moving from the US to the EU versus the other way around

(A) Odds ratio of US→EU vs. vice versa (B) Effect of HQ-wedge on the odds-ratio



Notes: This figure shows the implied migration probabilities from the US to the EU vs. vice versa and the role of the tax wedges. The left panel shows the probability of moving from the US to the EU divided by the probability of moving from the EU to the US, by firm productivity. The right panel shows how much this ratio is affected by the tax wedges $\tau(h)$ and $\kappa(h)$, where a value of 1 means that the tax wedge does not affect this odds ratio, and 2 means that the tax wedge doubles it.

wedge creates a size penalty of being in the EU. The joint effect of complementarity and progressivity shows up in the downward sloping relation. This is especially pronounced as one gets closer to the most productive firms.

The right panel isolates the effect of the wedge. It calculates the difference in the odds ratios including the wedge parameters $(\tau(h), \kappa(h))$ versus if both of these were zero. The downward-sloping line is entirely due to the progressivity associated with having a positive $\kappa(h)$. Interestingly, for firms below the 90$^{\text{th}}$ percentile, the wedge alone would make them more likely to move to the EU from the US than the other way around.[20] Were it

[20] Another way to see this is that, using the formula in equation (14), then regardless of the firm's productivity, τ makes each firm be $\exp\left(\frac{1}{\zeta^H}\log\left(1-\tau(\text{EU})\right)\right) = 1.41$ times more likely to move to the EU from the US than the other way around. This is offset by the efficiency and fragmentation benefits of being based in the US, and by the progressivity.

not for the redistributive wedge favoring these smaller firms in the EU, the advantage of the US in terms of efficiency per unit cost, and less fragmentation, would induce counterfactually many small firms to move there from the EU. For the largest firms however, to explain the large migration of firms to the US, the model identifies a large penalty from commanding operations from the EU.

To conclude, the third main result in this section is that the scale penalty for EU firms is significantly larger than it is for the US.

6 Conclusion

Why is the US more productive than the EU? Is it because its production workers are more skilled (Ricardo (1817)'s comparative advantage)? Is it because US management is more efficient at organizing sales and operating in multiple locations (the Chandler (1977) hypothesis studied in Engbom et al. (2025))? Or is it instead because financing is more abundant or cheaper in the US (a venture capital story as in Kortum and Lerner, 2000)? Is it because labor markets are less fluid in Europe and regulations are stricter and more intrusive, making it harder to operate in multiple EU regions in a productive way (Schoefer, 2025)? Or is it the fragmentation in EU goods and services markets, in contrast with the US's single larger homogeneous market (as in Marshall, 1890)? Finally, is it because of differences in taxes and regulations biased toward small firms that lower the effective returns from growing fast in the EU, or is it because the costs of moving to the US are lower because of visa policies or openness to immigrants?

The famous report by Draghi (2024) concluded that all of these factors mattered to some degree. It argued that the EU is a worse business environment for firms than the US because of regulatory barriers to scaling up, a fragmented single market, a shallow capital market, and a shortage of skills in technologically advanced domains.[21]

This paper takes a step forward by offering a transparent quantitative assessment of which reasons matter most. We develop a model of firm choice combining production, sales and management, and financing locations, build a global database on firms' inputs,

[21] A few quotes from the introduction of the report are illustrative: "Regulatory barriers to scaling up are particularly onerous in the tech sector, especially for young companies." "The lack of a true Single Market also prevents enough companies in the wider economy from reaching sufficient size to accelerate adoption of advanced technologies." "Europe needs to make it easier for "inventors to become investors" and facilitate scaling up of successful ventures." "A better financing environment for disruptive innovation, start-ups and scale-ups is needed as barriers to growth within the European markets are removed." "Skills shortages are acting as a barrier to innovation and technology adoption".

and combine the two to identify different margins of relative attractiveness of one region relative to others. Using the observed choices of location by firms, we conclude that there were three major advantages of the US relative to the EU according to firms: more efficient funding, more integrated within-union markets for locating inputs, and less aggressively scale-dependent policies that would discourage larger firms. Instead, workers in the EU do not appear to be less productive than those in the US, and the costs of entering markets outside of the EU are not significantly larger than those facing US firms.

References

ACEMOGLU, D. AND F. ZILIBOTTI (2001): "Productivity Differences," *Quarterly Journal of Economics*, 116, 563–606.

ALFARO-URENA, A., J. CASTRO-VINCENZI, S. FANELLI, AND E. MORALES (2023): "Firm Export Dynamics in Interdependent Markets," NBER working paper 31610.

ALFARO-UREÑA, A., I. MANELICI, AND J. P. VASQUEZ (2022): "The Effects of Joining Multinational Supply Chains: New Evidence from Firm-to-Firm Linkages," *Quarterly Journal of Economics*, 137, 1495–1552.

ALVIAREZ, V., J. CRAVINO, AND N. RAMONDO (2023): "Firm-Embedded Productivity and Cross-Country Income Differences," *Journal of Political Economy*, 131, 2289–2327.

ANTRAS, P. AND D. CHOR (2013): "Organizing the Global Value Chain," *Econometrica*, 81, 2127–2204.

ANTRAS, P., T. C. FORT, AND F. TINTELNOT (2017): "The Margins of Global Sourcing: Theory and Evidence from US Firms," *American Economic Review*, 107, 2514–2564.

ARKOLAKIS, C. (2010): "Market Penetration Costs and the New Consumers Margin in International Trade," *Journal of Political Economy*, 118, 1151–1199.

ARKOLAKIS, C., F. ECKERT, AND R. SHI (2023): "Combinatorial Discrete Choice: Theory and Application to Multinational Production," NBER Working Paper 31877.

BARTELSMAN, E., J. HALTIWANGER, AND S. SCARPETTA (2013): "Cross-Country Differences in Productivity: The Role of Allocation and Selection," *American Economic Review*, 103, 305–334.

BENABOU, R. (2002): "Tax and Education Policy in a Heterogeneous Agent Economy: What Levels of Redistribution Maximize Growth and Efficiency?" *Econometrica*, 70, 481–517.

BERGEAUD, A. (2024): "The Past, Present and Future of European Productivity," ECB Forum on Central Banking.

BLOOM, N., R. SADUN, AND J. V. REENEN (2012): "Americans do IT better: US Multinationals and the Productivity Miracle," *American Economic Review*, 102, 167–201.

BRUNNERMEIER, M. K. AND Y. SANNIKOV (2014): "A Macroeconomic Model with a Financial Sector," *American Economic Review*, 104, 379–421.

CAVALLO, A., M. G. COLOMBO, AND N. J. FOSS (2026): "Microfoundations of entrepreneurial ecosystems: a critical commentary on future research directions," *Small Business Economics*, 66, 1991–2010.

CHANDLER, A. D. (1977): *The Visible Hand: The Managerial Revolution in American Business*, Cambridge, MA: Harvard University Press.

COLOMBO, M. G., A. LUCINI-PAIONI, AND B. TOFAN (2025): "Mapping Venture Capital Investments in the (New) Space Economy with Large Language Models: a Comparative Analysis of Europe and the United States," SSRN 5506278.

COLONNELLI, E., M. CRUZ, M. PEREIRA-LOPEZ, T. PORZIO, AND C. ZHAO (2026): "Startups in Africa," Columbia University manuscript.

CONTI, A. AND J. A. GUZMAN (2023): "What Is the US Comparative Advantage in Entrepreneurship? Evidence from Israeli Migration to the United States," *The Review of Economics and Statistics*, 105, 528–544.

COSTINOT, A., D. DONALDSON, AND I. KOMUNJER (2012): "What Goods Do Countries Trade? A Quantitative Exploration of Ricardo's Ideas," *Review of Economic Studies*, 79, 581–608.

DALY, A., S. HESS, AND T. DEKKER (2014): "Practical Solutions for Sampling Alternatives in Large-Scale Models," *Transportation Research Record*, 2429, 148–156.

DORNBUSCH, R., S. FISCHER, AND P. A. SAMUELSON (1977): "Comparative Advantage, Trade, and Payments in a Ricardian Model with a Continuum of Goods," *American Economic Review*, 67, 823–839.

DRAGHI, M. (2024): "The Future of European Competitiveness," European Commission.

DUBIN, J. A. AND D. L. MCFADDEN (1984): "An econometric analysis of residential electric appliance holdings and consumption," *Econometrica: Journal of the Econometric Society*, 345–362.

EATON, J. AND S. KORTUM (2002): "Technology, Geography, and Trade," *Econometrica*, 70, 1741–1779.

ENGBOM, N., H. MALMBERG, T. PORZIO, F. ROSSI, AND T. SCHOELLMAN (2025): "Economic Development According to Chandler," NBER working paper 34483.

GARICANO, L., C. LELARGE, AND J. VAN REENEN (2016): "Firm Size Distortions and the Productivity Distribution: Evidence from France," *American Economic Review*, 106, 3439–3479.

GROSSMAN, G. M. AND E. ROSSI-HANSBERG (2008): "Trading Tasks: A Simple Theory of Offshoring," *American Economic Review*, 98, 1978–1997.

GUNER, N., G. VENTURA, AND Y. XU (2008): "Macroeconomic Implications of Size-Dependent Policies," *Review of Economic Dynamics*, 11, 721–744.

GUTIÉRREZ, G. AND T. PHILIPPON (2018): "How EU markets Became More Competitive than US markets: A Study of Institutional Drift," NBER working paper 24700.

HEAD, K. AND T. MAYER (2014): "Gravity Equations: Workhorse, Toolkit, and Cookbook," in *Handbook of International Economics*, ed. by G. Gopinath, E. Helpman, and K. Rogoff, Amsterdam: Elsevier, vol. 4, 131–195.

HECKMAN, J. J. (1979): "Sample Selection Bias as a Specification Error," *Econometrica*, 153–161.

HSIEH, C.-T. AND P. J. KLENOW (2009): "Misallocation and Manufacturing TFP in China and India," *Quarterly Journal of Economics*, 124, 1403–1448.

JIA, P. (2008): "What Happens When Wal-Mart Comes to Town: An Empirical Analysis of the Discount Retailing Industry," *Econometrica*, 76, 1263–1316.

JORGENSON, D. W. (2009): *The Economics of Productivity*, Edward Elgar.

KORTUM, S. AND J. LERNER (2000): "Assessing the Contribution of Venture Capital to Innovation," *RAND Journal of Economics*, 674–692.

LAGARDE, C. (2024): "Follow the Money: Channelling Savings into Investment and Innovation in Europe," Speech at the 34th European Banking Congress in Frankfurt.

LETTA, E. (2024): "Much More Than a Market: Speed, Security, Solidarity. Empowering the Single Market to Deliver a Sustainable Future and Prosperity for All EU Citizens," Council of the European Union.

LEVCHENKO, A. A. AND J. ZHANG (2016): "The Evolution of Comparative Advantage: Measurement and Welfare Implications," *Journal of Monetary Economics*, 78, 96–111.

LUCAS, R. E. (1978): "On the Size Distribution of Business Firms," *The Bell Journal of Economics*, 508–523.

——— (1988): "On the Mechanics ofEeconomic Development," *Journal of Monetary Economics*, 22, 3–42.

MARKOWITZ, H. (1952): "Portfolio Selection," *The Journal of Finance*, 7, 77–91.

MARSHALL, A. (1890): *Principles of Economics*, London: Macmillan.

MCFADDEN, D. L. (1978): "Modelling the Choice of Residential Location," in *Spatial Interaction Theory and Residential Location*, ed. by A. Karlqvist, L. Lundqvist, F. Snickars, and J. Weibull, Amsterdam: North-Holland, 75–96.

MCKAY, A. AND R. REIS (2021): "Optimal Automatic Stabilizers," *Review of Economic Studies*, 88, 2375–2406.

MUENDLER, M.-A. AND S. O. BECKER (2010): "Margins of Multinational Labor Substitution," *American Economic Review*, 100, 1999–2030.

RICARDO, D. (1817): *On the Principles of Political Economy and Taxation*, London: John Murray.

SCHIVARDI, F. AND T. SCHMITZ (2020): "The IT Revolution and Southern Europe's Two Lost Decades," *Journal of the European Economic Association*, 18, 2441–2486.

SCHOEFER, B. (2025): "Eurosclerosis at 40: Labor market institutions, dynamism, and European competitiveness," NBER working paper 33975.

SMITH, A. (1776): *An Inquiry into the Nature and Causes of the Wealth of Nations*, Wordsworth Editions.

TINTELNOT, F. (2017): "Global Production with Export Platforms," *Quarterly Journal of Economics*, 132, 157–209.

WEIK, S., A.-K. ACHLEITNER, AND R. BRAUN (2024): "Venture Capital and the International Relocation of Startups," *Research Policy*, 53, 105031.

Appendix

A Microfounding the financing costs and alternatives

Consider a world in which each region has a financial sector with an opportunity cost of funding equal to ρ. While the firm pays r_i in return form financing from that region, the financiers receive as expected excess returns only a fraction $1 - a_i^\tau(h)$ of these returns, as the other fraction is lost to intermediation costs in dealing with firms in hat HQ. Moreover, the financiers perceive the returns they will get from the firms with headquarters in the same region as being affected by a random component that has variance $a_i^\sigma(h)$. This reflects the expertise of the financiers with regard to this region. Finally, the financiers in region i have a limited wealth a_i^k to invest in firms, and they invest it according to a mean-variance payoff function.

We assume that these financiers solve a mean-variance portfolio choice problem with their funds. Therefore, they provide financing to the firms as a share of their assets, that is equal to the Sharpe ratio of this investment. Combining the ingredients in the previous paragraph, the supply of external finance from region i to the firm is:

$$v_i = \left(\frac{(1 - a_i^\tau(h_f))(r_{f,i} - \rho)}{a_i^\sigma(h_f)} \right) a_i^k \tag{A.1}$$

The amount lent is higher if intermediation costs are lower, the financiers have higher expertise, or the capital market in that region is deeper. In that sense, $a_i^\tau(h_f), a_i^\sigma(h_f), a_i^k$ all capture the relative efficiency of region i in providing external finance to a firm with a headquarters in region h. Letting $a_i^v(h) \equiv (1 - a_i^\tau(h_f))a_i^k / a_i^\sigma(h_f)$ be the productivity of region i's venture capitalists, this gives our model in equation (5).

A.1 Alternative model of financing: wages ahead

Say instead that the firm must finance a share σ_v of its total wage costs before production and to do so it must raise venture capital $v_f = \sum_{i \in I^v} v_{f,i}$. Then, Proposition 1 is unchanged. The profit function now is instead (with $\theta_v = 1$ for simplicity):

$$\Pi(.) = \left[1 - \frac{\sigma_v \theta_m}{1 - \theta_m} \left(\rho + \frac{\sigma_v X(.)}{\sum_{i \in I_f^v} \tilde{a}_i^v(h_f)} \right) \right] X(.)\,. \tag{A.2}$$

Still: (i) higher productivity in borrowing ($\tilde{a}^v(h)$) raises profits; (ii) borrowing from more regions (I^v) raises profits; and (iii) the two are complementary. These are the key results from our model.

A.2 Alternative model of financing: skin in the game constraints

The total amount of external finance is bounded above by:

$$v = \sigma_v k^{\omega_v} (X(.)k)^{1-\omega_v} \tag{A.3}$$

When $\omega_v = 1$, this is the classic skin-in-the-game constraint, saying that a fraction $1 - \sigma_v$ of the capital must funded by the entrepreneur's own resources. With $\omega_v = 0$, this is instead an earnings-based financial constraint following form the assumption that the entrepreneur could abscond with a share $1 - \omega_v$ of the operating profits before paying back the venture capitalists. By allowing for $\omega_v \in [0, 1]$ we allow for a mix of both financial constraints.

Proposition 1 is the same but now the scale of operations of the firm is determined by the inside capital that the entrepreneur chooses to provide it with. This could either be all of her net worth, or a fraction to it taking into account what share of the idiosyncratic risks of the firm can be diversified away, as in the classic model of Brunnermeier and Sannikov (2014). We treat this as exogenous, by writing $k_f = z_f^v$.

The profits of the firm are then given by (with $\omega_v = 1$)

$$\Pi(.) = \left[1 - \sigma_v X(.)^{-\omega_v} \left(\rho + \frac{\sigma_v X(.)^{1-\omega_v} z_f}{\sum_{i \in I^v} a_i^v(h)}\right)\right] X(.) z_f^v \tag{A.4}$$

Still: (i) higher productivity in borrowing ($\tilde{a}^v(h_f)$) raises profits; (ii) borrowing from more regions (I_f^v) raises profits; and (iii) the two are complementary. These are the key results from our model.

A.3 Alternative model of financing: elastic supply of funds and collateral constraints

To hire capital k, the firm can rely on some internal funds n but these are typically not enough. The firm must obtain external financing in the amount $v_i > 0$ per region from a set of regions I^v. The assumption of strictly positive financing is without loss of generality given the fixed costs.

In each region, the cost of that funding is the net interest rate r_i/z^v, where r_i is a region-specific baseline rate, while z^v is a firm-specific credit good-standing or governance that allows it to borrow at a lower cost. However, the firm faces a credit constraint because the entrepreneur could refuse to pay back the amount owed, and the financiers would only be able to seize a share $a_i^v(h)$ of the operating profits. These shares capture the region-specific productivity of corporate governance and insolvency procedures allowing firms to raise more credit in that region.

Combining these ingredients, for a given required amount of external financing $k-n$, the firm minimizes borrowing costs by solving the problem:

$$\min_{v_i} \sum_{i \in I^v} \left(\frac{r_i v_i}{z^v} \right) \quad \text{s.t.} \quad \sum_{i \in I^v} v_i = k - n \quad \text{and} \quad r_i v_i / z^b \leq a_i^b(h) X(.) k^{\frac{\psi}{1-\theta m}} \quad \forall i. \tag{A.5}$$

The cost-minimizing choices of external financing from different regions are such that the amounts are proportional to a measure of their relative productivity:

$$\frac{v_i}{v_j} = \frac{a_i^v(h)/r_i}{a_j^v(h)/r_j} = \frac{\tilde{a}_i^v(h)}{\tilde{a}_j^v(h)}. \tag{A.6}$$

with $\tilde{a}_i^v(h) \equiv a_i^v(h)/r_i$ for all regions, but the highest-cost region for the firm, call it 0: $r_0^v = \max_{i \in I^v} r_i$. For that region, a similar ratio holds with respect to other regions, but with $\hat{a}_0^v(h) < \tilde{a}_0^v(h)$, a lower bound on its productivity.

The total cost of external financing then is:

$$\sum_{i \in I^b} \left(\frac{r_i v_i}{z^v} \right) = \left(\frac{r_0^v}{z^b} \right) (k - n) - \left[\sum_{i \in I^v} (r_0^v - r_i) \, \tilde{a}_i^v(h) \right] X(.) k^{\frac{\psi}{1-\theta m}} \tag{A.7}$$

Still: (i) higher productivity in borrowing ($\tilde{a}^v(h)$) raises profits; (ii) borrowing from more regions (I^v) raises profits; and (iii) the two are complementary. These are the key results from our model.

B Model: Proof of the Propositions

The firm's productivity in production, sales, and, management, (z^y, z^q, z^s), the conditions in the regions the firm operates production and management locations, (I^y, I^m), and the location of the HQ together determine the earnings of the firm. For a fixed marginal cost of production, more efficiency per unit cost in sales and management raises the ability of the firm to sell more in each district and across more districts in each market. More locations raise earnings by expanding sales. And, a HQ that gives access to a more efficient operation of production, sales, and management, lower costs and raise earnings.[22]

B.1 Proof of Proposition 1

Production choices. Let the marginal cost of each production task be $c(\tau)$. Then, the total cost of producing one unit using all the tasks is $\int_0^1 c(\tau)y(\tau)d\tau$. Therefore, by a standard result, total costs are equal to $C(.)y$, where $C(.)$ is the marginal cost defined by:

$$c^y(z^y, I^y, h) = \left[\int_0^1 c(\tau)^{1-\sigma_y} d\tau\right]^{\frac{1}{1-\sigma_y}}. \tag{B.1}$$

The cost of each task is: $c(\tau)y(\tau) = \sum_{i \in I^y} w_i^y \ell_i(\tau)$. Therefore, the marginal cost of producing in a region is:

$$c_i(\tau) = \frac{w_i^y}{z^y a_I^y(h) \varepsilon_i(\tau)}. \tag{B.2}$$

Since workers are perfect substitutes, the solution to this problem is to locate each task in the region where its cost is lowest:

$$\ell_i(\tau) = \frac{y(\tau)}{z^y a_I^y(h) \varepsilon_i(\tau)} \quad \text{if} \quad c_i(\tau, h) \leq c_j(\tau, h) \quad \text{for all } j \quad \text{and 0 otherwise} \tag{B.3}$$

Consequently we have found:

$$c(\tau) = \min_{i \in I^y} \{c_i(\tau)\}. \tag{B.4}$$

Given the Fréchet distributed productivity shock, $\Pr(\varepsilon_i(\tau) \leq \varepsilon) = \exp\left(-\varepsilon^{-\theta_y}\right)$. There-

[22]We ignored tariffs and other trade costs. Modeling these as iceberg costs specific to each region, they would enter the decision on how the allocation of sales staff, similarly to the efficiency per unit cost of the staff in that region. Like wages, they would be absorbed in our definition of $\tilde{a}_i^m(h)$.

fore, the probability that $\ell_i(\tau) > 0$ is that minimum cost is achieved in region $i \in I^l$. It is the same for each task is the same given by:

$$\Pr\left(c_i(\tau,h) < \min_{i\neq j, j\in I_f^l} c_j(\tau,h)\right) = \frac{\left(\frac{a_i^y(h)}{w_i^y}\right)^{\theta_y}}{\sum_{j\in I^l}\left(\frac{a_j^y(h)}{w_j^y}\right)^{\theta_y}} \tag{B.5}$$

This has two implications. First, because that probability is i.i.d., then the average cost per task does not vary by the region in which it is optimally produced. Therefore, the firm's labor expenditure share is also equal to this probability:

$$\frac{w_i^y \ell_i}{w_j^y \ell_j} = \frac{\tilde{a}_i^y(h)}{\tilde{a}_j^y(h)}. \tag{B.6}$$

for any two regions $i, j \in I^y$. This proves the first part of the proposition.

Second, taking these choices into account, the firm' s marginal cost for a given set of production locations I^y is:

$$c^y(z^y, I^y, h) = \frac{1}{z^y}\left(\sum_{i\in I^y} \tilde{a}_i^y(h)\right)^{-\frac{1}{\theta_y}} \left[\Gamma\left(\frac{\theta_y + 1 - \sigma_y}{\theta_y}\right)\right]^{\frac{1}{1-\sigma_y}}, \tag{B.7}$$

where $\Gamma(\cdot)$ is the Gamma function.

Sales and management choices. Profit maximization by the monopolist firm in picking the price leads to a standard price, quantity and profit in each of the locations:

$$p_i(\delta) = \left(\frac{\sigma_m}{\sigma_m - 1}\right) c^y(.) \tag{B.8}$$

$$q_i(\delta) = \left(\frac{\sigma_m}{\sigma_m - 1}\right)^{-\sigma_m} c^y(.)^{-\sigma_m} \tag{B.9}$$

$$\pi_i(\delta) = z^q \frac{1}{\sigma_m - 1}\left(\frac{\sigma_m}{\sigma_m - 1}\right)^{-\sigma_m} c^y(.)^{1-\sigma_m} \tag{B.10}$$

Note that these are all the same across δ, as well as across regions. Therefore $\pi_i(\delta) = \pi(I^y, h)$

Maximizing operating profits:

$$\max_{m_i} \sum_{i \in I^m} z^s a_i^m(h) m_i^{\theta_m} k^{\psi} \pi(I^y, h) - \sum_{i \in I^m} w_i^m m_i \,, \tag{B.11}$$

yields:

$$m_i = \left(\frac{\theta_m z^s a_i^m(h) \pi(I^l, h)}{w_i^m} \right)^{\frac{1}{1-\theta_m}} k^{\frac{\psi}{1-\theta_m}} \,. \tag{B.12}$$

Managers earn w_i^m in a region. Equating marginal product of labor to relative wages, the optimal allocation of managers across regions is:

$$\frac{m_i}{m_j} = \left(\frac{a_i^m(h)/w_i^m}{a_j^m(h)/w_j^m} \right)^{\frac{1}{1-\theta_m}} \tag{B.13}$$

which proves the second part of the proposition.

Note also that the earnings of the firm net of the cost of capital and the fixed costs are given by:

$$\begin{aligned} &\sum_{i \in i^M} z^s a_i^m(h) \left(\frac{\theta_m z^s a_i^m(h) k^{\psi} \pi(I^l, h)}{w_i^m} \right)^{\frac{\theta_m}{1-\theta_m}} k^{\psi} \pi(I^l, h) \\ &- \sum_{i \in i^M} w_i^m \left(\frac{\theta_m z^s a_i^m(h) k^{\psi} \pi(I^l, h)}{w_i^m} \right)^{\frac{1}{1-\theta_m}} \\ &= (1-\theta_m) \theta_m^{\frac{\theta_m}{1-\theta_m}} (z^s)^{\frac{1}{1-\theta_m}} k^{\frac{\psi}{1-\theta_m}} \sum_{i \in I^m} (r_i(.) a_i^m)^{\frac{1}{1-\theta_m}} (w_i^m)^{-\frac{\theta_m}{1-\theta_m}} \end{aligned}$$

leading to the following expression:

$$\begin{aligned} \Pi^e(z^q, z^s, I^y, I^m, z^y, h) &= \left(\sum_{i \in I^m} \tilde{a}_i^m(h) \right) (z^q z^s)^{1/(1-\theta_m)} \times (c^y(I^y))^{-\frac{\sigma_m - 1}{1-\theta_m}} \times \\ &\quad \times k^{\psi/(1-\theta_m)} \times (1-\theta_m) \theta_m^{\frac{\theta_m}{1-\theta_m}} \sigma_m^{-\frac{\sigma_m}{1-\theta_m}} (\sigma_m - 1)^{\frac{\sigma_m - 1}{1-\theta_m}} \\ &\propto \left((z^y)^{\sigma_m - 1} z^q z^s \right)^{\frac{1}{1-\theta_m}} k^{\psi/(1-\theta_m)} \left(\sum_{i \in I^y} \tilde{a}_i^y(h) \right)^{\frac{\sigma_m - 1}{\theta_y(1-\theta_m)}} \left(\sum_{i \in I^m} \tilde{a}_i^m(h) \right) \end{aligned} \tag{B.14}$$

Sales and management choices. To minimize its funding costs, the firm solves the problem:

$$\min_{v_i} \sum_{i \in I^v} r_i v_i \text{ s.t. } \sum_{i \in I^v} v_i \geq k \tag{B.15}$$

The solution is clearly that we must have $r_i = r$ for $v_i \in [0, v]$ for every i. From equating $r_i = r_j$ we get the result in Proposition 1. Since the firm is risk neutral, and can perfectly substitute the source of financing across regions, it will borrow to equate the cost r_i across regions, so that the marginal cost of an extra unit of capital is a function of total borrowing.

Next, since $k = \sum_{i \in I^v} v_i$, then using equation (5):

$$k = \sum_{i \in I^v} \left(r z^v a_i^v(h) \right)^{1/\theta_v} \tag{B.16}$$

Rewriting this equation to solve for r gives equation:

$$r = \frac{1}{z^v} \left(\sum_{i \in I^v} \tilde{a}_i^v(h) \right)^{-\theta_v} k^{\theta_v}. \tag{B.17}$$

Higher productivity in borrowing z^v lowers the marginal interest rate at which the firm borrows, while borrowing from more regions, I^v, allows the firm to tap into the capital markets of different regions and therefore borrow at a lower costs from each one.

B.2 Proof of Proposition 2

Using the previous results of the appendix, profits before entry costs are:

$$\Pi(I, h, z) = \Pi^e(z^q, z^s, I^y, I^m, z^y, h) - rk \tag{B.18}$$

Using equation (B.14) and equation (B.17),we can rewrite it as:

$$\Pi(z, I, h) = \max_{k \geq 0} \left\{ \left((z^y)^{\sigma^m - 1} z^q z^s \right)^{\frac{1}{1-\theta^m}} \left(\sum_{i \in I^y} \tilde{a}_i^y(h) \right)^{\frac{\sigma^m - 1}{\theta^y(1-\theta^m)}} \left(\sum_{i \in I^m} \tilde{a}_i^m(h) \right) k^{\frac{\psi}{1-\theta^m}} \right. \tag{B.19}$$

$$\left. - \frac{1}{z^v} \left(\sum_{i \in I^v} \tilde{a}_i^v(h) \right)^{-\theta^v} k^{1+\theta^v} \right\}. \tag{B.20}$$

The first-order condition with respect to k is

$$\frac{\psi}{1-\theta^m}\left((z^y)^{\sigma^m-1}z^q z^s\right)^{\frac{1}{1-\theta^m}}\left(\sum_{i\in I^y}\tilde{a}_i^y(h)\right)^{\frac{\sigma^m-1}{\theta^y(1-\theta^m)}}\left(\sum_{i\in I^m}\tilde{a}_i^m(h)\right)k^{\frac{\psi}{1-\theta^m}-1} \tag{B.21}$$

$$=(1+\theta^v)\frac{1}{z^v}\left(\sum_{i\in I^v}\tilde{a}_i^v(h)\right)^{-\theta^v}k^{\theta^v}. \tag{B.22}$$

Rearranging gives

$$k^{1+\theta^v-\frac{\psi}{1-\theta^m}}\propto\left((z^y)^{\sigma^m-1}z^q z^s\right)^{\frac{1}{1-\theta^m}}z^v\left(\sum_{i\in I^y}\tilde{a}_i^y(h)\right)^{\frac{\sigma^m-1}{\theta^y(1-\theta^m)}}\left(\sum_{i\in I^m}\tilde{a}_i^m(h)\right)\left(\sum_{i\in I^v}\tilde{a}_i^v(h)\right)^{\theta^v}. \tag{B.23}$$

Hence

$$k^*\propto\left[\left((z^y)^{\sigma^m-1}z^q z^s\right)^{\frac{1}{1-\theta^m}}z^v\left(\sum_{i\in I^y}\tilde{a}_i^y(h)\right)^{\frac{\sigma^m-1}{\theta^y(1-\theta^m)}}\left(\sum_{i\in I^m}\tilde{a}_i^m(h)\right)\left(\sum_{i\in I^v}\tilde{a}_i^v(h)\right)^{\theta^v}\right]^{\frac{1}{1+\theta^v-\frac{\psi}{1-\theta^m}}}. \tag{B.24}$$

This requires $1+\theta^v-\frac{\psi}{1-\theta^m}>0$ which is the condition discussed above for an interior solution.

Substituting k^* back into the objective implies that, up to a multiplicative firm-specific term z, profits are proportional to

$$\Pi(z,I,h)\propto z\left(\sum_{i\in I^y}\tilde{a}_i^y(h)\right)^{\beta_y}\left(\sum_{i\in I^m}\tilde{a}_i^m(h)\right)^{\beta_m}\left(\sum_{i\in I^v}\tilde{a}_i^v(h)\right)^{\beta_v}, \tag{B.25}$$

where

$$\beta_y=\left(\frac{\sigma^m-1}{\theta^y(1-\theta^m)}\right)\left(\frac{1+\theta^v}{1+\theta^v-\frac{\psi}{1-\theta^m}}\right),\qquad \beta_m=\frac{1+\theta^v}{1+\theta^v-\frac{\psi}{1-\theta^m}}, \tag{B.26}$$

$$\beta_v=\theta^v\frac{\frac{\psi}{1-\theta^m}}{1+\theta^v-\frac{\psi}{1-\theta^m}}. \tag{B.27}$$

Therefore,

$$\Pi(z,I,h)\propto z\left(\sum_{i\in I^y}\tilde{a}_i^y(h)\right)^{\beta_y}\left(\sum_{i\in I^m}\tilde{a}_i^m(h)\right)^{\beta_m}\left(\sum_{i\in I^v}\tilde{a}_i^v(h)\right)^{\beta_v}, \tag{B.28}$$

which is the result in Proposition 2.

B.3 Proof of Proposition 3

Define the deterministic payoff from bundle $I = (I^y, I^m, I^v)$ as

$$V_I(z,h) \equiv \Pi(z,I,h) - \sum_{j\in\{y,m,v\}} \sum_{i\in I^j} e_i^j(h), \tag{B.29}$$

so that the extensive-margin problem (11) reduces to $\max_{I\in\mathcal{P}(I)}\{V_I(z,h) - \varepsilon^I(I)\}$. Treating $-\varepsilon^I(I)$ as the (mean-zero) Gumbel benefit shock of scale ζ^I, the multinomial logit formula gives

$$\Pr(I \mid z,h,e(h)) = \frac{\exp(V_I(z,h)/\zeta^I)}{\sum_{J\in\mathcal{P}(I)} \exp(V_J(z,h)/\zeta^I)}, \tag{B.30}$$

which, after substituting the definition of V_I, up to a multiplicative constant term gives equation (12):

$$\Pr(I \mid z,h,e(h)) \propto \exp\left(\frac{\Pi(z,I,h) - \sum_{j\in\{y,m,v\}}\sum_{i\in I^j} e_i^j(h)}{\zeta^I}\right). \tag{B.31}$$

B.4 Proof of Proposition 4

Total after-tax firm profits given h, z, $\varepsilon^I(I)$, and $\varepsilon^H(h)$ are

$$(1-\tau(h))\,\pi\left(h,z,\varepsilon^I(I)\right)^{1-\kappa(h)} \cdot \varepsilon^H(h)\cdot(1-\mu\cdot\mathbb{1}[h\neq h_0]).$$

Therefore, from the perspective of a firm who observes the HQ-level shock $\varepsilon^H(h)$ but not the $\varepsilon^I(I)$, the expected log after-tax profits are

$$\log(1-\tau(h)) + (1-\kappa(h))\,\mathbb{E}_{\varepsilon^I}\left[\log\pi\left(h,z,\varepsilon^I(I)\right)\right] + \log(1-\mu)\mathbb{1}[h\neq h_0] + \log\varepsilon^H(h).$$

From there, the choice probability in the proposition follows from $\log\varepsilon^H(h)$ being drawn from an i.i.d. Gumbel with mean zero and scale parameter ζ^H.

B.5 Proof of Proposition 5

The proof proceeds in three steps.

1. Formalizing the selection problem. Let region i's efficiency per unit cost in activity j carry a firm–region shock, so that $\tilde{a}_i^j(h)$ is replaced by $\tilde{a}_i^j(h)\exp(\epsilon_{f,t,i}^j)$ with $\epsilon_{f,t,i}^j \sim \mathcal{N}(0,\sigma_{\epsilon,j}^2)$ drawn i.i.d. across firms, regions, and activities. The firm observes its shocks before choosing where to operate, and so tilts its location set I toward regions where it is higher. The selection problem is that $\mathbb{E}[\epsilon_{f,t,i}^j \mid i \in I_{f,t}^j, h_f, z_f]$ varies across regions. To lighten notation, we fix an activity j and a region i and drop the firm and time indices, so that ϵ_i^j denotes the shock of interest and $\sigma_{\epsilon,j}^2$ its variance. We write $\boldsymbol{\epsilon}$ for the firm's full vector of shocks, of which ϵ_i^j is one component.

2. Expressing the selection term as the expectation of an inclusion probability. By the definition of conditional expectation and the law of iterated expectations (conditioning on $\boldsymbol{\epsilon}$),

$$\mathbb{E}[\epsilon_i^j \mid i \in I^j, h, z] = \frac{\mathbb{E}_{\boldsymbol{\epsilon}}\Big[\epsilon_i^j \Pr(i \in I^j \mid h, z, \boldsymbol{\epsilon})\Big]}{\Pr(i \in I^j \mid h, z)}. \tag{B.32}$$

Stein's lemma states that for $\epsilon_i^j \sim \mathcal{N}(0,\sigma_{\epsilon,j}^2)$ and any differentiable g with $\mathbb{E}|g'(\epsilon_i^j)| < \infty$, $\mathbb{E}[\epsilon_i^j\, g(\epsilon_i^j)] = \sigma_{\epsilon,j}^2\, \mathbb{E}[g'(\epsilon_i^j)]$. Applying Stein's lemma to equation (B.32) yields

$$\mathbb{E}[\epsilon_i^j \mid i \in I^j, h, z] = \frac{\sigma_{\epsilon,j}^2}{\Pr(i \in I^j \mid h, z)}\, \mathbb{E}_{\boldsymbol{\epsilon}}\left[\frac{\partial \Pr(i \in I^j \mid h, z, \boldsymbol{\epsilon})}{\partial \epsilon_i^j}\right]. \tag{B.33}$$

Under the Gumbel extensive-margin shocks, the probability of choosing location set I is the logit (12),

$$\Pr(I \mid \boldsymbol{\epsilon}, h, z) = \frac{\exp\left(\frac{1}{\zeta^I}[\Pi(I,h,z,\boldsymbol{\epsilon}) - e_I(h)]\right)}{\sum_J \exp\left(\frac{1}{\zeta^I}[\Pi(J,h,z,\boldsymbol{\epsilon}) - e_J(h)]\right)}, \qquad e_I(h) \equiv \sum_j \sum_{i \in I^j} e_i^j(h),$$

where ϵ_i^j enters only through region i's efficiency in activity j inside Π. The inclusion probability is $\Pr(i \in I^j \mid \boldsymbol{\epsilon}, h) = \sum_{I:\, i \in I^j} \Pr(I \mid \boldsymbol{\epsilon}, h)$, and, conditional on $\boldsymbol{\epsilon}$, the standard logit derivative gives

$$\frac{\partial \Pr(I \mid h, z, \boldsymbol{\epsilon})}{\partial \epsilon_i^j} = \frac{1}{\zeta^I} \Pr(I \mid h, z, \boldsymbol{\epsilon}) \left(\frac{\partial \Pi(I,h,z,\boldsymbol{\epsilon})}{\partial \epsilon_i^j} - \sum_{I'} \Pr(I' \mid h, z, \boldsymbol{\epsilon}) \frac{\partial \Pi(I',h,z,\boldsymbol{\epsilon})}{\partial \epsilon_i^j}\right).$$

The shock to region i affects profits only if i is included in the location set, so $\partial \Pi(I',h,z)/\partial \epsilon_i^j =$

0 whenever $i \notin I^{j'}$. The inner sum thus runs only over sets containing i and is common to every I. Summing over $I : i \in I^j$ and collecting terms,

$$\frac{\partial \Pr(i \in I^j \mid h, z, \boldsymbol{\epsilon})}{\partial \epsilon_i^j} = \frac{1}{\zeta^I} \Pr(i \in I^j \mid h, z, \boldsymbol{\epsilon})\big(1 - \Pr(i \in I^j \mid h, z, \boldsymbol{\epsilon})\big) \mathbb{E}\left[\frac{\partial \Pi(I, h, z, \boldsymbol{\epsilon})}{\partial \epsilon_i^j} \,\Big|\, i \in I^j, h, z, \boldsymbol{\epsilon}\right]$$

Using Stein's lemma under normality and the logit derivative above, the inclusion probability in the denominator in equation (B.33) cancels by the law of iterated expectations, leaving the expression

$$\mathbb{E}[\epsilon_i^j \mid i \in I^j, h, z] = \frac{\sigma^2_{\epsilon,j}}{\zeta^I} \mathbb{E}\left[\big(1 - \Pr(i \in I^j \mid h, z, \boldsymbol{\epsilon})\big) \frac{\partial \Pi(I, h, z, \boldsymbol{\epsilon})}{\partial \epsilon_i^j} \Big| \, i \in I^j, h, z\right]. \tag{B.34}$$

3. A first-order approximation. Equation (B.34) is exact but involves the unobserved shocks through the random inclusion probability $\Pr(i \in I^j \mid h, z, \boldsymbol{\epsilon})$. Adding and subtracting terms, equation (B.34) can be written as

$$\mathbb{E}[\epsilon_i^j \mid i \in I^j, h, z] = \frac{\sigma^2_{\epsilon,j}}{\zeta^I}\big(1 - \Pr(i \in I^j \mid h, z)\big) \mathbb{E}\left[\frac{\partial \Pi(I, h, z, \boldsymbol{\epsilon})}{\partial \epsilon_i^j} \,\Big|\, i \in I^j, h, z\right] + R_1 + R_2, \tag{B.35}$$

with

$$R_1 = -\frac{\sigma^2_{\epsilon,j}}{\zeta^I} \mathbb{E}\left[\big(\Pr(i \in I^j \mid h, z, \boldsymbol{\epsilon}) - \Pr(i \in I^j \mid h, z, \mathbf{0})\big) \frac{\partial \Pi(I, h, z, \boldsymbol{\epsilon})}{\partial \epsilon_i^j} \,\Big|\, i \in I^j, h, z\right],$$

$$R_2 = -\frac{\sigma^2_{\epsilon,j}}{\zeta^I} \big(\Pr(i \in I^j \mid h, z, \mathbf{0}) - \Pr(i \in I^j \mid h, z)\big) \mathbb{E}\left[\frac{\partial \Pi(I, h, z, \boldsymbol{\epsilon})}{\partial \epsilon_i^j} \,\Big|\, i \in I^j, h, z\right].$$

Since both remainder terms are $R_1 = O\left(\sigma^4_{\epsilon,j}\right)$, the proposition follows:

$$\mathbb{E}[\epsilon^j_{f,t,i} \mid i \in I^j_{f,t}, h_f, z_f] = \frac{\sigma^2_{\epsilon,j}}{\zeta^I} \big(1 - \Pr(i \in I^j_{f,t} \mid h_f, z_f)\big) \mathbb{E}\left[\frac{\partial \Pi_{f,t}(\cdot)}{\partial \epsilon^j_{f,t,i}} \,\Big|\, i \in I^j_{f,t}, h_f, z_f\right] + O(\sigma^4_{\epsilon,j}).$$

C Identification and Estimation

C.1 Approximate logit for home set

Given the assumption that $\varepsilon^I(I_h) = 0$ and $e^j_h(h) = 0$, the firm always has the option to stay at home and earn $\Pi(z, I_h, h) > 0$. Second, it has the option to operate abroad. The best option abroad depends on the deterministic payoffs of those options as well as the shocks. Since the shocks are Gumbel and the maximum of independent Gumbels is also Gumbel, the maximum profits abroad follow a Gumbel distribution. Specifically,

$$\max_{I \in \mathcal{P}(I), I \neq I_h} \Pi(z, I, h) - \sum_{j \in \{y,m,v\}} \sum_{i \in I^j} e^j_i(h) + \varepsilon^I(I)$$

follows a Gumbel distribution with location parameter $V(h,z) - \gamma\zeta^I$ and scale parameter ζ^I, where

$$V(h,z) = \zeta^I \log\left(\sum_{I \neq I_h} \exp\left(\frac{\Pi(z, I, h) - \sum_{j \in \{y,m,v\}} \sum_{i \in I^j} e^j_i(h)}{\zeta^I}\right)\right).$$

Since the "home option" yields a deterministic positive payoff $\Pi(z, I_h, h)$, the probability that the firm chooses $I = I_h$ is equal to the probability that $X(h,z) < \Pi(z, I_h, h)$ which is

$$\Pr(I_h \mid h, z) = \exp\left(-\exp\left(-\frac{\Pi(z, I_h, h) - V(h,z)}{\zeta^I} - \gamma\right)\right). \tag{C.1}$$

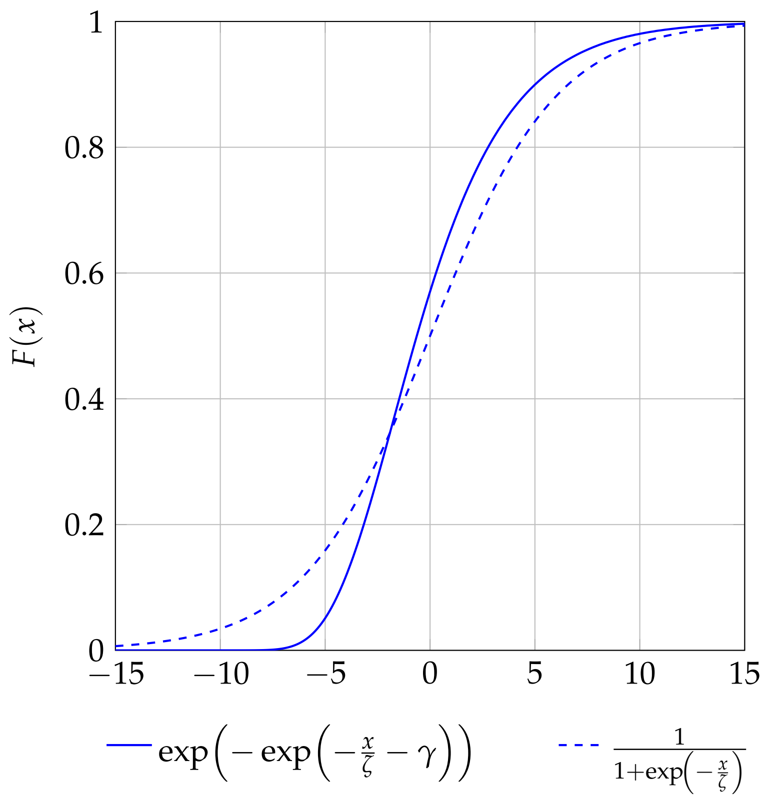
Instead, the multinomial logit used in the estimation implies that

$$\Pr(I_h \mid h, z) = \frac{1}{1 + \exp\left(-\frac{\Pi(z, I_h, h) - V(h,z)}{\zeta^I}\right)}. \tag{C.2}$$

Therefore, the probability of choosing the home option does not exactly have the logit form. Specifically, equation (C.1) is the CDF of the Gumbel distribution, while (C.2) is the CDF of the logistic distribution.

However, the two choice probability functions have similar shapes, as Figure C.1 shows. We therefore rely on the multinomial logit throughout the estimation. Note also that the approximation only pertains to the relative probability of choosing I_h vs. all other options. The probability conditional on choosing any of the foreign options is exactly logit.

FIGURE C.1: Comparison of the two functions for $\zeta = 3$.



C.2 Weak identification of shock variance

Recall from equation (20) that for any alternative set I',

$$\frac{\Pi(z, I', h)}{\Pi(z, I, h)} = \prod_{j=y,m,v} \left(\frac{\sum_{i \in I^{j\prime}} \tilde{a}_i^j(h)}{\sum_{i \in I^j} \tilde{a}_i^j(h)} \right)^{\beta_j}$$

A first-order approximation around the baseline choice I gives

$$\frac{\Pi(z, I', h)}{\Pi(z, I, h)} = \exp\left(\sum_j \beta_j \log\left(\frac{\sum_{i \in I^{j\prime}} \tilde{a}_i^j(h)}{\sum_{i \in I^j} \tilde{a}_i^j(h)} \right) \right) \approx 1 + \sum_j \beta_j \log\left(\frac{\sum_{i \in I^{j\prime}} \tilde{a}_i^j(h)}{\sum_{i \in I^j} \tilde{a}_i^j(h)} \right).$$

From there, it follows that the choice probability of a firm can be written as

$$\Pr(I' \mid z,h) \approx \frac{\exp\left(\Pi(z,I,h)\sum_j \frac{\beta_j}{\zeta^I}\log\left(\frac{\sum_{i\in I^{j\prime}}\tilde{a}_i^j(h)}{\sum_{i\in I^j}\tilde{a}_i^j(h)}\right) - \sum_j\sum_{i\in I^{j\prime}}\frac{e_i^j(h)}{\zeta^I}\right)}{\sum_{I''\in\mathcal{P}(I)}\exp\left(\Pi(z,I,h)\sum_j \frac{\beta_j}{\zeta^I}\log\left(\frac{\sum_{i\in I^{j\prime\prime}}\tilde{a}_i^j(h)}{\sum_{i\in I^j}\tilde{a}_i^j(h)}\right) - \sum_j\sum_{i\in I^{j\prime\prime}}\frac{e_i^j(h)}{\zeta^I}\right)}$$

which shows that, up to a first order, choice probabilities only identify $\frac{\beta^j}{\zeta^I}$ and $\frac{e_i^j(h)}{\zeta^I}$.

C.3 Gradient and Hessian of the likelihood

Log-likelihood. The log-likelihood is $\ell(\beta, e) = \sum_f \ell_f$ where

$$\ell_f = \frac{1}{\zeta^I}\left[\Pi(z_f, I_f, h_f) - \sum_j\sum_{i\in I_f^j} e_i^j(h_f)\right] - \ln\sum_{I'\in\mathcal{S}_f}\exp\left(\frac{\Pi(z_f, I', h_f) - \sum_j\sum_{i\in I^{j\prime}} e_i^j(h_f)}{\zeta^I}\right),$$

where $\Pi(z_f, I', h_f)$ is given by equation (7) and $\mathcal{S}_f$ is the sampled menu from Appendix **??**.

The profile likelihood concentrates out e at its conditional MLE $\hat{e}(\beta)$, so $\ell^P(\beta) = \ell(\beta, \hat{e}(\beta))$. By the envelope theorem, $\nabla_\beta \ell^P = \nabla_\beta \ell\big|_{\hat{e}}$.

Gradient. Differentiating $\Pi(z_f, I', h_f)$ in equation (20) with respect to β_j gives

$$\frac{\partial\,\Pi(z_f, I', h_f)}{\partial\beta_j} = \Pi(z_f, I', h_f)\cdot\ln\left(\frac{\sum_{i\in I^{j\prime}}\tilde{a}_i^j(h_f)}{\sum_{i\in I_f^j}\tilde{a}_i^j(h_f)}\right).$$

For the observed choice I_f, this term is zero. The score is therefore

$$\frac{\partial\ell^P}{\partial\beta_j} = -\frac{1}{\zeta^I}\sum_f\sum_{I'\in\mathcal{S}_f}\Pr(I' \mid z_f, h_f)\,\Pi(z_f, I', h_f)\ln\left(\frac{\sum_{i\in I^{j\prime}}\tilde{a}_i^j(h_f)}{\sum_{i\in I_f^j}\tilde{a}_i^j(h_f)}\right), \tag{C.3}$$

where $\Pr(I' \mid z_f, h_f)$ and $\Pi(z_f, I', h_f)$ are evaluated at $(\beta, \hat{e}(\beta))$.

Hessian. Differentiating (C.3) with respect to β_k yields

$$\frac{\partial^2 \ell}{\partial \beta_j \partial \beta_k} = -\frac{1}{\zeta^I} \sum_f \sum_{I' \in \mathcal{S}_f} \frac{\partial \Pr(I' \mid z_f, h_f)}{\partial \beta_k} \Pi(z_f, I', h_f) \ln \left(\frac{\sum_{i \in I^{j\prime}} \tilde{a}_i^j(h_f)}{\sum_{i \in I_f^j} \tilde{a}_i^j(h_f)} \right)$$

$$-\frac{1}{\zeta^I} \sum_f \sum_{I' \in \mathcal{S}_f} \Pr(I' \mid z_f, h_f) \Pi(z_f, I', h_f) \ln \left(\frac{\sum_{i \in I^{j\prime}} \tilde{a}_i^j(h_f)}{\sum_{i \in I_f^j} \tilde{a}_i^j(h_f)} \right) \ln \left(\frac{\sum_{i \in I^{k\prime}} \tilde{a}_i^k(h_f)}{\sum_{i \in I_f^k} \tilde{a}_i^k(h_f)} \right)$$

Similarly, one can derive the cross-derivatives with respect to $\boldsymbol{\beta}$ and the entry costs e, $\Delta \ell_{\beta e}$. $\Delta \ell_{ee}$ can be computed using standard packages from the "linear-in-utility" logit regression in the inner part of the algorithm.

Hessian of profile likelihood. Having computed the Hessian of the likelihood w.r.t. each pair of parameters, one can then construct the Hessian of the *profile likelihood* with respect to $\boldsymbol{\beta}$ as

$$\Delta \ell^P_{\beta\beta} = \Delta \ell_{\beta\beta} - \Delta \ell_{\beta e} \Delta \ell_{ee}^{-1} \Delta \ell_{e\beta}.$$

This Hessian takes into account how the estimates of the entry costs change in response to changes in $\boldsymbol{\beta}$.

C.4 One logit per activity

Since the number of alternatives is large when considering the three dimensions jointly, it is convenient to consider the probability of choosing a set in one dimension conditional on the other two.

For example,

$$\Pr(I^y \mid z, I^m, I^v, h) = \frac{\exp\left(\frac{\Pi(z, (I^y, I^m, I^v), h) - \sum_{i \in I^y} e_i^y(h)}{\zeta} \right)}{\sum_{I^{y\prime}} \exp\left(\frac{\Pi(z, (I^{y\prime}, I^m, I^v), h) - \sum_{i \in I^{y\prime}} e_i^y(h)}{\zeta} \right)}. \tag{C.4}$$

The fixed costs for management and finance drop out because the locations in these dimensions are held constant. The number of alternatives to evaluate in the denominator goes down significantly.

C.5 Computing expected log profits

The profits follow a simple distribution. As shown in Appendix C.1, the maximum profits that the firm can earn in location sets other than the home set I_h follows a Gumbel distribution with location parameter $V(h,z) - \gamma\zeta^I$ and scale parameter ζ^I, where

$$V(h,z) = \zeta^I \log\left(\sum_{I \neq I_h} \exp\left(\frac{\Pi(z,I,h) - \sum_{j\in\{y,m,v\}}\sum_{i\in I^j} e_i^j(h)}{\zeta^I}\right)\right),$$

and $\gamma \approx 0.5772$ is Euler's constant. Since the "home option" yields a deterministic positive payoff $\Pi(z, I_h, h) > 0$, the firms' profits are strictly positive and distributed as

$$\max\left\{\Pi(z, I_h, h), X(h,z)\right\},$$

so that the probability that the firm chooses $I = I_h$ is equal to the probability that $X(h,z) < \Pi(z, I_h, h)$ which is

$$\Pr(I_h \mid h, z) = \exp\left(-\exp\left(-\frac{\Pi(z, I_h, h) - V(h,z)}{\zeta^I} - \gamma\right)\right).$$

From there, the expectation of log profits $\mathbb{E}\left[\log \pi(h,z,\varepsilon^I)\right]$ are

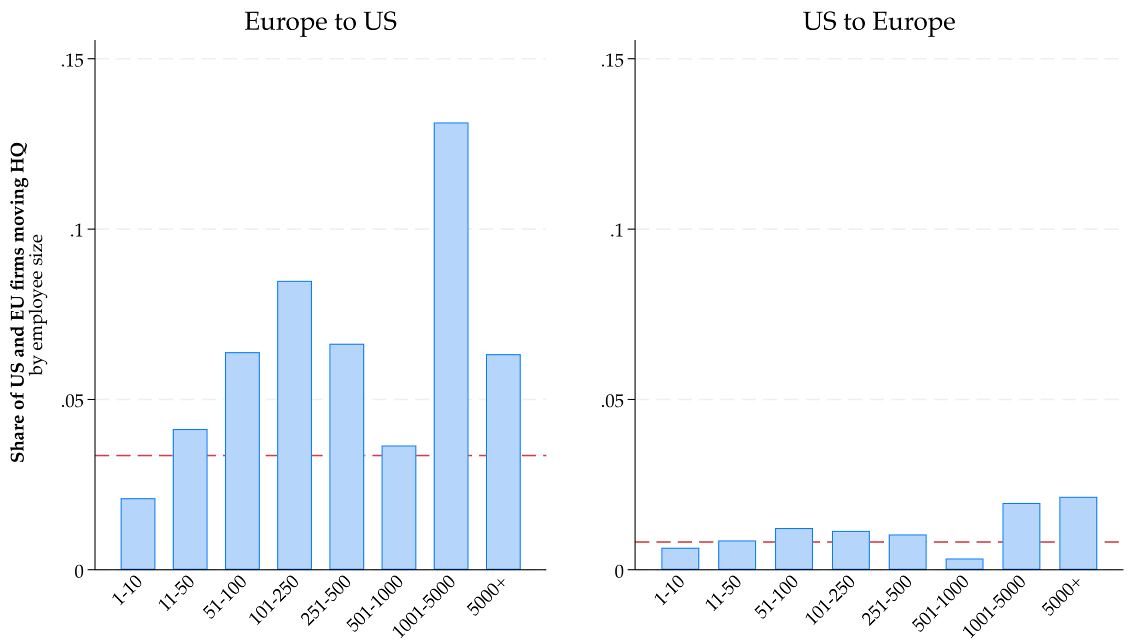
$$\Pr(I = I_h) \cdot \log \Pi\left(z, I_h, h\right) + \left(1 - \Pr(I = I_h)\right) \cdot \mathbb{E}\left[\log X(h,z) \mid X(h,z) > \Pi\left(z, I, h\right)\right].$$

and we compute $\mathbb{E}\left[\log X(h,z) \mid X > \Pi\left(z, I, h\right)\right]$ numerically.

D Additional Figures and Table

This section contains additional figures and tables either on the data or on the estimates

FIGURE D.1: HQ migration rates between the US and Europe by size of firm



Notes: This figure shows the share of firms under ten years old that moved their headquarters from Europe to the US and from the US to Europe between 2014 and 2024, based on the matched Crunchbase snapshots. The rates are broken down by the number of employees in 2024. The dashed lines show the unconditional average. Europe is classified as the 27 European Union countries and the UK.

TABLE D.1: Efficiency per unit costs by region and dimension: $\tilde{a}_i^j$

Region	Production	Management	Financing
United States	1.00	1.00	1.00
	(.)	(.)	(.)
EU27 and UK	0.98	1.03	0.64
	(0.01)	(0.01)	(0.01)
Africa	0.35	0.36	0.50
	(0.01)	(0.01)	(0.02)
Asia	0.98	0.89	0.69
	(0.01)	(0.01)	(0.01)
Latin America	0.48	0.45	0.36
	(0.01)	(0.01)	(0.01)
Oceania	0.27	0.29	0.42
	(0.00)	(0.00)	(0.02)
Rest of Europe	0.30	0.32	0.47
	(0.00)	(0.00)	(0.01)
Rest of North America	0.32	0.33	0.43
	(0.00)	(0.00)	(0.01)

Notes: This table reports estimates of $\tilde{a}_u^i$ for each region, relative to the United States (which is normalized to 1). Standard errors are in parentheses.

TABLE D.2: Efficiency penalty of region away from HQ union ($\exp(\eta_{O,h})$, 1 is inside HQ union)

Region	Production	Management	Financing
United States	1.74	1.67	0.33
	(0.02)	(0.01)	(0.02)
EU27 and UK	1.83	1.70	0.81
	(0.02)	(0.01)	(0.02)
Africa	3.68	3.55	0.50
	(0.03)	(0.03)	(0.07)
Asia	2.49	2.29	1.06
	(0.01)	(0.01)	(0.03)
Latin America	3.74	3.62	1.07
	(0.02)	(0.02)	(0.05)
Oceania	3.89	3.64	1.17
	(0.02)	(0.02)	(0.07)
Rest of Europe	2.88	2.67	0.50
	(0.02)	(0.02)	(0.05)
Rest of North America	3.19	3.11	1.02
	(0.02)	(0.02)	(0.04)

Notes: This table report estimates of the productivity when operating outside the HQ union (relative to the productivity in operating from that union when the HQ is in the respective union). Standard errors are reported in parentheses.

TABLE D.3: Segmentation costs per foreign location (in mln $) by HQ region

Region	Production	Sales	Finance
United States	9.97	10.18	16.26
	(0.05)	(0.06)	(0.16)
EU27 and UK	9.27	9.47	16.59
	(0.06)	(0.06)	(0.20)
Africa	10.40	10.75	15.98
	(0.18)	(0.20)	(0.55)
Asia	10.77	10.99	15.04
	(0.09)	(0.10)	(0.22)
Latin America	10.95	11.16	16.97
	(0.14)	(0.15)	(0.51)
Oceania	8.34	8.48	16.34
	(0.17)	(0.17)	(0.66)
Rest of Europe	7.92	8.13	15.14
	(0.17)	(0.18)	(0.59)
Rest of North America	8.14	8.29	15.06
	(0.14)	(0.14)	(0.46)

Notes: This table reports estimates of fixed costs per foreign location (in mln $) when the location is outside the HQ union. Standard errors are reported in parentheses.

TABLE D.4: Estimates of HQ parameters

$\tau(\text{EU})$	$\kappa(\text{EU})$	μ	ζ^H
0.269	0.747	1.000	3.032
(0.745)	(0.253)	(.)	(1.783)

Notes: This table reports estimates of the parameters estimated on the HQ-level. For this analysis, we computed counterfactual expected profits $\mathbb{E}[\log \pi \left(h, z, \varepsilon^I\right)]$ on the basis of a firm's productivity z in 2014 (before any potential moving).