Location Effects or Sorting? Evidence from Firm Relocation*

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Abstract

This paper characterizes firm relocation decisions and leverages firm mobility to disentangle the drivers of spatial wage disparities. Using administrative data from France and commercial data from the United States, we document five facts: (1) firm relocations are frequent, with 3–5% of establishments moving each year; (2) relocation patterns exhibit large gross flows and spatial frictions; (3) larger, higher-wage establishments tend to move to larger, higher-wage markets; (4) relocation is not associated with substantial changes in activity or organizational structure; and (5) relocation prompts workforce adjustments to the new market. We develop a simple spatial equilibrium model with worker and firm mobility that rationalizes these findings. Using a double movers design, we decompose local wages in France into components capturing location effects, firm characteristics, and worker attributes. We find that while firm and worker sorting accounts for about half of the wage variation across commuting zones, location effects contribute only 2–5% once worker and firm characteristics are accounted for.

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1 Introduction

The prevalence of spatial disparities between local markets motivates significant place-based policy interventions. In particular, local governments invest significant resources in attracting firms to relocate. In the United States, Bartik (2020) estimates that state and local governments collectively spend around $50 billion annually on business incentives, making it the largest component of place-based policies in the country. These programs are grounded in the belief that firms are highly mobile and that their relocation decisions can profoundly impact the economic prosperity of local communities. Despite this rationale, firm mobility and its effects remain poorly understood. Key questions include: How mobile are firms in practice? What factors influence their location decisions? And to what extent do these decisions drive local market prosperity compared to regional fundamentals or the characteristics of the local workforce?

We address these questions through two key contributions. First, we establish a set of stylized facts about firm mobility. Using administrative data from France and commercial data from the United States, we explore how common firm relocations are, what it entails for a firm to change location, the effects of relocation on firms, and which firms move to which markets. We also provide a simple spatial equilibrium model with firm mobility that can account for our findings. Second, we capitalize on the prevalence of firm mobility in the economy to develop a new decomposition of regional wages, disentangling the contributions of firms, locations, and worker characteristics to wage differences across space. In line with the rationale behind many local policies, we find a high degree of mobility, and that a substantial share of local wage disparities arises from the sorting of firms.

Studying relocation decisions presents a key challenge: in many administrative data sources, an establishment's identifier changes when it moves. We address this issue by utilizing unique data from France's *Register of Establishment Relocation* (1993–2021), which mandates reporting whenever an establishment changes its address. In this context, a relocation is defined as the transfer of an establishment's non-labor means of production from one location to another, resulting in the creation of a new establishment at the destination and the closure of the original location. We conduct a series of tests to validate that relocations in these data align with the intuitive notion of a change in the firm's main location of activity. For instance, we find that most relocations involving multi-establishment firms coincide with changes in the firm's headquarters, rather than the entry or exit of local branches. To ensure our findings are not unique to France or to this specific definition of relocation, we replicate our main facts using U.S. commercial data from Dun & Bradstreet. In this dataset, we track single-unit firms or headquarters of multi-unit firms across space using their name, age, and ownership structure. It is worth noting that throughout the paper we measure the relocation of individual establishments.

When we refer to firm relocation in the context of multi-unit firms, it can be thought of as a change in the firm's headquarters.

We organize our findings around five key facts about firm relocation decisions. First, we show that relocation is a common phenomenon in the economy, with approximately 4% of all establishments relocating annually. Relocation is widespread across sectors and regions. Second, we characterize the geography of relocation. Similar to worker migration, firm mobility involves much larger gross flows than net flows, suggesting that idiosyncratic motives often outweigh shared location factors like market size or local taxation. Correspondingly, relocation flows across space are well captured by a gravity equation, with distance strongly influencing movement rates between locations. Third, we study heterogeneity across firms in their location decisions and find evidence of sorting patterns. Conditional on the origin location, we show that larger and higher-wage firms tend to choose larger and higher-wage destinations.

We then turn to examine how firms evolve when they relocate. Our fourth key fact shows that relocation results in minimal changes to a firm's core activities or production structure. Specifically, we find little evidence of shifts in industry classification or occupational composition among relocating establishments. Moreover, movers and non-movers are equally likely to experience changes in their client base or the products and services they offer. In contrast, our fifth fact reveals substantial changes in labor inputs and pay among relocating establishments. These firms significantly reduce hiring in their original location, increase hiring in their new location, and adjust wages toward the prevailing average in the new market. Notably, we observe no pre-relocation wage changes or post-relocation wage dynamics for the typical relocating establishment, suggesting a strong static "location effect" in firms' pay structure.

We provide a theoretical interpretation of these five facts using a simple spatial equilibrium model with firm mobility. In the model, firm owners choose their location and the inputs of production in their selected location. The production function incorporates supermodularity between a firm's productivity and the location's fundamental productivity, and firm owners have idiosyncratic preferences for locations, similar to the migration literature. In the labor market, firms post wages, and workers exhibit idiosyncratic preferences for firms, resulting in firm-specific wage premiums. This framework can rationalize our key findings, including substantial gross flows between locations, a gravity structure for firm relocations, the sorting of large, high-wage firms into large, high-wage locations, and a wage-location effect when firms move. Notably, the model also yields a wage equation that depends on location, firm, and worker effects, motivating our wage decomposition exercise.

In our second key contribution, we exploit the widespread mobility of firms within the economy to examine the role of firms in generating spatial wage disparities. Answering this question also sheds light on the extent to which local governments can improve local

pay by incentivizing firms to relocate. To address this, we conduct a wage decomposition analysis inspired by Abowd et al. (1999) (hereafter AKM). Departing from the traditional wage decomposition literature, we disentangle the influence of locations from that of establishments. Specifically, we explore both a two-way decomposition of establishment wages into establishment and location effects—where these components may also capture location-specific or establishment-specific human capital—and a three-way decomposition that separately accounts for worker effects.

To identify establishment, worker, and location effects, we leverage establishment and worker mobility across locations, as well as worker mobility across establishments. We find that an additively separable structure for log wages offers a strong approximation of the data, achieving an R^2 of close to 90%. We observe no significant pre- or post-movement wage dynamics for either establishments or workers, along with nearly symmetric wage adjustments when moving to higher-wage or lower-wage locations, supporting the assumption of conditional exogenous mobility. To address the limited-mobility bias of workers across establishments, we cluster establishments following Bonhomme et al. (2019). Notably, this bias is less concerning for mobility across space, as we observe a large number of relocating establishments and migrating workers across commuting zones.

We find that location effects explain only 2%-5% of the total variance of log wages across space. In contrast, worker effects, establishment effects, and their covariance account for approximately 30%, 13%, and 40% of the total variance, respectively. Additionally, around 15% of the variance is attributed to the covariance between establishment and location effects and between worker and location effects, indicating a significant role for the sorting of workers and establishments across space. Importantly, the small share of pure location effects suggests a limited influence of agglomeration forces in driving spatial wage disparities.

We conclude that our findings align with the expectations of many regional policymakers. Firm mobility is widespread, and the spatial sorting of firms plays a crucial role in shaping the economic prosperity of local communities. At the same time, our findings suggest that idiosyncratic motives play an important role in shaping firm location decisions, limiting their sensitivity to local business and tax incentives.

Related literature. This paper relates to several strands of literature. First, we relate to the small literature that examined firm mobility in specific contexts. Duranton and Puga (2001) documents net migration of mature firms from diversified cities to specialized locations; Voget (2011) studies relocation of multinational headquarters as a response to taxation; Bergeaud and Ray (2020) investigates relocation decisions in the context of firms' demand for real estate; Bryan and Guzman (2023) studies the movement of high-potential startups. Relative to these studies, we provide a comprehensive view of firm relocation decisions, and leverage it to quantify the importance of firms for spatial wage inequality.

Second, we relate to the literature in spatial economics on firm sorting and its role in explaining differences in economic activity across space, including Gaubert (2018), Lindenlaub et al. (2022), Lhuillier (2022), Hong (2023), and Oh (2023). These studies consider static firm location decisions and do not directly utilize information on relocation decisions to quantify the importance of firm sorting. We make progress on these questions by quantifying the magnitude and significance of firm sorting using a mover design. In addition, while our focus is mainly empirical, we provide a spatial equilibrium model with firm mobility that aligns with our key findings.

Third, we relate to the vast literature that decomposes wages into firm and worker effects, following Abowd et al. (1999), Card et al. (2013), and Bonhomme et al. (2019); and the literature that uses worker mobility to study location effects in worker wages, following Glaeser and Maré (2001), Combes et al. (2008), De la Roca and Puga (2016), and Card et al. (2025). Relative to these two strands of literature, we leverage firm mobility to separate firm effects from location effects. Finally, we also relate to studies that implement a two-sided movers design in other contexts, such as Badinski et al. (2023) or Swagel (2024) in the context of geographic variation in healthcare utilization.

The remainder of the paper is structured as follows. In Section 2 , we present the data that we use from France and the United States, and discuss the definition of a relocation. In Section 3 , we provide a series of stylized facts about relocation decisions. In Section 4 , we present a spatial equilibrium model that can account for these findings. In Section 5 , we provide a new decomposition of spatial wage inequality that treats location and firm effects separately. Section 6 concludes.

2 Data

Our design relies on observing both workers and establishments moving between locations. While we explain the identification and the main assumptions in Section 5 .1, this Section provides details on the measurement in the data. We start with the French administrative data then describe the US data used to proxy for establishment mobility.

2 .1 French administrative data

We combine two administrative data sources to track the mobility of workers and establishments over space: linked employer-employee data and a registry of establishment relocation. We complement these data with a survey of entrepreneurs to provide qualitative evidence on plant mobility.

Linked Employer Employee Data: We use comprehensive employment records at

the job spell level. These data are based on mandatory employer declarations for employees subject to French payroll taxes. They include information on employees' wages (gross and net) and the number of hours worked during the year. They also provide some characteristics of the employees (e.g., age, gender, place of residence, place of work) and of the companies and establishments for which they work (e.g., industry code and location at the municipality level). Importantly for our study, the data are reported at the establishment level which allows us to follow the mobility of workers between establishments and locations. The data are very granular as France is divided into about 35,000 municipalities ($\approx 40\%$ of the total in Europe). We exploit this granularity to distinguish mobility within and between commuting zones.

The raw data consist of a series of cross sections that include all workers observed in year t and information on the jobs they held in $t-1$. Using the algorithm developed by Babet et al. (2022), we link the cross-sections together and recover a panel of workers for the period 2002-2019. This allows us to observe a large number of workers moving between establishments and locations. For comparison, previous work has relied on a restricted panel version covering about $1/25^{th}$ of the workforce (see for example Abowd et al. (1999)). We focus on employees between 23 and 60 years old working in metropolitan France. We keep their highest paying job during the year based on total gross earnings.

Registry of establishment relocation: Relocation is defined by the statistical office as the transfer of the non-labor means of production (i.e., machinery and capital used for production) between two locations. Administratively, this implies closing the former establishment in the sending location and reopening it in the receiving location. Although this phenomenon is not specific to France (see the next Section for evidence on the US), it is difficult to measure in practice. In many countries, an establishment identifier is specific to its location. As a result, any change in location results in a new identifier. To overcome this issue, we exploit administrative data that track the relocation of establishments (SIRENE register). For every year between 1993 and 2022, the register provides the link between the identifier in the sending and receiving locations. We use this unique feature of the data to shed new light on plant relocation. The register covers all types of establishments, including headquarters, research facilities, and production plants. It includes firms operating in the private sector, with the exception of agriculture and finance.

Survey of Entrepreneurs: The SINE survey consists of three waves, including an initial interview and two follow-up questionnaires in years three and five. It is administered to a random sample of new entrepreneurs, covering about a third of all firms created in the first semester of the survey year. In 2014, there were around 24,000 enterprises surveyed. We focus on companies that are still active at the last interview. The survey provides detailed information on the characteristics of the entrepreneurs, the development of the

firm's activity and its clientele. It also contains interesting information on the potential challenges and shocks faced by entrepreneurs before starting their business and during the first few years of activity (e.g. changes in local competition or difficulties in accessing credit). We link this survey to our relocation register using a unique firm identifier. In the next section, we compare firms that relocated at least one establishment during their first five years of activity with firms that did not relocate any activity.

2 .2 U.S. data

Dun & Bradstreet. We use data from the Dun & Bradstreet Historical Records to provide facts on firm relocation in the United States in recent decades. This dataset traces U.S. private and public companies going back to 1969, with the exception of 1981 and 1984. Each establishment in a multi-establishment firm is linked to its headquarters establishment. While we cannot infer movements for the typical establishment, we can trace the mobility of single-unit firms or headquarters of multi-unit firms across space. Recall that in the French data, these categories cover the vast majority of relocation events. We identify a relocation when such an establishment changes its address, while keeping its name and the firm's year of birth. We further require no changes in the firm ownership when the establishment moves.

Data on U.S. public corporations. We also provide a time series for relocation rates for publicly-listed firms. We recover a firm's business mailing address from its 10-k filings to the U.S. Securities and Exchange Commission (SEC) between 1993-2021 using the EDGAR platform. These addresses typically capture the firm's administrative headquarters location. We then define a relocation as a change in that address.

3 Characterization of firm relocation

In this section, we document a number of salient facts on firm relocation. First, we examine the prevalence of firm mobility. Second, we explore the geographic patterns of these moves, by showing how far establishments move, and which types of establishments move where. Third, we analyze adjustments made by establishments after relocating. We document all facts for France, as well as for the US when data permit.

3 .1 How prevalent is firm relocation?

We begin by documenting the prevalence of firm relocation. Figure 1 shows the time series of establishment relocation between 1994 and 2023. For each year, we compute the ratio between the number of establishments relocating during the year and the total number

of establishments operating in the economy. In France, the relocation rate remained relatively stable between 1994 and 2007, averaging about 4.0%. This rate decreased to 3.5% during the Great Recession, and has remained stable at that level since. Focusing on establishments that report some employees in the employment records, our results are almost identical. Headquarters exhibits a higher propensity to relocate. For France, focusing on headquarter establishments only for France, relocation rates range from 4.0% to 4.5%.

Appendix Figure A.1 provides further time series on establishment relocation. Panel (a) shows that moves of establishments are observed across all industries, with heterogeneous rates. The business services sector has the highest relocation rates, averaging between 5.0% and 6.0% over the period, consistent with Duranton and Puga (2001). In manufacturing, retail and household services, about 3.0% of establishments relocate every year. The hospitality and agrifood industries exhibits the lowest relocation rates, though even those sectors experience an annual 1.0% relocation share. Relocating establishments are generally smaller than the average firm, but they still account for a significant share of employment. Panel (b) shows that establishments relocating employ about 2.5% of French employees.

For the US, we proxy relocations by changes in zip code, which likely underestimates the actual number of relocations. US data is limited to headquarter relocations. Using Compustat data, we estimate the relocation rate of US headquarters to be between 4.0% and 6.0%. For establishments observed in the Dun and Bradstreet dataset, the relocation rate ranges from 1.5% to 3.0%.

Taking these estimates into account, and given the higher reliability of the French data for tracking relocations, our first fact is that approximately 4.0% of establishments relocate each year.

3 .2 Geography of firm relocation

We now turn to the geographic patterns of firm relocation, addressing two key questions: 1) Where do establishments relocate? 2) What types of establishments move to these locations? The first question concerns the distance involved in relocations and whether certain locations systematically attract or lose firms. The second question explores whether the 4% of establishments that relocate annually contribute to sorting between firms and locations.

Where do establishments relocate? As a first step, we investigate the role of distance in relocation to determine whether firms tend to relocate within close proximity. As shown in Panel (c) of Appendix Figure A.1, a large share of relocations (90%) occurs

within the same region, with 22 regions in France. Moreover, 75% of relocations are within the same commuting zone, and 30% occur within the same city. Our analysis relying on changes in location will consider moves across two different commuting zones. Commuting zones serve as proxies for local labor markets, as they are defined based on commuting patterns between areas of residence and employment. There are 304 commuting zones in France. Based on evidence provided in Section 3 .1, about 1% of all French establishments change commuting zone every year.

These patterns suggest that relocations are predominantly local. To explore the role of distance further, we estimate a gravity model:

$$log(\#\text{ moves}_{ij}) = \eta_i + \mu_j + log(\text{Distance}_{ij}) + \epsilon_{ij}, \tag{1}$$

where the dependent variable is the logarithm of the number of establishments relocating from province i to province j. η_i and μ_j are origin and destination fixed effects, respectively. $Distance_{ij}$ is the number of kilometers between provinces i and j. Panel (a) of Figure 2 shows the relationship between the log of the number of moves and the log of the distance. We estimate an elasticity of the number of bilateral moves to distance of -0.96 (standard error of 0.01). This result confirm the strong and negative role of distance.[1] Such strong gravity patterns indicate that relocating far from initial location is more costly, which suggests strong spatial friction at play during a relocation.

The gravity model treats flows from i to j symmetrically with flows from j to i. We now investigate whether there are systematic directional flows between specific locations. For each pair of locations, we calculate the following index:

$$\text{Index}_{ij}^{\text{Directionality}} = \frac{|\#\text{ Outflows}_i - \#\text{ Inflows}_j|}{\#\text{ Outflows}_i + \#\text{ Inflows}_j}, \tag{2}$$

where $\#$ Outflows$_i$ denotes the number of establishments leaving commuting zone i and $\#$ Inflows$_j$ the number of establishments relocating to commuting zone j. The index measures the asymmetry between gross and net flows, indicating the extent of unidirectional movement from origin i to destination j. An index of zero means that bilateral flows are perfectly symmetric i.e. there are moves out of and from the zone. On the other hand, an index equal to one indicates that flows are unidirectional, i.e. net flows are equal to gross flows. Panel (b) of Figure 2 shows the distribution of $\text{Index}_{ij}^{\text{Directionality}}$ for all location pairs. The concentration around zero suggests that gross flows are much larger than net flows, implying that relocations are distributed across various zones without a clear pattern of systematic outflows from certain locations. Hence, our second main fact is that firm relocation is characterized by strong gravity patterns and large gross flows.

[1] See Appendix Table A.2 and Appendix Table A.3 for the distribution of distances involved in relocations, for both establishments and workers.

Which establishments move where? After documenting where establishments relocate, the natural next question asks which establishments move where. Specifically, we compare the characteristics of establishments relocating from the same origin but to different destinations. To do this, we estimate the following regression:

$$x_{c(J)} = \eta_i + \gamma_1 x_J + \gamma_2 Age_J + u_J, \tag{3}$$

where x_J represents the characteristics of the establishment at the time of relocation (e.g., log size) and $x_{c(J)}$ denotes the characteristics of the destination commuting zone, measured before the move. We control for establishment age and origin commuting zone fixed effects to compare establishments of similar age and origin.

Figure 3 presents the results for size (Panel (a)) and hourly wage (Panel (b)). After controlling for age and origin, we find that larger establishments tend to relocate to larger commuting zones. Similarly, establishments that pay higher wages on average tend to move to higher-wage areas. A 10% increase in the wage level at the establishment is associated with a 0.2% higher average hourly wage in the destination zone. These correlations suggest that firm relocation contributes to sorting between firm and location, although at this stage, local average wage can be driven by different workers. Our third fact is that larger and higher-paying establishments relocate to larger and higher paying locations.

3 .3 Firm adjustments after a relocation

We now analyze the potential changes in an establishment following a relocation. We separately consider two types of adjustments. First, we focus on structural changes related to the establishment's activity and organization. Second, we turn to labor adjustments, in response to operating on a new labor market. We document a new fact for each of those two adjustment types.

3 .3.1 Activity and organization

We first test whether establishments relocating to a new location implement structural changes in the type of activity they perform or their organization. To do this, we define several proxies for changes in activity, organization or major changes in the production function. Those proxies are defined in the French administrative data (DADS and FICUS-FARE), and the results are validated using specific questions on major changes experiences asked to entrepreneurs.

Measures in administrative data. Table 1 shows the share of establishments keeping the same industry code, same headquarter status, same legal category or same top manager from one year to the other. It distinguishes between establishments that relocate between those two years and those that do not. The first column shows that 94% of establishments relocating keep the same industry code (compared to 99% of establishments not relocating. The industry code describes the type of activity accomplished by the establishment (it can be different from the one of the firm). Importantly, when declaring the relocation, an entrepreneur is asked to provide the accurate industry code on the form. This means that the fact that the majority indicate the same code as before is indicative of a continuation of the activity operated by the establishment. 99% of establishments that were headquarters before the relocation remain headquarters after, consistent with the fact that this is the same establishment as before, operating the same activity. This implies, for instance, that the relocation does not lead to the replacement of administrative activities by production ones. 96% also keep the same legal status (e.g. simplified corporation or limited liability company). 67% of relocating establishments keep the same top manager, while 77% of establishment not relocating do. We proxy the top manager by taking the identification number of the highest paid manager in the company. Table A.4 shows the difference-in-difference version, which allows us to control for potential differences between movers and non-movers as well as year fixed effects. The magnitudes are very similar, which a small fraction of establishments changing those characteristics after a relocation. Those results indicate the absence of major changes in the organization or activity of establishments when they relocate. Figure 4 also shows the strong persistence of the main input composition. Panel (a) shows that the share of low shilled employee (blue collars and low-skilled white collars) remains very close. Panel (b) shows the persistence of the capital-to-labor ratio in the establishment after a relocation.

Measures in the survey of entrepreneurs. We then complement the results obtained using administrative sources with a survey. We rely on the SINE survey, which asks entrepreneurs about the types of changes they have implemented or faced since the creation of the establishment. By matching the survey data to the registry of establishment relocations, we can compare responses for establishments that have moved to those that have not. Figure 5 shows the answers to the question "Did you experience any major change since creation?", separately for movers and non-movers, and the changes encountered. The results are strikingly similar between establishments which moves and those which did not. 55% of entrepreneurs of establishment that indicate that no major change took place. As a comparison, 56% pick that option among the non-movers. Movers and non-movers then exhibit the same average estimates for the probability of having changed the types of services offered (15%), the location of their clients (9%), the number of clients (31%) and the types of clients (11%). While it makes sense that an

establishment incurs some changes over time since creation, like the number of customers, those which relocate are not more likely to have faced any change than those which did not. Appendix Figure C.1 further documents the challenges faced by these entrepreneurs, revealing no significant differences between movers and non-movers in terms of challenges encountered during the establishment's creation or after.

Both the administrative data and the survey indicate that establishments maintain the same type of activity and do not implement major changes in terms of their organization or input composition after relocating.

3 .3.2 Labor adjustments

Although establishments do not appear to implement structural changes after relocation, we now explore whether they make adjustments to their labor input. Specifically, we are interested in whether they begin employing workers from the new location and whether the wages paid by the establishment respond to local wage levels. Figure 6 presents several results related to labor adjustments. Panel (a) shows the share of employees residing in the origin commuting zone, the destination commuting zone, or another commuting zone. Before relocation, more than half of the employees lived in the original location, about a quarter resided in the destination commuting zone, and the remaining quarter lived in other zones. One year after the move, the share of employees living in the destination commuting zone rises to around 50%, while the share from the origin zone drops to about 25-28%. This shift suggests that the workforce composition adjusts after the move, with a larger proportion of workers coming from the new local labor market. Interestingly, this shift occurs quickly after the relocation, with steady-state shares reached almost two years later.

Given these changes in location and workforce composition, the next question is how wages evolve. Specifically, we examine whether establishments moving to areas with higher average wages—compared to their origin—also increase their own wage levels. To study this systematically, we compare the wage evolution of relocating establishments based on the wage gap between the destination and origin locations. We estimate the following regression, applying the specification of Badinski et al. (2023) for the healthcare market to our case:

$$log(wage_{Jt}) = \phi_J + \delta_t + \theta_{r(J,t)}\Delta_J + \beta x_{Jt} + \nu_{Jt}, \tag{4}$$

where the outcome variable is the log of the average hourly wage in establishment J in year t. ϕ_J and δ_t are establishment and year fixed effects, respectively. Δ_J is the difference in average log hourly wage between the destination commuting zone and the origin commuting zone, computed the year of the move. x_{Jt} consists of indicators for years

relative to establishment J's relocation. The relative year, $r(J,t)$ is defined relative to establishment J's change of location. The main parameter of interest, $\theta_{r(J,t)}$ are on the interactions between relative year indicators and the difference in wage between destination and origin commuting zone. It captures how the establishment-level average wage evolves in the years before and after a relocation, as a share of the difference in average wage between the new location and the origin.

We estimate two versions of Equation (4). In the first, we include both movers and non-movers. For non-movers, the relative year and Δ_J are equal to zero. In the second version, we focus exclusively on establishments that relocate, and we drop the relative year fixed effects (x_{Jt}). In both cases, we use a balanced panel of establishments to ensure that composition changes do not affect our estimates.

Panel (b) of Figure 6 depicts the results. It shows that the average hourly wage of the establishment is very stable in the four years before the relocation. The lack of pre-trends is supportive of one of the identifying assumptions made in the next Section. Immediately after the relocation, there is a jump in wages that indicates some role for the location in establishment-level pay. We estimate that relocating to a location with average wages 1% higher results in an establishment-level average wage higher by 0.15% after the move. The change happens immediately at relocation, and the wage is then stable. This finding is consistent with both a role for the location and a role for the establishment in determining wages. If wages were only determined by the establishment, wages would not jump at relocation. If, on the contrary, there was a local market wage determining all the wages paid, we would find an estimate close to 1. Although at this stage, we don't know which of the local workers or the location market wage drives the change, the next Section will provide evidence on this.[2]

We deduce two additional facts on firm relocation. First, establishments relocating do not implement structural changes. Second, they adjust their workforce and wages to the new location.

3 .4 Summary of five main facts

We summarize the evidence presented above with five new facts about firm relocation across space. First, firm relocation is common, with an annual average of 4% of operating establishments relocating each year, both in France and the US. Second, relocations are characterized by large gross flows and exhibit strong gravity patterns. Third, larger and higher-paying establishments tend to relocate to larger and higher-paying locations. Fourth, establishments maintain the same type of activity and organizational structure

[2]Appendix Appendix Figure B.1 depicts similar event studies at the worker level, for (i) a change in establishment and (ii) a change in location. We discuss them in the next Section.

after relocating. Fifth, establishments adjust their workforce composition and wages in response to the local labor market.

Overall, we find that firm mobility is widespread and that these moves influence firm-level wages. This suggests that the location of a firm plays a significant role in determining the wages it pays. We conclude this section by raising two open questions that will be addressed in the next section. First, while we observe that relocation is linked to some sorting between firms and locations, we ask how substantial this sorting is at the economy-wide level. Second, we note that relocation involves both changes in workforce composition and wages. The next question, then, is how much of this wage adjustment is driven by differences in worker characteristics across locations, and how much is due to the location itself.

4 A model of firm relocation

In this Section, we develop a simple spatial equilibrium model with firm mobility. The goal of the model is twofold: first, to provide a parsimonious theoretical setting that can rationalize the set of facts established in Section 3 . Second, we use the model to a establish a wage equation that will motivate our wage decomposition exercise in Section 5 .

4 .1 Setting

We consider a static model with a discrete number of N locations. The economy is populated by a unit mass of firm owners and a measure L of workers. We focus our analysis on firm mobility and abstract from migration decisions of workers. Therefore we assume that each location is populated by L_n workers, such that $L = \sum_{n=1}^{N} L_n$.

Firm owners. Each firm owner ω is endowed with an initial location o – capturing the birth place of the business idea – and with productivity level z, drawn from a cumulative distribution function $G(z)$. The firm owner chooses the location for their business $n \in \{1...N\}$ to maximize

$$\max_{n \in \{1...N\}} u(\pi_n(z)) + \kappa_{on} + \varepsilon_n^f,$$

where $\pi_n(z)$ is the expected income flow from operating a firm in location n for firms of type z; κ_{on} is a bilateral relocation friction between locations o and n; and ε_n^f is an idiosyncratic preference shock for location n, drawn from a type-1 extreme value distribution with shape parameter ξ.

Production. We assume that firms produce a freely-traded homogeneous good, and that profits arise due to decreasing returns to scale (DRS) technology. This specification is isomorphic to assuming that firms produce a differentiated good in a setting with

monopolistic competition and CES preferences. The production function is given by

$$y_n(z) = z\Phi_n \left(k^{1-\alpha} \left(\prod_{s=1}^{S} \ell_s^{\beta_s} \right)^{\alpha} \right)^{\eta},$$

where k is the amount of real estate services that the firm uses; Φ_n is the productivity term that is common to all firms in location n, capturing location fundamentals and agglomeration spillovers; ℓ_s is the amount of type-s labor that the firm hires; α is the labor intensity of production; η captures returns to scale, where we assume $\eta < 1$; and β_s is the intensity of type-s workers in the firm's labor composite.

Labor supply. Each location is populated by S types of workers, with the supply of s-type workers in location n given by L_{ns}, such that $\sum_{s=1}^{S} L_{ns} = L_n$. Firms post wages for every worker type, denoted by $w_{ns}(z)$. Workers have idiosyncratic preferences for firms and choose which firm to work for. We assume that workers choose firms that maximize their indirect utility function, given by

$$\log \frac{w_{s\omega}}{r_n^{\psi}} + \varepsilon_{\omega}^{w},$$

where b_ω is the idiosyncratic preference for firm ω; $w_{s\omega}$ is the wage offered by firm ω for workers of type s; q_n is the price of real estate services in market n; and ψ is the expenditure share on real estate services. Assuming that ε_{ω}^{w} is distributed EV-1 with shape parameter ϵ, the mass of workers of type s that choose a firm of type z is given by

$$\ell_{ns}(z) = L_{ns} W_{ns}^{-\epsilon} w_{ns}^{\epsilon}(z),$$

where

$$W_{ns} = \left(\int_{z'} w_{ns}^{\epsilon}(z')\, dG_n(z') \right)^{\frac{1}{\epsilon}}$$

is the local ideal wage index for workers of type s in market n.

4 .2 Firm's problem

Upon choosing location n, the firm's profit maximization problem is given by

$$\pi_n(z) = \max_{\{\ell_S\},k} z\Phi_n \left(k^{1-\alpha} \left(\prod_{s=1}^{S} \ell_s^{\beta_s} \right)^{\alpha} \right)^{\eta} - q_n k - \sum_{s=1}^{S} L_{ns}^{-\frac{1}{\epsilon}} W_{ns} \ell_s^{\frac{\epsilon+1}{\epsilon}}.$$

The firm chooses its usage of labor inputs and real-estate services to maximize revenues net of labor costs and real-estate costs, where note that $L_{ns}^{-\frac{1}{\epsilon}} W_{ns} \ell_s^{\frac{\epsilon+1}{\epsilon}}$ captures total payroll to workers of type s.

Solving the firm's profit maximization problem yields the following expressions for the

firm's revenues ($r_n(z)$), profits ($\pi_n(z)$), type-s labor ($\ell_{ns}(z)$), and type-s wages ($w_{ns}(z)$), conditional on activity in market n:

$$\begin{aligned} r_n(z) &= \left(\frac{\bar{\eta} z \Phi_n}{q_n^{\eta(1-\alpha)} W_n^{\eta\alpha\frac{\epsilon}{\epsilon+1}}} \right)^{\frac{1}{1-\eta\left(\alpha\frac{\epsilon}{\epsilon+1}+1-\alpha\right)}}, \\ \pi_n(z) &= (1-\eta) r_n(z), \\ w_{ns}(z) &= \left(L_{ns}^{-1} W_{ns}^{\epsilon} \beta_s \alpha \eta r_n(z) \right)^{\frac{1}{1+\epsilon}}, \\ \ell_{ns}(z) &= \left(\beta_s \alpha \eta L_{ns}^{\frac{1}{\epsilon}} W_{ns}^{-1} r_n(z) \right)^{\frac{\epsilon}{\epsilon+1}}, \end{aligned}$$

where $\bar{\eta} \equiv \left(\eta\alpha\frac{\epsilon}{\epsilon+1}\right)^{\eta\alpha\frac{\epsilon}{\epsilon+1}} (\eta(1-\alpha))^{\eta(1-\alpha)}$, and $W_n \equiv \prod_{s=1}^{S} (W_{ns}/\beta_s)^{\beta_s}$. Notably, the firm's revenues, profits, wages, and employment are all log-linear functions, increasing in the firm's productivity z and the location productivity Φ_n.

Finally, solving for the firm's location decision yields the following expression for the probability that a firm of type z that starts in location o chooses location n:

$$\chi_{on}(z) = \frac{\exp\left(\frac{1}{\xi}\left(u(\pi_n(z)) - \kappa_{on}\right)\right)}{\sum_{m=1}^{N} \exp\left(\frac{1}{\xi}\left(u(\pi_m(z)) - \kappa_{om}\right)\right)}$$

. This choice probability is increasing in the expected profits from operating a firm in location n, and decreasing in the bilateral relocation cost κ_{on}.

4 .3 Empirical implications

The model aligns with our key observations about firm relocation flows.

Gross relocation flows. The model generates gross relocation flows that can be much larger than net relocation flows, due to the existence of idiosyncratic location preference shocks and bilateral relocation frictions.

Gravity for firm relocation. The model admits a log-linear equation for type-z relocation rates between locations o and n,

$$\log \chi_{on}(z) = \underbrace{\frac{1}{\xi} u(\pi_n(z))}_{\text{Destination FE}} \underbrace{- \log \sum_{m=1}^{N} \exp\left(\frac{1}{\xi}\left(u(\pi_m(z)) - \kappa_{om}\right)\right)}_{\text{Origin FE}} - \underbrace{\frac{1}{\xi}\kappa_{on}}_{\text{Bilateral frictions}},$$

where a destination fixed effect captures the the firm's expected profits in market n; the origin fixed effect captures firm market access from its birth location, or a multilateral resistance term in location o; and the residual captures the bilateral frictions κ_{on}. When κ_{on} is parameterized as a function of distance between o and n, the model admits a

standard log-linear gravity equation.

Firm sorting. When $u(\cdot)$ is linear, the relocation rates satisfy $\frac{\partial^2 \chi_{on}(z)}{\partial z \partial \Phi_n} > 0$. That is, conditional on the firm's origin o, higher productivity firms are more likely to choose higher productivity locations.

Wage equation and location effect. The model admits a simple log-linear structure for the wages of type-z firms, given by

$$\log w_{ns}(z) = \text{Const}_s + \log L_{ns}^{-\frac{1}{1+\epsilon}} W_{ns}^{\frac{\epsilon}{1+\epsilon}} + \frac{\frac{1}{1+\epsilon}}{1-\eta\left(\alpha\frac{\epsilon}{\epsilon+1}+1-\alpha\right)}\log z + \frac{\frac{1}{1+\epsilon}}{1-\eta\left(\alpha\frac{\epsilon}{\epsilon+1}+1-\alpha\right)}\log\left(\frac{\Phi_n}{q_n^{\eta(1-\alpha)} W_n^{\eta\alpha\frac{\epsilon}{\epsilon+1}}}\right).$$

Through the lens of the model, the firm's wages include a log-separable *location effect*. This location effect captures local productivity (Φ_n), local labor market conditions (W_{ns} and L_{ns}), and local real estate prices (r_n).

5 Spatial disparities in wages

5 .1 Statistical model

In this Section, we quantify the contribution of worker, establishment and location effects in driving spatial disparities in wages. We combine information on establishments relocation between commuting zones and linked employer-employee data, to estimate the following model:

$$Y_{ict} = \alpha_i + \phi_{J(i,t)} + \psi_c + \text{X'}_{it}.\beta + \epsilon_{ict}, \tag{5}$$

where Y_{ict} if the (log) gross hourly wage paid to employee i, working in plant $J(i,t)$, located in CZ c, observed at time t. α_i is worker's i fixed effect. It captures the time invariant characteristics that affect worker's i compensation (e.g. ability). $\phi_{J(i,t)}$ is the establishment-specific component of earnings. It reflects differences in productivity and pay structure between establishments. ψ_c is location c fixed effect. It captures differences in compensation between locations, while controlling for worker and establishment characteristics. A positive ψ_c implies that similar workers and establishments will experience higher wages when operating in this location, as opposed to the average location. As discussed in Section 4 , it accounts for both differences in fundamentals, such as floor space, and in productivity (e.g., agglomeration effects). In the standard AKM (1999) setting, this coefficient is not separately identified from the establishment fixed effect as

every establishment is observed in only one location. We leverage the mobility of establishments between locations to separate the contribution of establishments from the one of locations. We provide more details about the estimation below. Finally, the model allows for time varying controls X_{it} that include a polynomial of workers' age and year fixed effects.

Sample: We estimate this model on the universe of companies that operate in the private sector over the period 2002-2019. We focus on establishments that have at least one full-time employee during the year. We drop singletons and focus on the largest connected set of workers, establishments and locations.

We end up with more than 161 million worker-year observations, including about 1.8 million unique establishments, 22.7 million unique workers and 304 commuting zones. The small relative number of commuting zones implies a high level of mobility for both workers and plants. For every commuting zone, there are on average 287 establishments moving, and close to 29,000 workers (see Appendix Table A.1).[3] To account for the large number of establishments, that may result in limited mobility bias (Abowd et al., 2004; Andrews et al., 2008), we follow Bonhomme, Lamadon and Manresa (2019). We cluster establishments into 10 groups using a k-means algorithm based on percentiles of the within establishment wage distribution. We report both models for comparison. We also explore the robustness of the results to different number of clusters and alternative moments of the wage distribution in the next section.

Identification: The model is identified using (i) the mobility of workers between establishments and CZs, and (ii) the mobility of establishments between CZs. This two sided movers design is illustrated in Figure 7. While the standard AKM (1999) model requires the sample to be connected through the mobility of workers between establishments, this, alone, is not sufficient to separate the establishment from the location effect. Workers' mobility between two commuting zones identifies jointly the effect of the new establishment and of the new location (a simultaneous change in ϕ and ψ). As a second source of identification, we exploit the mobility of establishments between commuting zone, assuming that ϕ stays constant. This assumption is supported by the evidence provided in Section 3 : establishments tend to perform the same type of economic activity before and after they move. This additional mobility allows us to compare similar individuals, working in the same establishment, but observed in different locations. The area fixed effects is then identified through: (a) workers changing location *with* their establishment, and (b) the mobility of workers between mover and non-mover establishments. In the next Section, we show that the results are not sensitive to excluding workers who move with their establishment.

[3]The median number of moves is close to 100 for establishments and 11,000 for workers.

Main hypotheses: The identification of $\{\alpha, \phi, \psi, \beta\}$ relies on two main assumptions. First, we assume the additive separability of log wages: we can express the log of wages as the sum of some fixed-effects. This log additive specification is predicted by our structural model. Indeed, we showed in Section 4 that the log of wages can be expressed as a constant and the sum of three components: (a) the productivity of the entrepreneur, (b) the composition of the local labor market, and (c) a function of the productivity of the area and the fundamentals (e.g., floor space). Empirically, the high adjusted R^2 of 0.88 indicates that this model provides a good approximation of the data.

The second main assumption is the conditional exogenous mobility of workers and establishments. Conditional on the fixed effects (i.e., on workers' ability, plants' productivity and local conditions), mobility must be as good as random. This allows for the sorting of productive workers into productive establishments and locations (similarly the sorting of productive plants into productive locations), as long as mobility is not driven by time varying unobservables (ϵ_{ict}). Intuitively, mobility would, in this case, attribute the effect of these shocks to the change in establishment or location. In practice, this excludes any form of (i) drift (time varying change in productivity), (ii) idiosyncratic productivity shocks (e.g., Ashenfelter dip), or (iii) match effect.

We start by investigating whether workers and establishments experience trends in compensation before they move. The event study from Figure 6 panel (b), discussed in Section 3 , shows that establishments moving to high vs. low paying locations did not experience differential trends. There is a clear change in wages at the time of the move, with no trends either before and after the relocation. This is consistent with the absence of drift in the fixed effects and with the log additivity assumption discussed above. We reproduce in Appendix Figure B.1 the same event studies for workers changing establishments within the same commuting zone (Panel (a)) and between commuting zones (Panel (b)). The patterns are very comparable to what we observed for establishments. We complement these event studies with descriptive evidence on mean wages around worker and establishment moves. We follow the work of Card et al. (2013, 2016) and plot in Figure 8 the evolution of workers' average log hourly wage, residualized for age and year fixed effects, around a change in establishment. We plot the change for different quartiles of sending and receiving establishment fixed effects based on Equation 5. We separate workers' mobility into changes in establishments within the same commuting zone (Panel (a)) and changes in establishments between commuting zones (Panel (b)). The results are qualitatively similar for both types of relocation. There is no evidence of trends either before or after the move. Workers moving from high to low fixed effects establishments (solid line) experience a sharp drop in earnings while workers moving from low to high fixed effects establishments (dashed line) experience a sudden increase in earnings. There is no change in wages for workers changing establishments within the same quartile of

fixed effect, consistent with the predictions of our statistical model. In addition, we find a clear ordering, consistent with previous research on the AKM design: individuals who move from highest to lowest quartiles were initially paid less than individuals moving to relatively higher quartiles. We then turn to the mobility of establishments between locations (Panel (c)). We plot the change in the average wage paid by establishments around their relocation, for different quartiles of sending and receiving location effects.[4] The results are qualitatively comparable, but the magnitudes are smaller for plants' relocation. This suggest more heterogeneity in the establishment effects than in the location effects, as we will show in the next Section.

We then investigate whether mobility is driven by transitory shocks (e.g., Ashenfelter dips). Again, the event study design is helpful to rule out shocks that would take place before or after the move. The parallel trends in the pre and post move periods suggests that plants and workers moving did not experience shocks that pushed them to relocate. A limitation is that we cannot observe these shocks if they are permanent and concomitant to the move. As a complement to the event study design, we leverage the SINE survey of entrepreneurs that provides information about the shocks entrepreneurs experienced either in the process of creating their firm, or during the first two years of activity. We reproduce the responses for entrepreneurs who relocated at least one establishment and for non-movers in Appendix Figure C.1. We consider several potential shocks. First, are establishments moving as a response to a change in local competition? Panel (a), displays the share of entrepreneurs who report experiencing a stable, increasing or decreasing level of competition during the first two years of activity. The responses are very similar for the two groups: about 55% of entrepreneurs declare stable levels of competition, around 35 to 40% declare an increase in competition, and less than 5% declare a decrease in competition. Second, did they experience issues while starting their firm, such as access to financing, real estate, skilled workforce or reaching to customers? Again, Panel (b) shows that the responses are quantitatively very similar for movers and non movers. Finally, we find that the two groups of firms do not differ in the shocks experienced during their first two years of activity in terms of access to labor force, production cost, access to finance and competition (see Panel (c)). This suggests that the mobility of establishments is unlikely to be driven by such shocks.

Third, we exploit the granularity of the data to run a placebo test. Our statistical model predicts that establishment mobility within the same location should not affect wages, as there is no change in either the establishment or the location effects. On the other hand, if mobility is driven by productivity shocks or changes in economic activity, we should capture this effect. Panel (d) of Figure 8 provides the results of the event study

[4] We construct the quartile based on the sum of the pure location effect (ψ_c) and the average quality of the workforce ($\overline{\alpha_c}$), as relocating establishments experience both a change in the local productivity shifter and in the composition of the workforce.

within the same commuting zone, by quartile of location fixed effect. Consistently with the prediction of our model, we find no changes in wages around the move.

Finally, we investigate whether mobility could be driven by match effects: a specific premium on top of the average effect that a random mover (worker or establishment) would get. We follow the approach taken by Card et al. (2013, 2016). Our statistical model predicts that, in the absence of match effects, wage gains or losses should be symmetric when moving from A to B and respectively from B to A. The existence of (positive) match effect would imply some asymmetry. For every pair of units (establishments or locations), movers joining the higher paying unit would get higher gain than predicted by the simple difference in fixed effects, while movers joining the lower paying unit would experience a smaller decrease in wages due to the positive match effect. Building on Panel (a), (b), and (c) of Figure 8, we observe that changes are actually close to symmetric, suggesting a modest role for match effects.

5 .2 Disparities between locations

5 .2.1 Contribution of worker, plant and location effects to wage disparities

We now turn to spatial disparities in wages between locations. Building on equation 5, we aggregate the log hourly wage, the fixed effects, the time varying controls and the error term at the commuting zone level. These averages are weighted by the number of worker-year observations. We obtain: $\overline{log(Y_{ict})} = \overline{\alpha_c} + \overline{\phi_{J(c)}} + \psi_c + \overline{\mathrm{X'}_c}.\beta + \overline{\epsilon_c}$, for every commuting zone in our sample.

We identify four sources of heterogeneity between locations. First, $\overline{\alpha_c}$ and $\overline{\phi_{J(c)}}$ accounts for differences in the average level of ability and productivity of the workers and establishments located in the different commuting zones. It captures a composition effect. Second, the parameter ψ_c reflects differences in location productivity shifters, including agglomeration effects, and in fundamentals (e.g., structure). $\overline{\mathrm{X'}_c}$ accounts for differences in observable characteristics, such as the age of the workforce. Finally, the error term $\overline{\epsilon_c}$ is equal to zero as we average over a large number of workers within commuting zones.

We then investigate the contribution of these four components to the variance of wages between commuting zones using the following decomposition:

$$Var(\overline{log(Y_c)}) = \underbrace{Var(\overline{\alpha_c})}_{\text{Workers contribution}} + \underbrace{Var(\overline{\phi_c})}_{\text{Plants contribution}} + \underbrace{Var(\psi_c)}_{\text{Area contribution}} \quad (6)$$

$$+ \underbrace{2.cov(\overline{\alpha_c}, \overline{\phi_{J(c)}}) + 2.cov(\psi_c, \overline{\alpha_c}) + 2.cov(\psi_c, \overline{\phi_c})}_{\text{"Sorting" of workers and firms}}$$

$$+ \underbrace{Var(\overline{X_c}) + 2.cov(\overline{X_c}, \overline{\alpha_c}) + 2.cov(\overline{X_c}, \overline{\phi_{J(c)}}) + 2.cov(\overline{X_c}, \psi_c)}_{\text{Demographic controls}}$$

$$+ \underbrace{Var(\overline{\epsilon_c})}_{=0}$$

This implies that the variance of the average log hourly wage between locations can be decomposed into the sum of the variance of the fixed effects and their respective covariances. We interpret the variance components as (a) differences in intrinsic productivity (ψ_c), and (b) differences in the local composition of workers and establishments ($\overline{\alpha_c}, \overline{\phi_{J(c)}}$). Second, the covariance terms are informative about the sorting of workers and establishments between locations. A positive $cov(\overline{\phi_{J(c)}}, \overline{\alpha_c})$ implies the co-location of high ability workers and high productivity establishments in the same locations. A positive $cov(\psi_c, \overline{\phi_c})$ (respectively $cov(\psi_c, \overline{\alpha_c})$) indicates the sorting of productive establishments into productive locations (respectively, high ability workers into high productivity locations).

We provide the main results of the decomposition in Table 2. We start with the baseline model (column (1)), before turning to the clustered model (column (2)). The table reports the standard deviation of the average log hourly wage between CZs, the standard deviation of the worker, plant, and location effects, and of the time varying controls. It includes the coefficients of correlation between the fixed effects, and the contributions (in percent) of the variance and covariance components. The decomposition yields two main results.

First, close to 50% of the variance is due to the heterogeneity in workers and establishments between commuting zones. The worker effects ($\overline{\alpha_c}$) explain about 30% of the variance between CZs, while establishment effects ($\overline{\phi_{J(c)}}$) explain around 17%. In contrast, the location effect *per se* accounts for a more modest 4.5% of the variance. Wage disparities are mainly driven by worker and plant composition, as opposed to differences in city effects. We then plot the average log hourly wage (Panel (a)) as well as the three fixed effects (Panel (b),(c),(d)) in Appendix Figure D.1. The distribution of average worker and establishment fixed effects mirror closely the distribution of the gross hourly wage. Interestingly, the location effect provides a slightly different picture. It highlights more geographically concentrated pockets of productive areas, especially in the Paris region and in the north and north-east quadrants. On the contrary, regions like Brittany (north-west) and the south-west quadrant display lower location effects.

The second main takeaway from this decomposition is that the sorting of workers and establishments plays a major role. It explains about half of the observed spatial disparities. A significant fraction of the sorting comes from the co-location of productive establishments and workers in the same locations, which explains about a third of the variance between CZs. Second, we find evidence of the sorting of high ability workers in productive locations (≈12% of the variance) and of productive plants in productive locations (≈5%). We provide graphical evidence of the sorting of workers and establishments between locations. Figure 9 plots the correlation between the average worker and plant effects (Panel (a)), worker and area effects (Panel (b)), and plant and area effects (Panel (c)). We find a strong positive correlation between plant and worker effects. The coefficient is close to one, with a large R^2 of 0.53. The relationship stays positive and significant at 5% when considering the sorting of workers between locations, though with a lower predictive R^2. Finally, we find a positive but not significant relationship between plant and location effects consistent with its lower contribution to total variance.

To get a better understanding of what these location effects capture, we project the estimated location effects on usual proxies of density, such as population, employment, and the share of college graduates. As a starting point, Appendix Figure E.1 plots the results of a binscatter of the area effects against (log) employment density in 2015. We find evidence of a clear density premium: workers with same ability, working in similar plants, are paid more on average in denser locations. However, we find that the sensitivity of regional wage effects to regional size and density drops by over half once establishment fixed effects are accounted for. This is suggestive evidence of weaker role for agglomeration forces than is typically estimated in the literature. To see this, recall that through the lens of our model, the regional wage effects capture regional productivity components. Regressing these regional effects against regional size or density (in logs) – without controlling for establishment effects – we obtain a coefficient of about 0.02 (Panel B and C of Appendix Table E.1). This result aligns with the range of estimates for agglomeration spillovers in the literature (see Appendix Table E.2). Once firm sorting is accounted for through establishment fixed effects, we estimate a coefficient that is substantially smaller, around 0.008. In Appendix Table E.1 we show that this conclusion is robust to using alternative measures of density such as population density or the share of college graduates.

Finally, it is important to highlight that, while previous papers have found significant effects of early exposure to better neighborhoods (Chetty and Hendren, 2018a,b), our location effects bear a different interpretation. In our setting, exposure to better neighborhoods during childhood will load onto higher worker fixed effects and higher entrepreneurs' productivity. This paper provides evidence on another type of location effects that materializes at a latter stage, when employees and entrepreneurs reach the

labor market. As such, they relate to the location effects considered in Glaeser and Gottlieb (2009) and Card et al. (2025). In Section 5 .3, we discuss how our estimates of location effects compare with previous estimates from the literature.

Finally, we reproduce the analysis using clustered establishment fixed effects to account for potential limited mobility between establishments. The results are qualitatively and quantitatively comparable. The clustered model suggests a smaller role for establishments (13.4% vs. 17%) and location (2.4% vs. 4.5%), and a slightly larger contribution of sorting (54.8% as opposed to 49.8% previously). Again, sorting is driven mostly by the co-location of productive workers and establishments in the same location, and to a lesser extend by the sorting of productive workers and establishments in productive areas (≈7-8% for each).

5 .2.2 Robustness checks

We consider the robustness of the decomposition to alternative specifications. We report the results in Table 3. Columns (1) and (2) reproduce our main results. In column (3) and (4), we include a polynomial of the age of the establishment as an additional time varying control (respectively with and without clustering). As evidenced in the firm dynamics literature, firm pay setting can evolve with their age (Brown and Medoff, 2003; Babina et al., 2019). In particular, young firms might back-load workers' compensation to reduce financial constraints (Michelacci and Quadrini, 2005). However, the inclusion of establishment age does not affect our results. We find very comparable results for both variances and covariances. Second, we reproduce the analysis in column (5) and (6) without workers changing location with their establishment. As discussed in Section 5 .1, location effects are identified when (a) workers change location with their establishment and (b) via the mobility of workers between establishments that move and establishments that do not. We replicate the estimation without the first source of variation as the mobility of the establishment in itself could affect workers compensation. For example, workers might need to be compensated for higher commuting time (Verdugo and Kandoussi, 2024). In addition, if wages are rigid, the wage of incumbents might not immediately adjust following a relocation, as opposed to the wage of new hires. Third, we consider alternative clustering. In column (7) we use the average wage and the standard deviation at the establishment level as clustering variables (as opposed to percentiles of the wage distribution). The results are almost unchanged. We then increase the number of clusters from 10 to 100, using either percentiles of the wage distribution (column (8)) or the mean and the standard deviation (column (9)). Adding more clusters marginally increases the contribution of establishments and reduces the one of locations, but preserves

the magnitude of the different components overall. Finally, we turn to an alternative approach to separately estimate establishment and location effects. While our main approach was estimating simultaneously the three coefficients, we also consider a two step procedure. We start from the standard AKM (1999) design with Worker and Establishment x Location effects. We then decompose the Establishment x Location effect using the mobility of establishments between locations. In practice we estimate:

$$Y_{ict} = \alpha_i + \phi_{J(i,t),c} + \text{X'}_{it}.\beta + \epsilon_{ict} \quad \text{(Step 1)}, \tag{7}$$

$$\phi_{J,c} = \phi_J + \psi_c + \eta \quad \text{(Step 2)},$$

The results are almost identical to the baseline results (column (1)).

We then investigate the heterogeneity of the results by major industries: manufacturing, lower-skill services (e.g., retail, accommodation, services to households), and higher-skill services (e.g., consulting, marketing, accounting). We reproduce the results in Appendix Table F.1. We only report the results of the clustered specification. As a preliminary remark, it is interesting to note the higher level of disparities between locations in more skilled industries, as evidenced by higher standard deviation in average log hourly wages. Turning to the decomposition, we find sizeable differences between industries. First, we observe that workforce composition between locations plays a much larger role in higher skilled industries, with about 47% of the variance in the manufacturing and 39% in the skilled services. Second, location effects are relatively more important in the low-skill industries (4.2% as opposed to less than 2%). Finally, we find interesting differences in the sorting patterns. In the manufacturing, there is a strong co-location of high ability workers and establishments, stronger than what is observed in the other industries. However, we find little evidence of the sorting of productive establishments and workers in high paying locations. On the contrary, we find clear evidence of sorting in the services: for both workers and plants in the lower skill industries and for workers in higher skill industries.

5 .3 Comparison with alternative approaches

In this Section, we investigate how our approach compares to alternative methods. We consider three main approaches. First, we follow the seminal approach of Glaeser and Maré (2001); Combes et al. (2008) and estimate the following model using French administrative data:

$$Y_{ict} = \alpha_i + \psi_c + \text{X}_{it}.\beta + \epsilon_{ict}. \tag{8}$$

This approach exploits the mobility of workers between locations to identify the role of places, conditional on workers ability. The main limitation of such approach is that it does not account for the productivity of the establishment in which individuals work. As highlighted in Card et al. (2025), mobility between locations is also associated with a change in the hierarchy of the establishment in which individual work. On average, people moving from lower to higher paying areas tend to leave relatively higher ranked establishments in the sending city and join relatively lower ranked establishments in the receiving city. This change in hierarchy leads to underestimating the actual contribution of locations to spatial disparities. To account for this factor, Card et al. (2025) develop an alternative approach. They start from the standard AKM (1999) model, estimated by the mobility of workers between establishments. Then, they aggregate the estimated establishment x location effects at the CZ level:

$$\Psi_c = \frac{\sum_{c(f)=c} N_f \delta_f}{\sum_{c(f)=c} N_f}, \tag{9}$$

where δ_f is the establishment fixed effect and N_f the number of worker-year observations. This strategy captures the average change in wages for workers moving from the average establishment in the sending location, to the average establishment in the receiving location. As a result, it solves the issue of hierarchy discussed above. However, as we can see from equation 9, establishment and location effects are perfectly collinear. We cannot disentangle the role of establishments vs. a pure location effect, nor study the sorting of establishments over space. As a first step in this direction, we start with a simple two-way fixed effect model that includes only establishment and location effects:

$$Y_{Jct} = \phi_J + \psi_c + \mathrm{X}_{Jt}.\beta + \epsilon_{Jct}, \tag{10}$$

where Y_{Jct} is the (log) average hourly wage paid by establishment J, observed in location c at time t. This model mirrors the approach of Glaeser and Maré (2001); Combes et al. (2008) using establishments' mobility instead of workers' mobility. Interestingly, it allows us to study the contribution of establishments separately from location, and their sorting pattern. However, it completely abstracts from worker heterogeneity, both between establishments and locations. Finally, we compare these different approaches to our full, three way, model that separately identifies the contribution of workers, establishments and locations.

We report the results in Table 4. Columns (1) and (2) correspond to our main specifications for the three-way model. Column (3), exploits the mobility of establishments between CZs to estimate model 10. Column (4) replicates the approach by Card et al. (2025) with French administrative data, while column (5) reproduces the main decomposition from their paper. Finally, column (6) display the result of a two-way fixed effect

model with worker and location effects (model 8).

Despite different approaches, columns (3) to (6) provide relatively similar results with (i) a high location effect (∼25-30%) and (ii) a sizeable role for sorting (explaining about 40% of between CZ variance). Model 8 (worker and location) yields a slightly smaller location effect of 14%, consistent with the "hierarchy" effect discussed earlier. Model 9 (a la Card et al. (2025)) and 10 (establishments and locaitons) provide identical estimates, with locations explaining 26% of between CZ variance (columns (3) and (4)). Perhaps surprisingly, our estimation of model 9 with French data matches closely the results found in Card et al. (2025) with US data. Despite different institutions and levels of inequality, we find similar contribution of worker, location and sorting to spatial disparities.

Finally, allowing for heterogeneity of workers, establishments and locations provide new insights. First, a large fraction of the location effects estimated with two-way models actually reflects differences in the composition of either establishments or workers between locations. The pure location effect is about a fifth of what alternative approaches suggest. Second, the role of sorting becomes even more prevalent when we account for the sorting of establishments and workers between locations, and the co-location of productive plants and workers.

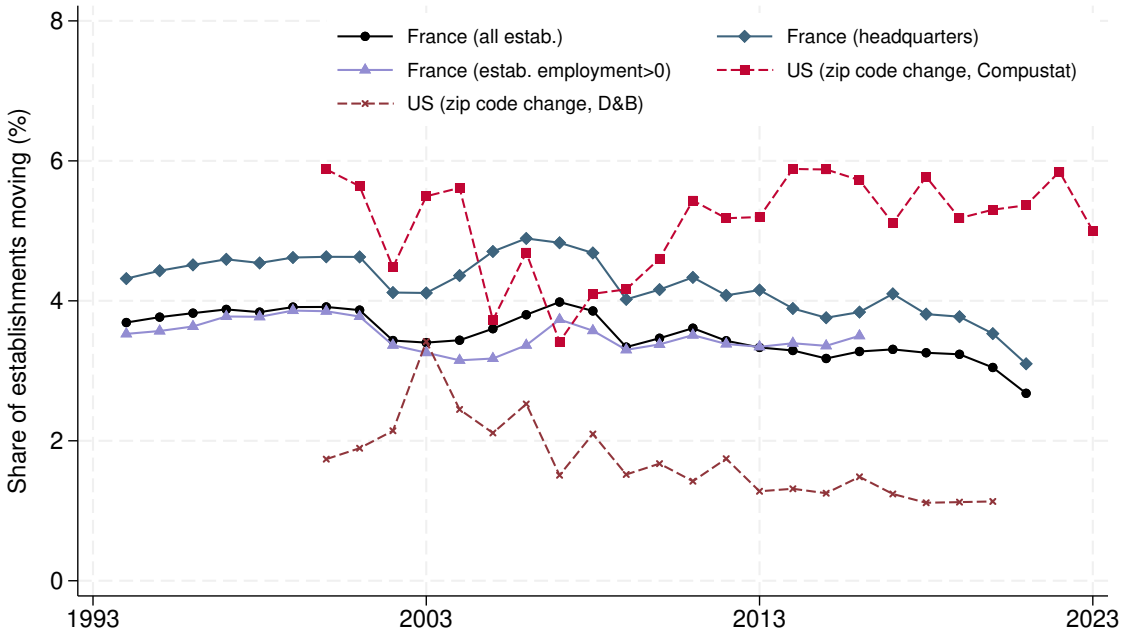
6 Conclusion

This paper makes two main contributions. First, we provide a set of key facts characterizing firm relocation in both France and the US. We show that firm relocation is prevalent, with 4% of operating establishments relocating annually, corresponding to 2.5% of the workforce. Relocations are observed across all industries. Second, relocations are marked by large gross flows and strong gravity patterns, indicating that establishments tend to move nearby and that moves are observed between all locations. Third, relocation increases sorting: larger and higher-paying establishments are more likely to relocate to larger, higher-wage locations. Fourth, establishments retain the same type of activity after relocating, suggesting that moves are not associated with structural changes. Fifth, establishments adjust to the local market, particularly to local wage levels, after relocating. These five facts have two important implications. First, they highlight that the location of a firm plays a significant role in determining the wages it pays. Second, they suggest that there is positive sorting between establishments and locations.

Our second contribution uses a two-sided mover design to separate the contributions of workers, establishments, locations, and sorting in explaining wage disparities across places. By combining data on workers changing firms and locations with establishment relocations, we estimate the relative contributions of these factors to spatial wage differences. We find that location differences explain only a small fraction (2% to 5%) of spatial wage disparities. However, the sorting of establishments and workers between locations amplifies these small differences.

Figures

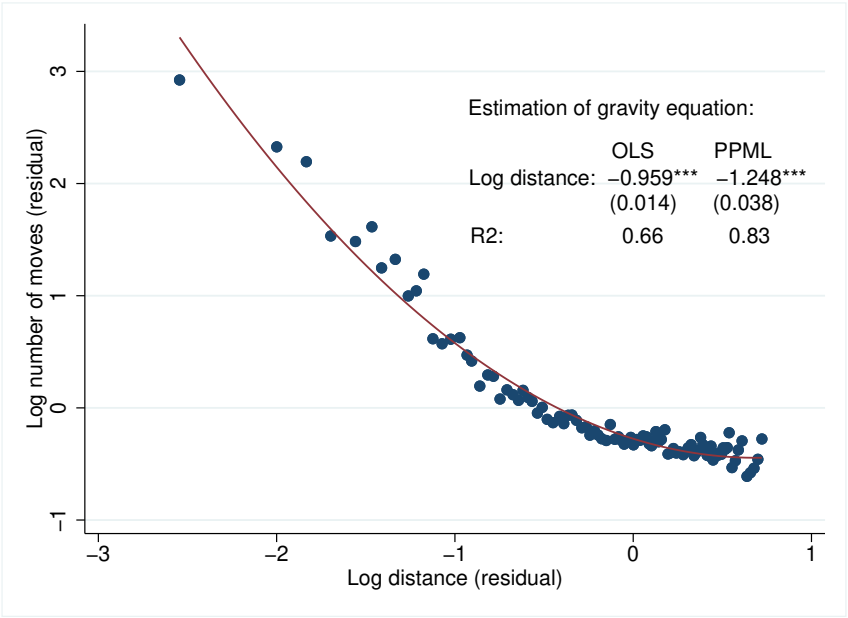
Figure 1: Share of Establishments Relocating in France and in the US



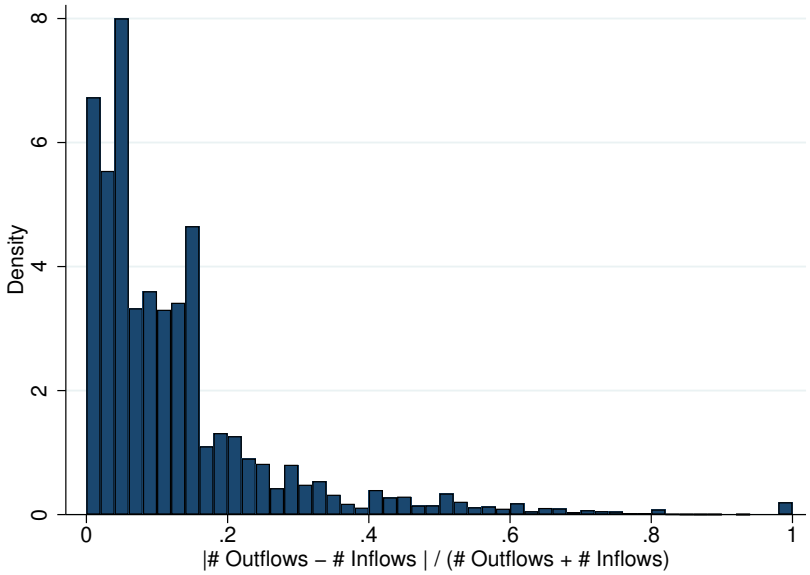
Notes: Figure 1 plots, for each year between 1994 and 2023, the share of establishments relocating as a fraction of the total number of establishments for France (solid lines) and for the United States (dashed lines). The solid dark line with circular markers includes all types of establishments. The solid blue line with diamonds restricts the sample to headquarters. The solid lavender line with triangles considers only establishments with positive employment, as measured in the linked employer-employee data. Turning to the US, the dark-red dashed line with crosses includes all headquarters of firms observed in the Dun and Bradstreet data, while the lighter red dashed line with squares focuses on relocation of headquarters from Compustat firms. Data: Linked employer-employee data, relocation register, register of establishments, Dun and Bradstreet data, Compustat. Go back to main text

Figure 2: Gravity Equation and Bilateral Flows

(a) Gravity



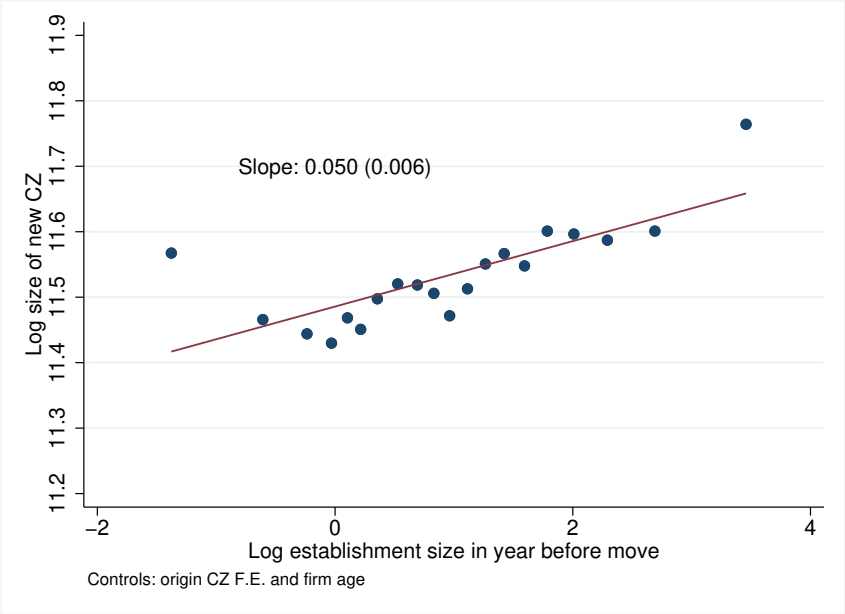
(b) Bilateral Flows



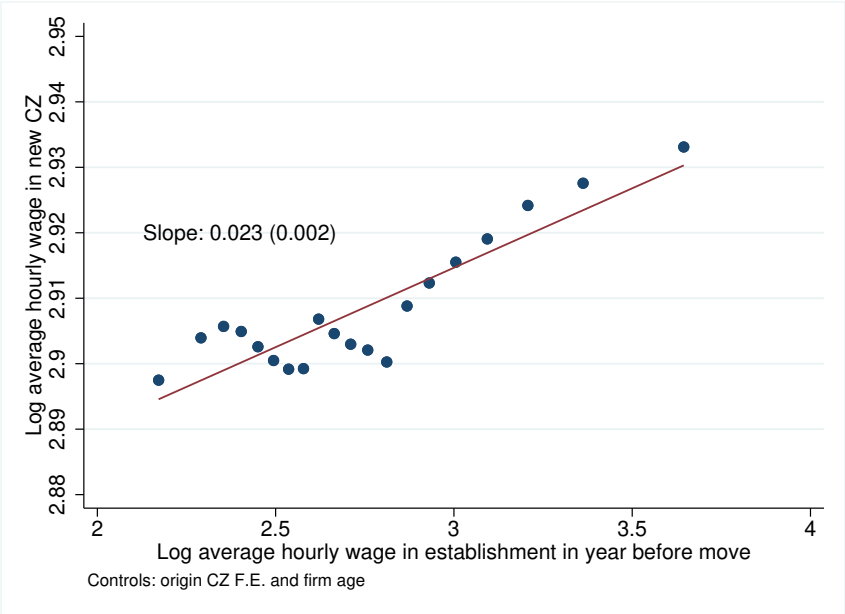
Notes: Figure 2 panel (a) is a binscatter that plots the relationship between the (log) number of establishments relocating between every pairs of Provinces in France over the period 1994-2021 and the (log) distance between these two locations. There are 96 Provinces. Both quantities are first residualized for origin by year and destination by year fixed effects to account for systematic differences in market access. The table reports the coefficients of a log-log regression model (column 1) and a pseudo-poison model (column 2). See equation 1 for more details. Panel (b) plots the distribution of the ratio between net and gross flows, for every pair of Provinces. This index takes values between 0 and 1. A value of 1 implies unidirectional flows: establishments are either going from location A to B, or from location B to A, but not both. A value of 0 means that entries and exits perfectly offset each other. Every pair is weighted by the total number of moves (entry + exits). Data: relocation register. Go back to main text

Figure 3: Correlation Between Establishment Size and Pay and Destination Size and Pay

(a) Establishment Size and Destination Size



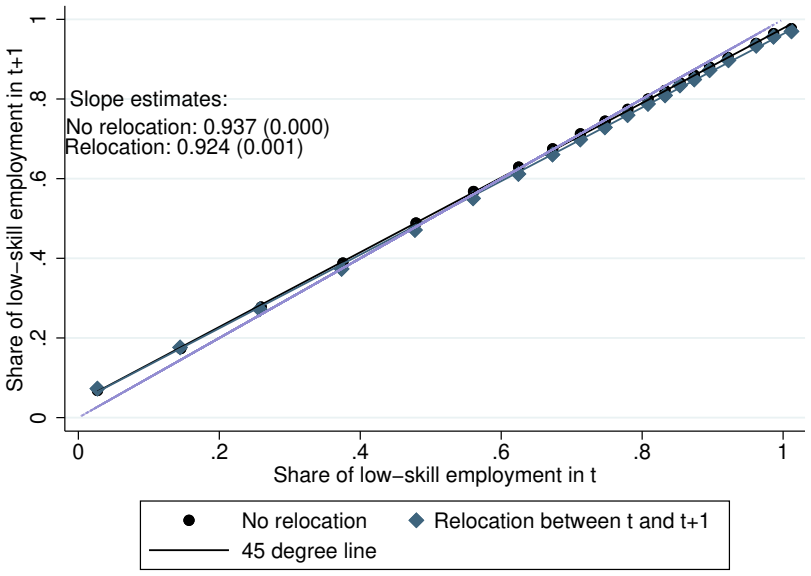
(b) Establishment Wage and Destination Wage



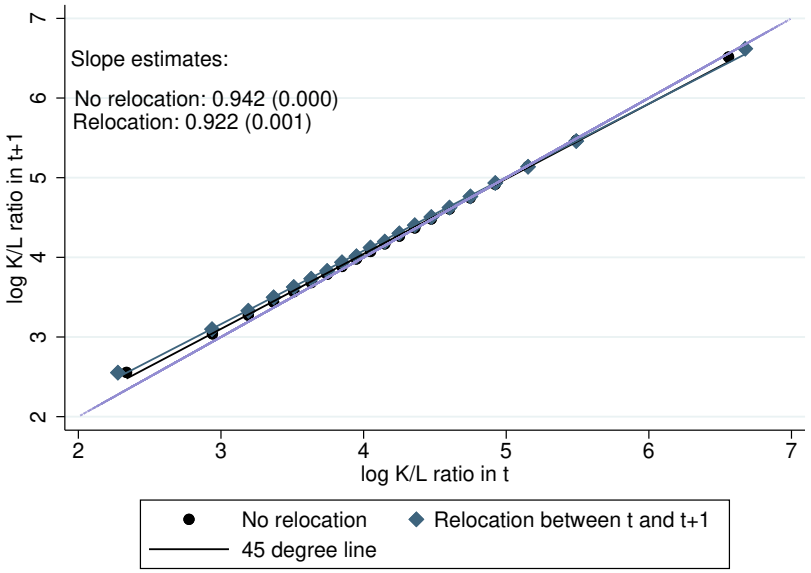
Notes: Figure 3 shows the correlation between characteristics of relocating establishments and characteristics of destinations. The fitted lines and slopes report estimates of γ_1 in Equation (3), for x = log size, log average hourly wage. The regression controls for establishment age at the time of the relocation and commuting zone of origin fixed effects. Robust standard errors are reported in parentheses. Panel (a) focuses on log size, while Panel (b) depicts estimates for the log hourly wage. Data: linked employer-employee data and relocation register. Go back to main text

Figure 4: Evolution of Input Composition for Movers and Non-Movers

(a) Skill Composition

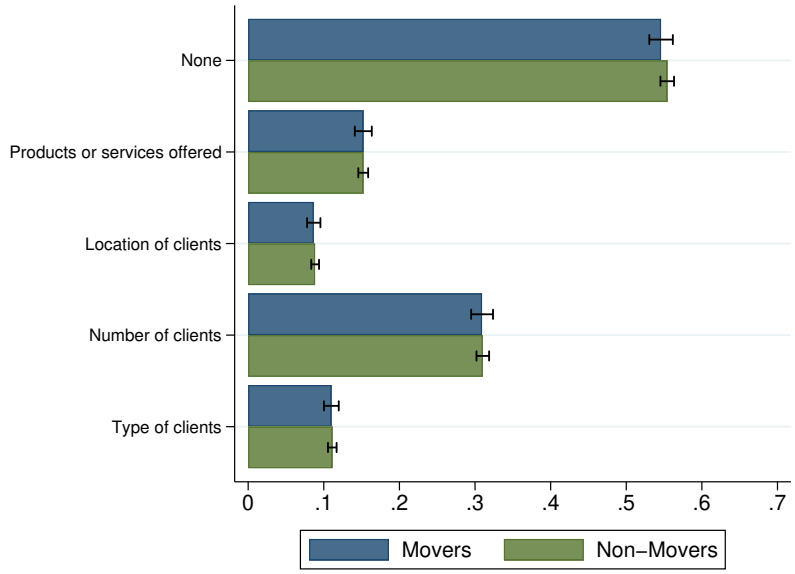


(b) Capital-to-Labor Ratio



Notes: Figure 4 shows the correlation between an establishment characteristic in a given year (x-axis) and the same characteristic the subsequent year (y-axis), for two continuous variable. In panel (a), the variable under consideration is the share of low-skill workers employed in the establishment, defined as blue-collars and low-skill white collars and computed from the DADS. In panel (b), the characteristic is the logarithm of the capital to labor ratio, computed from the FICUS-FARE. The two panels are binscatter graphs, where the circles are for establishments that do not relocate to a different location between year t and year t+1, while the diamonds are for establishments that experience a relocation. The purple line depicts a 45-degree line. Estimates of the slopes are reported, with robust standard errors in parentheses. Go back to main text

Figure 5: Survey of Entrepreneurs: Major Changes Experiences by Movers and Non-Movers



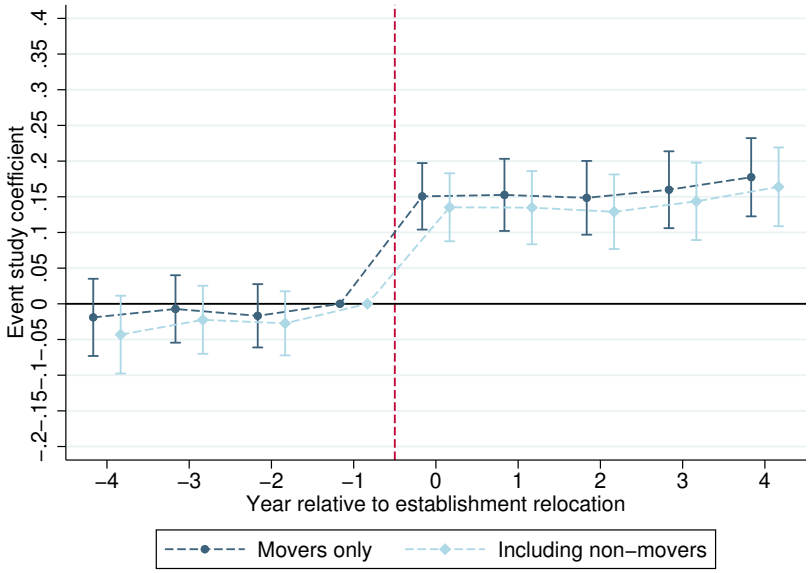
Notes: Figure 5 compares answers from entrepreneurs who relocated at least one establishment during their first five years of economic activity, with answers of entrepreneurs who did not. The question of interest is: "**Did you experience any major change since the creation of the firm?**". Entrepreneurs can report experiencing multiple changes. The dark lines correspond to the 95% confidence interval computed using robust standard errors. Data: SINE survey of entrepreneurs (2014) and relocation register. Go back to main text

Figure 6: Adjustment to Local Labor Market After Relocating

(a) Composition of Workforce in Establishment

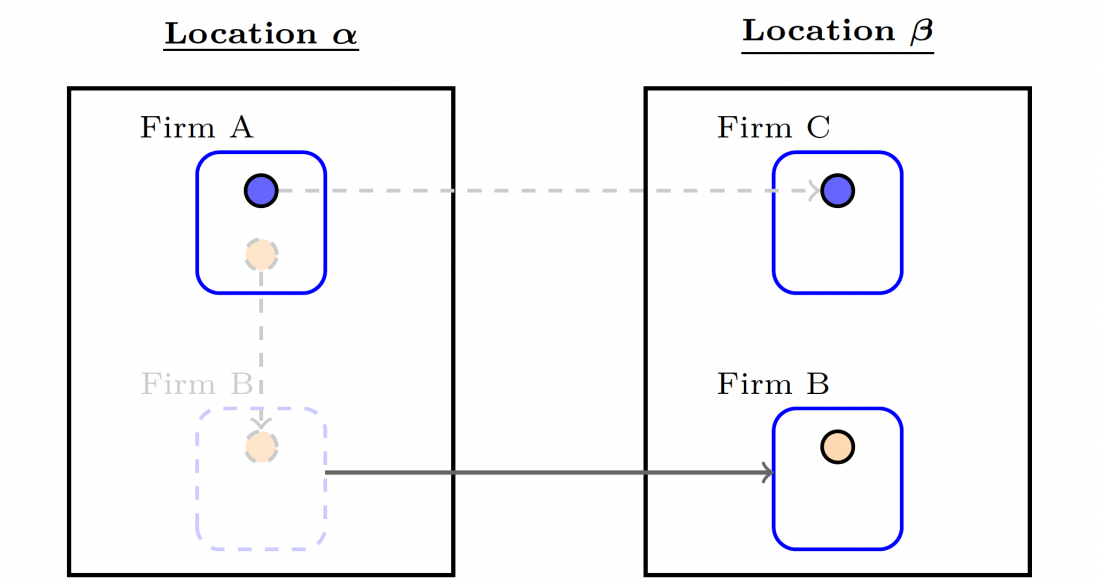


(b) Effect of Destination Wage on Establishment Wage



Notes: Figure 6 shows labor adjustments around firm relocation. Panel (a) depicts the average share of workers residing in the destination commuting zone, the commuting zone of origin, and another commuting zone. Averages are computed for each year before and after relocation. Year 0 corresponds to the year of the move. Panel (b) plots estimates of θ in Equation (4) for two samples. The first sample consists of all establishments relocating. The second one also includes those that do not relocate. Standard errors are clustered at the establishment level. Data: linked employer-employee data and relocation register. Go back to main text

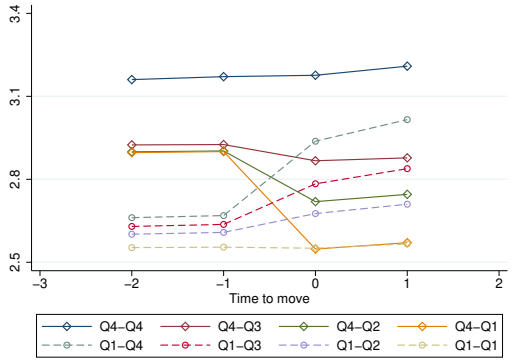
Figure 7: Identification with the Two Sided Movers Design



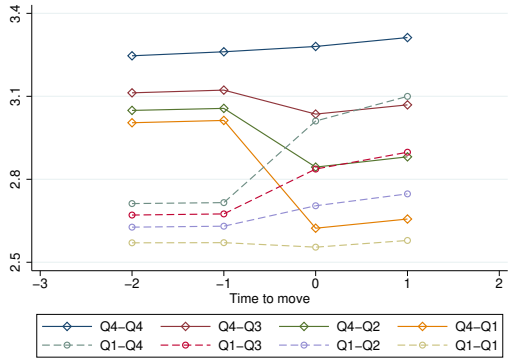
Notes: Figure 7 illustrates the two sided movers design used to estimate equation 5. Rectangles with straight angles represent locations α and β. Rounded rectangles correspond to establishments A, B and C. Finally, the arrows represent the mobility of agents (workers and establishments) between establishments and locations. Go back to main text

Figure 8: Change in Wages by Quartile of Estimated Fixed Effects

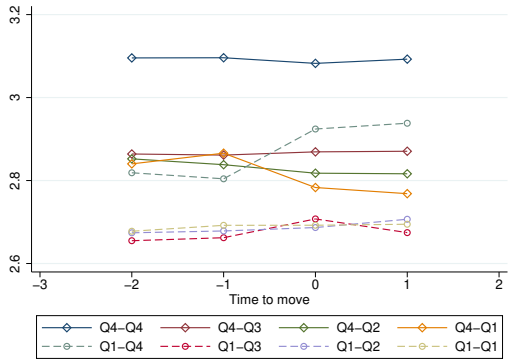
(a) Workers Changing Establishment Within Location



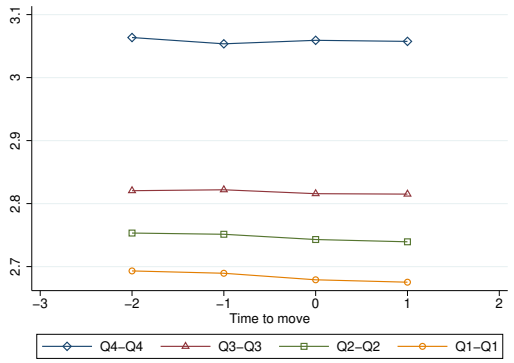
(b) Workers Changing Establishment and Location



(c) Establishments Changing Location



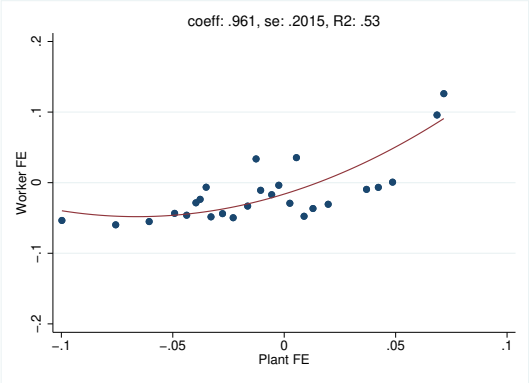
(d) Placebo: Establishments Moving Within Location



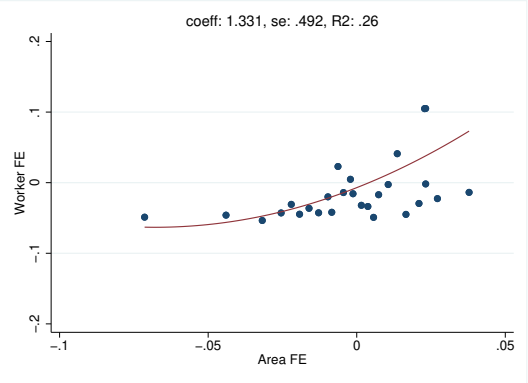
Notes: Figure 8 plots the evolution of the average (log) wages earned by workers and paid by establishments around a relocation, separately for different quartiles of origin and destination fixed effects. Panel (a) focuses on workers moving between high and low paying establishments, within the same commuting zones. Establishments are divided into four quartiles of fixed effects based on estimation of equation 5. Panel (b) reproduces the same figure for workers changing establishment between commuting zones. The quartiles are computed using the sum of establishments and location fixed effects. Panel (c) turns to the average wage paid by establishments following a relocation between commuting zones. The quartiles reflect the sum of area and average worker fixed effects. Panel (d) focuses on establishments relocating within the same commuting zone, hence within the same quartile of fixed effects. Time to move equal to 0 corresponds to the first full year after the move. We focus on a balance sample of workers and establishments observed two years around the move and exclude the transition year. Data: linked employer-employee and relocation register (2002-2019). Go back to main text

Figure 9: Correlation Between Estimated Fixed Effects

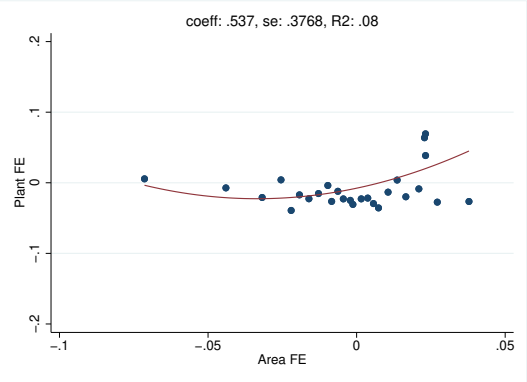
(a) Worker and Establishment



(b) Worker and Location



(c) Establishment and Location



Notes: Figure 9 shows the result of a binscatter that displays the correlation between average worker, establishment and area fixed effects, between commuting zones. The fixed effects result from the estimation of equation 5. The coefficients, standard errors and R^2 are derived from a linear regression using the underlying micro data at the commuting zone level.Data: linked employer-employee and relocation register (2002-2019). Go back to main text

Tables

Table 1: Establishments Preserving their Organization

	Same Industry	Preserve HQ Status	Same Legal Category	Same Top Manager
Relocation	0.944	0.989	0.957	0.670
No Relocation	0.990	0.998	0.977	0.766

Notes: Table 1 shows the share of establishment keeping identical the characteristic indicated in the first row, between year t and year t+1. Those shares are presented separately for establishments experiencing a relocation between two consecutive years, and for those that do not. For instance, 94.4% of establishment relocating keep the same industry code the year after their relocation, and 99.0% of establishment that do not relocate keep the same code between two consecutive years. Go back to main text

Table 2: Decomposition of Wage Disparities into Worker, Establishment, Location Effects and Sorting

	(1)	(2)
	Baseline	Clustered
Standard deviation of log wages	0.113	0.113
Number of worker-year observations	161,262,266	161,383,668
Number of workers	22,664,335	22,684,178
Number of plants	1,765,559	1,867,831
Number of locations	304	304
Std. dev. of worker effect	0.062	0.063
Std. dev. of plant effects	0.047	0.041
Std. dev. of location effects	0.024	0.018
Std. dev. of Xb	0.003	0.002
Correlation of worker/plant effects	0.725	0.971
Correlation of plant/location effects	0.275	0.637
Correlation of worker/location effects	0.514	0.452
Share of variance of log wages due to:		
Person effects	0.302	0.311
Plant effects	0.172	0.134
Location effects	0.045	0.024
Covariance of worker and plant effects	0.330	0.397
Covariance of plant and location effects	0.048	0.073
Covariance of worker and location effects	0.120	0.078
Xb and other covariances	-0.017	-0.017
Residual	0.000	0.000
RMSE of model	0.16	0.16
Adjusted R2	0.88	0.88

Notes: Table 2 provides the results of the variance decomposition of the average log gross hourly wage between commuting zones. The formula is detailed in equation 6. Column (1) reports the results of the plug-in estimator (see equation 5), while column (2) provides results of the model with clustered establishment fixed effects. Following Bonhomme et al. (2019) we use a K-means algorithm to cluster establishments into ten groups based on percentiles of their distribution of gross hourly wage. We then estimate one fixed effect per group of establishments. Go back to main text

Table 3: Robustness: Alternative Samples and Specifications for the Decomposition

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Baseline	Clustered	Controlling for Plant Age	Controlling for Plant Age (Clustered)	Without Stayers	Without Stayers (Clustered)	Alternative Clustering	Clustered (100)	Alternative Clustering (100)	Two Steps Estimation
Standard deviation of log wages	0.113	0.113	0.116	0.116	0.105	0.105	0.113	0.113	0.113	0.113
Number of worker-year observations	161,262,266	161,383,668	152,774,762	152,581,685	146,022,117	146,154,670	161,342,616	161,383,668	161,342,616	161,238,989
Number of workers	22,664,335	22,684,178	22,090,472	21,856,018	21,539,489	21,562,547	22,678,788	22,684,178	22,678,788	22,661,243
Number of plants	1,765,559	1,867,831	1,846,417	1,848,224	1,741,129	1,851,464	1,831,817	1,867,831	1,831,817	1,763,518
Number of locations	304	304	304	304	304	304	304	304	304	304
Std. dev. of worker effect	0.062	0.063	0.063	0.065	0.057	0.058	0.063	0.062	0.062	0.062
Std. dev. of plant effects	0.047	0.041	0.047	0.043	0.049	0.039	0.042	0.044	0.045	0.046
Std. dev. of location effects	0.024	0.018	0.023	0.018	0.029	0.017	0.017	0.016	0.016	0.025
Std. dev. of Xb	0.003	0.002	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.003
Correlation of worker/plant effects	0.725	0.971	0.7435	0.975	0.422	0.967	0.972	0.968	0.969	0.709
Correlation of plant/location effects	0.275	0.637	0.336	0.656	-0.0341	0.63	0.623	0.567	0.544	0.305
Correlation of worker/location effects	0.514	0.452	0.529	0.485	0.635	0.428	0.435	0.372	0.345	0.564
Share of variance of log wages due to:										
Person effects	0.302	0.311	0.295	0.310	0.293	0.305	0.313	0.302	0.300	0.301
Plant effects	0.172	0.134	0.164	0.135	0.214	0.138	0.136	0.155	0.160	0.164
Location effects	0.045	0.024	0.039	0.023	0.079	0.028	0.023	0.020	0.019	0.048
Covariance of worker and plant effects	0.330	0.397	0.327	0.399	0.319	0.397	0.401	0.419	0.424	0.315
Covariance of plant and location effects	0.048	0.073	0.054	0.074	-0.009	0.078	0.070	0.063	0.061	0.054
Covariance of worker and location effects	0.120	0.078	0.113	0.083	0.128	0.078	0.074	0.058	0.053	0.135
Xb and other covariances	-0.017	-0.017	0.009	-0.024	-0.024	-0.024	-0.017	-0.017	-0.017	-0.017
Residual	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Number of clusters	.	10	.	10	.	10	10	100	100	.
RMSE of model	0.164	0.164	0.164	0.164	0.164	0.164	0.165	0.164	0.164	.
Adjusted R^2	0.88	0.88	0.88	0.88	0.85	0.85	0.85	0.85	0.85	.

Notes: Table 3 compares the results of our main specifications, displayed in columns (1) and (2), to alternative specifications. Column (3) expands the set of time varying controls in equation 5, and includes a polynomial of order three of the age of the establishment. Column (4) is the clustered version of this specification (10 clusters of establishments). Columns (5) and (6) re-estimate the main model, respectively the clustered model, by excluding workers who continue to work in the same establishment after its relocation. The model is estimated only through establishment relocation and workers mobility between establishments, not within the same establishment moving between locations. Columns (7), (8) and (9) investigate alternative clustering approaches. First, column (7) uses mean and standard deviation of wages as clustering variables, instead of percentiles of the wage distribution. Second, column (8), replicates the standard clustering approach with 100 clusters instead of 10. Column (9) combines approaches (7) and (8) with 100 clusters based on mean and standard deviation of wages within establishments. Finally, column (10) provides a decomposition of between CZ variance of wages using a two steps estimation approach based on equation 5 .2.2. Data: linked employer-employee data and register of firm relocation (2002-2019). Go back to main text

Table 4: Comparison with Alternative Approaches

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline	Clustered	TWFE Plant Mobility	a la CRY (2024)	CRY (2024)	TWFE Worker Mobility
	FRA	FRA	FRA	FRA	USA	FRA
Standard deviation of log wages	0.113	0.113	0.091	0.113	0.147	0.113
Number of observations	161,262,266	161,383,668	20,613,261	198,295,046	2,523M quarters	198,446,232
Number of workers	22,664,335	22,684,178	.	2,329,531	112M	27,465,944
Number of plants	1,765,559	1,867,831	2,665,472	27,439,613		.
Number of locations	304	304	304	304	741	304
Std. dev. of worker effect	0.062	0.063	.	0.0615	0.081	0.0782
Std. dev. of plant effects	0.047	0.041	0.0562	.	.	.
Std. dev. of location effects	0.024	0.018	0.0465	0.0576	0.079	0.0422
Std. dev. of Xb	0.003	0.002	0.0038	0.0032	0.006	0.0031
Correlation of worker/plant effects	0.725	0.971	.	.	.	.
Correlation of plant/location effects	0.275	0.637	0.63	.	.	.
Correlation of worker/location effects	0.514	0.452	.	0.81	0.64	0.75
Share of variance of log wages due to:						
Person effects	0.302	0.311	.	0.298	0.303	0.481
Plant effects	0.172	0.134	0.382	.	.	.
Location effects	0.045	0.024	0.261	0.261	0.293	0.14
Covariance of worker and plant effects	0.330	0.397	.	.	.	.
Covariance of plant and location effects	0.048	0.073	0.401	.	.	.
Covariance of worker and location effects	0.120	0.078	.	0.451	0.382	0.391
Xb and other covariances	-0.017	-0.017	-0.043	-0.01	0.022	-0.011
Residual	0.000	0.000	0	0	0	0
RMSE of model	0.16	0.16	0.18	0.16	.	0.17
Adjusted R2	0.88	0.88	0.75	0.86	.	0.84

Notes: Table 4 provides a comparison of our main estimates based on equation 5 (columns (1) and (2)) and alternative approaches. Column (3) displays the results of a two-way fixed effect model with establishment and location effects (see model 10). The outcome of interest is the (log) average gross wage paid by establishments. It is identified through the relocation of establishments between commuting zones. Column (4) replicates the approach from Card et al. (2025) on our French data. We estimate a standard AKM (1999) model using worker mobility between establishments. We then aggregate the establishments fixed effects at the commuting zone level, that we interpret as a location fixed effect (see equation 9). Column (5) reproduces the results from the original paper based on LEHD data. Finally, Column (6) displays the results of a two-way fixed effect model with workers and locations. The model is estimated using worker mobility between commuting zones. Data: linked employer-employee data and register of firm relocation (2002-2019). Go back to main text

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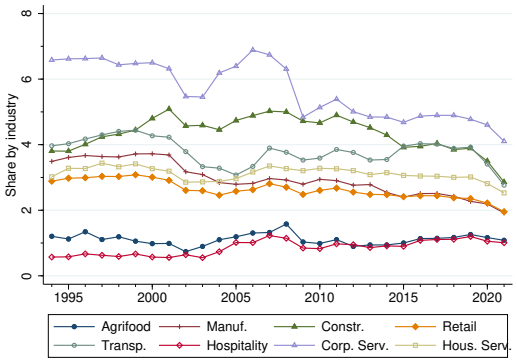
Appendix

A Additional Details on Firm Relocation

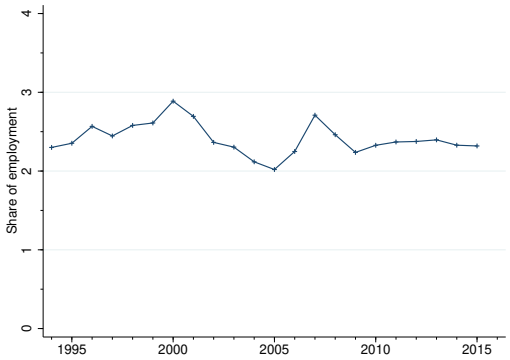
A.1 France

Figure A.1: Times Series - Establishment Relocation

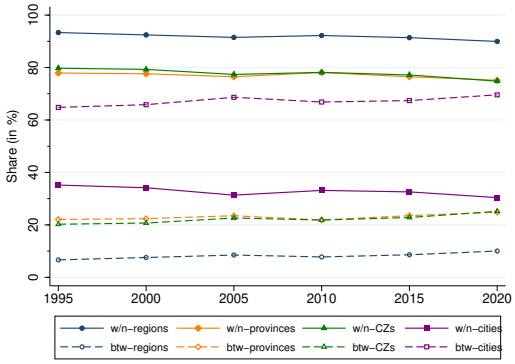
(a) By Industry



(b) Employment Share



(c) By Distance



Notes: Figure A.1 provides additional evidence on the mobility of establishments. Panel (a) plots the share of establishments moving every year by major industry: agrifood, manufacturing, construction, retail, transportation, hospitality, services to firms and real estate, services to households. Panel (b) reports the share of establishments moving weighted by their initial size, measured in the linked employer-employee data. Finally, panel (c) reports the share of moves that took place within vs. between locations, for four types of administrative boundaries. There are 22 regions in France, 96 provinces, 304 commuting zones and about 35,000 municipalities. Go back to main text

Table A.1: Distribution of the Number of Moves Between CZs

	Mean	P10	P25	P50	P75	P90
Establishments	287	29	49	94	202	418
Workers	28,750	3,903	6,008	10,826	24,517	52,628

Notes: Table A.1 reports the distribution of the number of workers and establishments changing commuting zones over the period 2002-2019. On average, a commuting zone experiences 287 establishment relocation and 28,750 worker moves (respectively 94 and 10,826 for the median commuting zone). Go back to main text

Table A.2: Distribution of Distance: All Establishment Moves

Distance	Same city	< 5 km	6-10 km	11-25 km	26-50 km	51-100 km	101-250 km	> 250 km
Share	32.67	19.33	18.00	12.51	5.10	2.49	2.77	5.15

Notes: Table A.2 reports the distance traveled by establishments, by bins, for all type of moves, including moves within the same municipality. The distance is measured in kilometers as the shortest path between the centroids of the two locations along the surface of a mathematical model of the earth. Go back to main text

Table A.3: Distribution of Distance: Between CZ Establishment Moves

	P5	P10	P25	P50	Mean	P75	P90	P95
Establishment relocation (in km)	6	9	17	42	151	210	500	639
Worker relocation (in km)	20	21	30	69	178	277	517	636
Minimal distance between CZs (km)	18	21	26	31	32	39	45	49

Notes: Table A.3 reports the distribution of the distance traveled by establishments and workers moving between commuting zones. The third line corresponds to the distribution of the shortest distance that needs to be traveled to change commuting zone in France, for each CZ. The distance is measured in kilometers as the shortest path between the centroids of the two locations along the surface of a mathematical model of the earth. Go back to main text

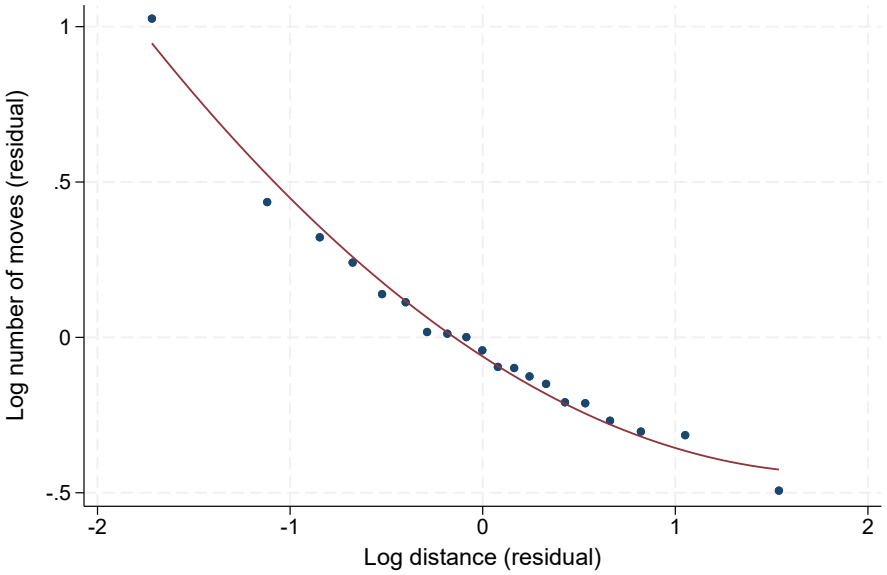
Table A.4: Difference-in-Differences: Establishments Preserving their Organization

	Same Industry	Preserve HQ Status	Same Legal Category	Same Top Manager
Mover x Year Post Move	-0.044	-0.007	-0.020	-0.098
	(0.000)	(0.000)	(0.000)	(0.001)
Mover	-0.002	-0.003	0.025	0.003
	(0.000)	(0.000)	(0.000)	(0.001)
Year Post Move	-0.003	0.000	-0.005	-0.027
	(0.000)	(0.000)	(0.000)	(0.001)
Year F.E.	Yes	Yes	Yes	Yes

Notes: Table A.4 reports the estimates of a difference-in-difference specification in which the outcome listed in the first row if the outcome variable. Each outcome is a dummy variable equal to one if the establishment keeps a given characteristic identical from one year to the other. The specification is the following: $y_{it} = \delta_t + \beta_1 \text{Mover'i x Year Post Move}_t + \beta_2 \text{Mover}_i + u_{it}$. For an establishment relocating, the variable Year Post Move$_t$ equals one only the first year post-relocation. The standard errors are clustered at the establishment level and are reported in parentheses. For example, an establishment relocating is 4.4 percentage points less likely to keep an identical industry code in the year following the relocation. Go back to main text

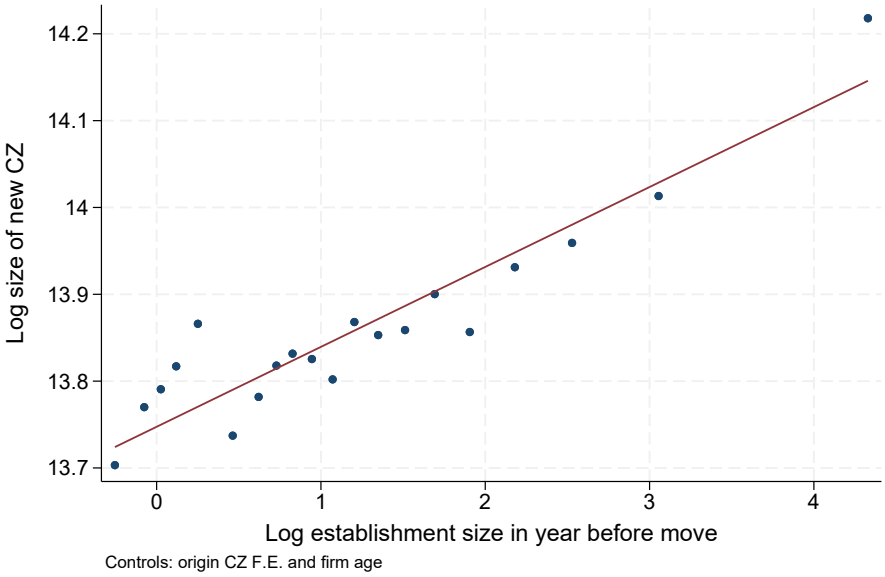
A.2 United States

Figure A.2: Gravity Equation



Notes: Figure A.2 is a binscatter that plots the relationship between the (log) number of establishments relocating between every pairs of Labor Market Areas (LMAs) in the United States over the period 2000-2010 and the (log) distance between these two locations. Both quantities are first residualized for origin by year and destination by year fixed effects to account for systematic differences in market access.

Figure A.3: Correlation Between Establishment Size and Destination Size



Notes: Figure A.3 shows the correlation between the size of relocating establishments and the size of destination commuting zones in the United States. The regression controls for establishment age at the time of the relocation and commuting zone of origin fixed effects. Data: Dun & Bradstreet.

B Worker-Level Event Studies

Figure B.1: Workers Changing Firm or Location

(a) Change in Firm



(b) Change in Location

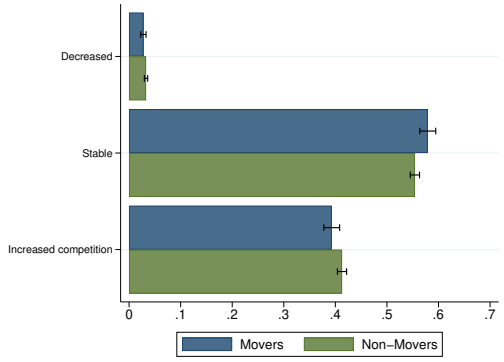


Notes: Figure B.1 depicts estimates of parameter θ^W in the following regression: $log(wage_{it}) = \phi_i + \delta_t + \theta^W_{r(i,t)}\Delta^z_i + \beta x_{it} + \nu_{it}$, with z = firm, location. ϕ_i and δ_t are worker and year fixed effects. $r(i,t)$ is the relative year of the change. We consider two versions of that equation, corresponding to two types of events. First, Panel (a) considers a worker switching firm as an event, and Δ^{firm}_i is the gap in average wage between the new firm and the former firm. Panel (b) considers a worker changing commuting zone, and $\Delta^{location}_i$ is the gap in average wages between destination and origin. Both panels present estimates on two sample. The first sample considers workers than change (firm or location), while the second panel include non-movers. In the second case, Δ_i is normalized to zero, the relative year of the move is also 0, and we include fixed effects for the relative year of the move, x_{it}. Go back to main text

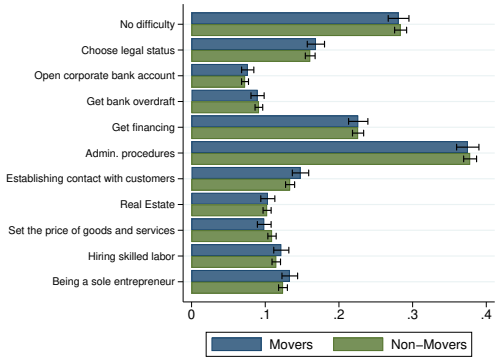
C Establishment Relocation and Potential Shocks

Figure C.1: Changes Faced by Entrepreneurs Relocating their Establishment

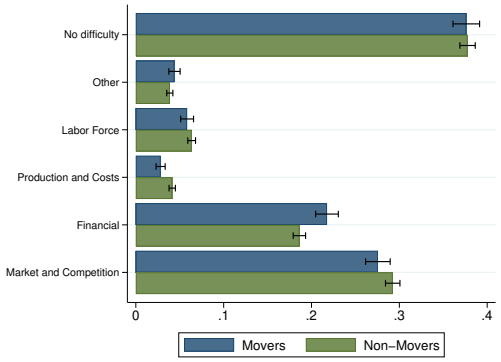
(a) Changes in Local Competition



(b) Problems During Creation



(c) Challenges During the First Two Years

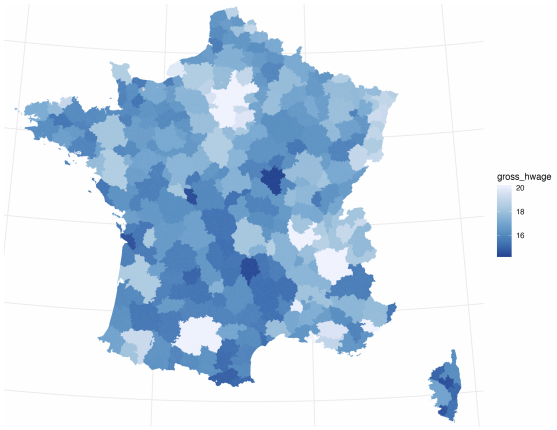


Notes: Figure C.1 compares answers from entrepreneurs who relocated at least one establishment during their first five years of economic activity, with answers of entrepreneurs who did not. There are three questions of interest. Panel (a): "Since the creation of your firm, would you say that the level of competition: (i) increased, (ii) is stable, (iii) decreased?". Panel (b): "When you set up your company, did you encounter any difficulties?". Panel (c): "Since the creation of your company, what has been THE MAIN OBSTACLE to its development?". Entrepreneurs can choose multiple responses. The solid dark lines correspond to the 95% confidence interval computed using robust standard errors. Data: SINE survey of entrepreneurs (2014) and relocation register. Go back to main text

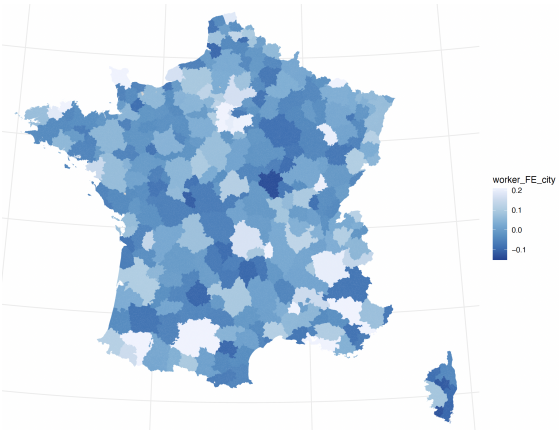
D Wage Heterogeneity across Space

Figure D.1: Spatial Disparities in Wages and Estiamted Fixed Effects

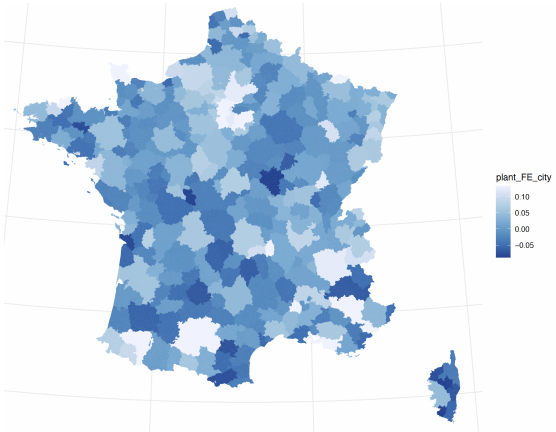
(a) Gross Hourly Wage



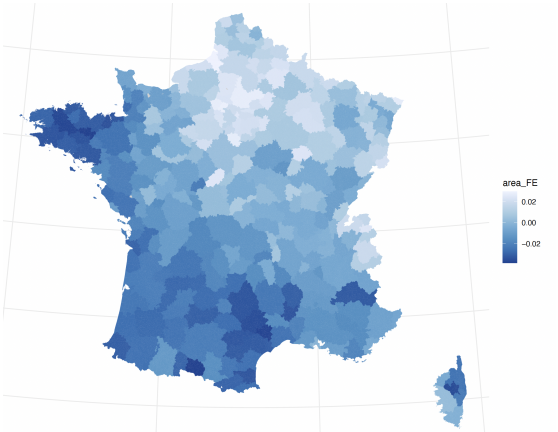
(b) Average Worker Fixed Effects



(c) Average Establishment Fixed Effects



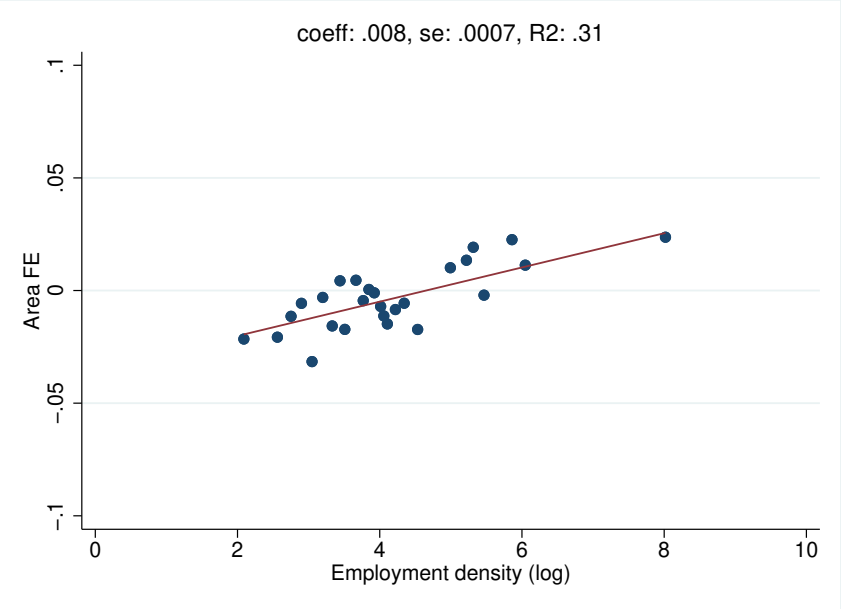
(d) Location Fixed Effects



Notes: Figure D.1 plots the distribution of wages between commuting zones. Panel (a) displays the average gross hourly wage per CZ. Panel (b), (c), (d), plots respectively the average worker, establishment and location fixed effects per CZ. The fixed effects are estimated based on equation 5. Go back to main text

E Location Effects

Figure E.1: Commuting Zone Fixed Effects and Size



Notes: Figure E.1 plots the correlation between the location fixed effects estimated from equation 5 and the log of employment per square meter of the commuting zone, observed in the 2015 census. The coefficient, standard error and R^2 come from the estimation of the corresponding linear regression with robust standard error. Go back to main text

Table E.1: Elasticity of Location Effects With Respect to Density

	(1) Population (log)	(2) Employment (log)	(3) Population density (log)	(4) Employment density (log)	(5) College share	(6) College density (log)
Panel A: main specification						
Area fixed effect	0.0081***	0.0080***	0.0077***	0.0076***	0.0011***	0.0067***
	(0.00097)	(0.00084)	(0.00066)	(0.00069)	(0.00013)	(0.00056)
Observations	304	304	304	304	304	304
Adj R^2	0.21	0.23	0.30	0.31	0.22	0.29
Panel B: estimates *a la* Card, Rothstein and Yi (2025)						
Area fixed effect	0.0143***	0.0157***	0.0250***	0.0256***	0.0021***	0.0208***
	(0.00251)	(0.00236)	(0.00229)	(0.00210)	(0.00046)	(0.00207)
Observations	304	304	304	304	304	304
Adj R^2	0.10	0.13	0.30	0.33	0.08	0.26
Panel C: two way fixed effect model with workers and locations						
Area fixed effect	0.0205***	0.0201***	0.0207***	0.0202***	0.0028***	0.0178***
	(0.00395)	(0.00355)	(0.00068)	(0.00066)	(0.00051)	(0.00057)
Observations	304	304	304	304	304	304
Adj R^2	0.44	0.46	0.69	0.71	0.45	0.67

Notes: Table E.1 reports the results of a linear regression of the location fixed effects on different measures of density: (1) log of population, (2) log of employment, (3) log of population per meter square, (4) log of employment per square kilometer, (5) share of college graduates, (6) log of college graduates per square kilometer, observed in the 2015 census. Panel A uses location fixed effect estimated from equation 5, controlling for worker and plant fixed effects. Panel B and C reproduces the results using instead the location effects estimated as in Card et al. (2025) and in a two way fixed effect model with workers and locations, respectively (see Section 5 .3). The standard errors are robust to heteroskedasticity. Go back to main text

Table E.2: Estimates of Density Premium from the Literature

	Country	Pooled estimator	Fixed effect model	Dynamic model	
				Initial premium	Medium-term premium
Mion and Naticchioni (2009)	Italy	0.022*** (0.0005)	0.0074*** (0.001)	.	.
Combes et al. (2010)	France	0.051*** (0.002)	0.033*** (0.001)	.	.
Glaeser and Resseger (2010)	USA	0.041*** (0.011)	.	.	.
De la Roca and Puga (2016)	Spain	0.046*** (0.008)	0.0241*** (0.0058)	0.0223*** (0.0058)	0.051*** (0.0109)
Duranton and Puga (2023)	USA	.	.	0.0451*** (0.0045)	0.0759*** (0.0064)
Individual controls		Yes	Yes	Yes	
Location effect		Yes	Yes	Yes	
Worker effect		No	Yes	Yes	

Note: Table E.2 compares estimates of the elasticity of location effects with respect to density from the literature. The initial premium in De la Roca and Puga (2016) and Duranton and Puga (2023) corresponds to the elasticity of the instantaneous gains (i.e. measured just after a move) with respect to density. The medium-run premium includes the initial premium and the gains from the experience acquired in the city. It is computed using the average experience workers accumulate in the city, which is 7.7 years in De la Roca and Puga (2016) and 8.4 years in Duranton and Puga (2023). Go back to main text

F Decomposition by Industry

Table F.1: Three-Way Decomposition by Industry

	(1)	(2)	(3)	(4)
	All	Manufacturing	Lower-Skill Services	Higher-Skill Services
Standard deviation of log wages	0.113	0.145	0.099	0.158
Number of worker-year observations	161,383,668	44,576,542	67,237,473	30,615,442
Number of workers	22,699,490	6,140,108	10,806,411	5,479,442
Number of plants	1,867,831	226,763	1,030,656	364,242
Number of locations	304	304	304	304
Std. dev. of worker effect	0.063	0.099	0.046	0.098
Std. dev. of plant effects	0.041	0.049	0.038	0.05
Std. dev. of location effects	0.018	0.019	0.02	0.022
Std. dev. of Xb	0.002	0.003	0.002	0.006
Correlation of worker/plant effects	0.971	0.971	0.965	0.99
Correlation of plant/location effects	0.637	-0.024	0.818	0.684
Correlation of worker/location effects	0.452	-0.233	0.657	0.588
Share of variance of log wages due to:				
Person effects	0.311	0.467	0.216	0.391
Plant effects	0.134	0.112	0.149	0.101
Location effects	0.024	0.017	0.042	0.019
Covariance of worker and plant effects	0.397	0.445	0.347	0.391
Covariance of plant and Location effects	0.073	-0.002	0.129	0.06
Covariance of worker and Location effects	0.078	-0.042	0.125	0.101
Xb and other covariances	-0.017	0.001	-0.008	-0.056
Residual	0	0	0	0
Number of clusters	10	10	10	10
RMSE of model	0.164	0.157	0.156	0.166
Adjusted R^2	0.88	0.86	0.84	0.88

Notes: Table F.1 reproduces the variance decomposition exercise from equation 6, separately by major industry. Lower-skill services include retail, accommodation, food services and other services to households. Higher skill services include services to firms and real estate services. Go back to main text