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L'infrastructure TGV est-elle un facteur de compétitivité pour les entreprises françaises ?

Résumé

Dans ce document, nous documentons la pertinence empirique de différentes modélisations de la gestion des groupes à implantations multiples proposées dans la littérature. Elles suggèrent que des réductions de temps de transport facilitant le déplacement des managers entre quartiers généraux et filiales facilitent la transmission d'information entre ces unités, avec un impact associé positif sur la taille des filiales et leur degré de spécialisation fonctionnelle sur leurs activités de production, ainsi que sur la marge opérationnelle du groupe dans son ensemble. Ces prédictions sont testées sur la population des groupes français à implantations multiples, en tirant profit des réductions de temps de transport induites par l'extension du réseau TGV jusqu'en 2011. Les résultats obtenus sont particulièrement élevés dans les secteurs des services, pour lesquels les mécanismes de transmission d'information sont réputés cruciaux (Petersen et Rajan, 2002) : le réseau TGV y est associé à une augmentation moyenne d'un poste de production par filiale bénéficiaire (contre 0,2 poste dans les secteurs du commerce et de l'industrie), et au transfert d'environ un poste de manager de la filiale vers son quartier général. Ces résultats sont robustes à l'utilisation de différentes stratégies d'identification permettant de traiter le problème de l'endogénéité de la localisation de l'infrastructure TGV (inclusion de plusieurs ensembles d'effets fixes de grande dimension contrôlant finement des chocs locaux comme dans Giroud, 2013, ou utilisation placebo des lignes non réalisées du plan gouvernemental de 1991, selon la méthodologie de Donaldson, 2014). Au niveau groupe, des régressions descriptives suggèrent que l'impact sur la marge opérationnelle serait de l'ordre de 0,5 point de pourcentage en moyenne.

Mots-clés : Coûts de communication, quartiers généraux d'entreprises, organisation des entreprises, infrastructure, TGV

Communication Costs and the Internal Organization of Multi-Plant Businesses: Evidence from the Impact of the French High-Speed Rail

Abstract

We document the impact of travel time between affiliates and headquarters of geographically dispersed corporate groups on the management of such business organizations. Theory suggests that the easier circulation of managers might facilitate the transmission of information between production plants and headquarters, thus fostering growth and functional specialization (on production activities) at remote affiliates and decreasing operational costs at the group level. We test these predictions on the population of French corporate groups, using the expansion of the High Speed Rail network as an arguably exogenous shock on internal travel times. Results are most pronounced in the service industries, where information to be transmitted is arguably softer (Petersen and Rajan, 2002): we estimate that HSR induced the creation of one production job for the average affiliate in these industries (against 0.2 job in retail, trade or manufacturing industries), and the shift of around one managerial job from affiliate to HQ. These results are robust to alternative identification strategies addressing the problem of the endogenous placement of the HSR infrastructure (use of high-dimensional fixed effects controlling for local and affiliate-level shocks as in Giroud, 2013 and evidence from un-realized lines as in Donaldson, 2014). At the group level, descriptive regressions suggest that the impact on the operational profit margin is around 0.5 percentage points in most industries.

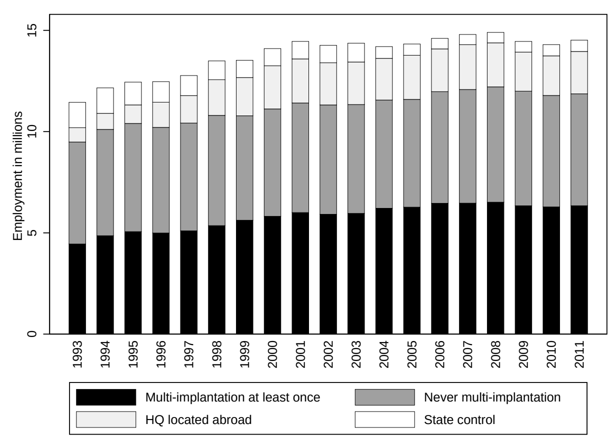
Keywords: Communication costs, headquarters, firm organization, public infrastructure, high-speed rail

Classification JEL : R30, L22, R40

1 Introduction

Large corporations operating multiple affiliates located in different locations are prevalent and account for a disproportionate fraction of output and employment. Figure 1 shows that in France, geographically dispersed corporate groups account for around 40% (6 million workers in 2011) of total employment in the for-profit sector,[1] and even more when taking account of groups headquartered from abroad. The splitting and implantation decisions of such corporations involves a trade-off between the gains to access remote markets and the managerial costs to operate distant affiliates that has been the object of study of a large literature in economic geography (e.g. Aarland et al., 2007; Davis and Henderson, 2008; Henderson and Ono, 2008; Strauss-Kahn and Vives, 2009) and in trade (see the recent survey about the prominent role of multinationals in Antràs and Yeaple, 2014). Yet, empirical contributions often propose analyzes that are reduced form in nature, such that in practice, very little is known about the way these business organizations are managed. In this paper, we contribute to fill this gap and provide detailed evidence about the nature of the higher managerial costs implied by geographic dispersion.

Figure 1: The Prevalence of Geographically Dispersed Corporate Groups
Break-down of total employment in the for-profit sector, by type of business organization



Sources: Matched DADS files and LIFI survey, covering the for-profit sector (except agricultural activities and workers of the personnel service industries directly employed by households). See section 3 for further details.
Note: Employment is measured in terms of days of work, normalized by 360 (to be comparable with headcounts).

To that end, we take advantage of large scale administrative and survey data allowing us to describe the structure of the workforce of all French corporate groups, over almost 20 years (from 1993 to 2011). We furthermore use the expansion of the French high-speed rail (HSR) network over that period as a shock on communication costs between the headquarters and affiliates of groups which benefited from this new infrastructure.

Our empirical investigation is guided by theoretical predictions. The literature in corporate finance (Giroud, 2013; Giroud and Mueller, 2015) suggests that the geographical dispersion of affiliates might hamper

[1]Excluding workers directly hired by households.

information gathering and monitoring by the managers of the group's headquarters, thus amplifying the moral hazard problems that characterize the management of remote affiliates. This literature predicts in particular that lower geographical dispersion, associated with lower travel times, could affect affiliate size positively. The literature in economic geography (Duranton and Puga, 2005) further suggests that the geographical dispersion of affiliates in a corporate group is related to the optimal mix of "functions" present in each implantation. A prediction of this strand of literature is that a reduction in communication costs between headquarters and affiliates lowers the cost of transferring headquarters services to remote affiliates and therefore decreases the need to locate the corresponding support activities at affiliates. This in turn increases the incentives to rationalize the mix of functions at affiliates and make them more focused on their production activities. Last, the literature in organizational economics (Garicano, 2000; Garicano and Rossi-Hansberg, 2006, 2012; Antràs et al., 2006, 2008) predicts that workers within the corporate groups are differentially impacted by decreases in internal communication costs, depending on their skills. A robust prediction of this set of papers is that the need for skills decreases at affiliates, such that wages of the less skilled workers (and the associated labor costs) decrease.[2]

We test these predictions in the French data and implement different identification strategies that have been proposed in the literature to address the problem of the endogenous placement of the HSR infrastructure (use of high-dimensional fixed effects controlling for local and affiliate-level shocks as in Giroud, 2013 and evidence from un-realized lines as in Donaldson, 2014). Our regressions show that the impact of reduced travel times on affiliate size and functional specialization is highest in the service industries, where information to be transmitted is arguably softer (Petersen and Rajan, 2002). Results are also significant in the trade and manufacturing industries, but point estimates are lower. Our estimates allow to quantify the impact of the expansion of the HSR network on the management of remote affiliates. We obtain that for the average affiliate benefiting from the infrastructure, HSR induced the shift of roughly one job from administrative to production activities in service industries (with the associated decrease in the productive capacity of the considered affiliate), against 20% of a job in other industries (retail, trade or manufacturing). We also obtain that affiliates in the manufacturing and business services industries experienced decreases in production labor costs, of around half the cost of a production job for the average affiliate. At the group level, our regressions suggest that the impact on the operational profit margin ranges from 0.5 to 1.5 percentage points depending on the industry.

Our results can also be used to provide estimates of the overall cost of geographical dispersion: for example, our estimates imply that remote affiliates in the personnel service industries would operate with roughly 1.5 additional production jobs if geographical distance could be fully abolished by a perfect communication technology. The figure would raise to 4 production jobs on average in business services industries, and to 2 production jobs in manufacturing industries. These quantifications can be interpreted as an upper bound for the "productivity" effect that can be expected from internal communication technologies. In this respect, our results also show (by revealed preferences) that face-to-face interactions made easier by the HSR technology remain crucial, in spite of the development of other means of communication (phone, e-mail, visio-conference) over the same period (Storper and Venables, 2004). Our results also show that business travelers (or their employers) are willing to pay a significant premium for reduced travel time, in spite of the arguably high

[2] Refer to Bassanini et al. (2015) and Landier et al. (2007) for an in-depth analysis of labor adjustments on the extensive margin (dismissals) depending on the distance to headquarters.

comfort and "workability" of HSR coaches.

Last, our paper also contributes to the large literature investigating the economic impact of transport infrastructures. However, most papers in this field focus on standard rail or road infrastructure, which essentially generate a reduction in trade barriers which pertains mainly to the circulation of *goods* (Donaldson and Hornbeck, 2015). The impact of such shocks are now well understood (Melitz, 2003): they induce increases in the global volume of trade activities as well as in firm selection, and ultimately aggregate productivity (Michaels, 2008; Datta, 2012; Banerjee et al., 2012; Donaldson, 2014; Faber, 2014; Ghani et al., 2015). In contrast, high-speed rail is a transportation technology that is almost only accessible to people.[3] As previously explained, the mechanisms involved are therefore very different (Bernard et al., 2015; Nunn, 2007; Cristea, 2011).

The remainder of the article is organized as follows. Section 2 proposes a synthesis of theoretical predictions relating communication costs to the managerial organization of corporate groups and their overall performance. In section 3, we describe our data as well as the French HSR network. We also provide a comprehensive picture of the geographical dispersion of French corporate groups. Our empirical strategy is explained in section 4 and the main regressions results at the affiliate level are discussed in section 5. Section 6 provides additional descriptive results at the (entire) group level and section 7 concludes.

2 The Management of Multi-Plant Businesses: A Review of Theoretical Predictions

In this section, we review three different (but non mutually exclusive) strands of the literature analyzing how travel times between headquarters and affiliates of corporate groups are likely to affect their managerial organization and performance. In each case, the testable empirical predictions are outlined.

2.1 Geographical Dispersion and Affiliate Size

A recent literature in corporate finance (Giroud, 2013; Giroud and Mueller, 2015) relates travel times to information transmission between headquarters and affiliates in settings where there are information asymmetries and moral hazard problems. It delivers predictions linking travel times and affiliate size, as measured by e.g. employment.

These contributions specifically focus on the dual managerial structure of corporate groups, with both managers at headquarters ("principals"), who are endowed with the ultimate decision rights, and managers at remote affiliates ("agents") who are not, but who have an informational advantage over managers at headquarters about the profitability of local investment projects. The management of such business organizations features a moral hazard problem if the interests of managers at affiliates are not fully aligned with the interests of managers at headquarters. Whether local managers over-invest (over-hire) or under-invest (under-hire)

[3] In the case of the French High Speed Rail program, most of the infrastructure is not even accessible to freight (at the notable exception of mail) because HSR tracks are too steep for the weight of freight trains. Notice that in this paper, we only focus on the "productivity" effect of HSR and do not consider the potential market creation impact of HSR, which could be particularly relevant in industries related to tourism. The analysis of this dimension would require an entirely different identification strategy.

when decision rights are delegated to them depends on whether managers at affiliates have preferences for local "empire building" strategies, or conversely if they prefer an excessively "quiet life". Bertrand and Mullainathan (2003) actually show that the second case is more frequent among US managers, which implies that managers at affiliates are likely to under-invest when investment decisions are delegated to them. In such a setting, lower travel times between headquarters and remote affiliates increase monitoring and are therefore associated with higher investment (Giroud, 2013) and higher complementary employment (Giroud and Mueller, 2015) at affiliates.[4]

To test the relevance of such mechanisms in the French data, we replicate the analyzes in Giroud (2013) and Giroud and Mueller (2015) and investigate the correlations between employment at affiliates and travel time to their headquarters.[5]

2.2 Geographical Dispersion and the Functional Specialization of Affiliates

The literature in economic geography suggests that the geographical dispersion of affiliates in a corporate group is related to the optimal mix of "functions" present in each implantation. In Duranton and Puga (2005), firms are considered as bundles of two broad types of functions: "headquarter services" on one hand, and production activities on the other hand. These two functions can be either pooled in the same location or split into different plants. Splitting is costly, for example because of the agency problems outlined in section 2.1.[6] However, there are gains to split firms when there exist "function specific" agglomeration economies, such as the possibility to outsource certain activities to local suppliers that might be specifically appropriate, the optimization of labor costs across local labor markets (depending on local labor supply), or simply market access for final products.

The distinctive prediction of Duranton and Puga (2005) is that a reduction in travel time lowers the cost of transferring headquarter services to remote affiliates, thus increasing the incentives to specialize affiliates by function.[7] We therefore expect them to be relatively more focused on their production activities and to discard the administrative tasks which are cheaper to complete at headquarters. This prediction can be tested by regressing the share of employment at affiliates that is devoted to production activities (as opposed to managerial activities) against travel time between affiliates and headquarters: we expect the sign of the corresponding coefficient to be negative.

[4]This reasoning assumes that investment decisions for affiliates are delegated to local managers. This needs not be the case (see section 2.2) but the same prediction holds (in expectation) under centralized control at headquarters when HQ managers are risk averse: easier information acquisition about the profitability of investment projects at remote affiliates decreases the "uncertainty premium" required by them and increases average investment.

[5]Unfortunately, our data do not enable us to observe investment at the affiliate level, such that for this variable, we will only be able to estimate regressions aggregated across all affiliates, at the group level (see section 6).

[6]Duranton and Puga (2005) model such mechanisms in a reduced form, as a fraction of managers' time that is lost in travels to visit the remote affiliate. Refer to Acemoglu et al. (2007) for a more detailed description of the trade-offs involved: the optimal organizational choice between delegation of authority to a local manager or centralized decision taking at headquarters trades off the gain to rely the local manager's superior information against the risk that he could use his informational advantage to make choices that are not in the best interest of the group as a whole. Shorter travel times ease information acquisition by principals, and shift the trade-off in favor of centralized control at headquarters.

[7]Notice that in Duranton and Puga (2005), this result is an equilibrium outcome: a decrease in the cost of remote management (if sufficiently large) shifts the entire economy from an equilibrium where no firm is geographically dispersed and cities specialize by sector, to an equilibrium where all firms adopt a multi-location organizational form and cities specialize by function. The authors suggest that a "smoother" result would hold in an augmented version of the model incorporating some firm level heterogeneity, together with (sufficiently large) sunk costs of reorganization. Such additional dimensions of firm heterogeneity would explain why all firms would not split instantaneously and relocate all of their units along the new HSR lines as they open.

2.3 Geographical Dispersion and Wages at Affiliates

The literature in organizational economics (Garicano, 2000; Garicano and Rossi-Hansberg, 2006, 2012; Antràs et al., 2006, 2008) enables to make predictions about the way heterogeneous workers (in terms of skills) might be differentially impacted by decreases in internal communication costs within a same group. These papers show that business organizations (groups, or sub-units of groups such as affiliates) tend to organize as hierarchies because these types of organizations allow for the most parsimonious usage of two costly inputs of production: workers' time and workers' knowledge. In such structures, the bottom layer is specialized in the most common problems and concentrates the less skilled workers, while the upper layers only deal with exceptions (Garicano, 2000). Managers in one layer spend their time communicating with less skilled agents in the layer just below and solving some of the problems that are transmitted to them. They pass the rest to the layer with more skilled agents just above them.

This baseline representation of how productive activities organize is plugged into a two - region model in Antràs et al. (2006) and Antràs et al. (2008), which can easily be transposed to our setting. As in section 2.2, lower travel times, i.e. decreases in communication costs between units located in different regions, always increase the relative benefit to split businesses in order to take advantage of lower relative wages in the less dense areas; it also has a positive impact on overall group size. A more distinctive prediction of these papers is that lower communication costs increase the incentives to organize in more complex hierarchical organizations (having more layers) by making them a better "technology" to economize on knowledge. As a result, the relative role of managers at headquarters increases, while it is profitable to decrease the knowledge content of bottom production workers at affiliates (and therefore, their skills), in order to save on their wage. We test this prediction by regressing the wage of low-skill production workers on travel time, and expect a positive sign for this coefficient.[8]

2.4 Geographical Dispersion and Operational Profit at the Group Level

In all models of sections 2.2 to 2.3, decreases in travel time between headquarters and affiliates always decrease the overall costs of operating large, multi-plant businesses. At the group level, we therefore expect a negative correlation (other things equal) between the operating profit margin and average travel time to affiliates. Furthermore, corporate groups which are cheaper to operate should grow larger, other things equal: we therefore also expect a negative correlation between overall group size and average travel time to affiliates. While employment is the only reliable proxy of affiliate size in the French data (see section 3 below), there are several proxies available at the group level, most importantly: employment, value added, or tangible investment.

[8] Section 2.1 also generates predictions related to wages. In this set-up, a decrease in communication costs would alter the wage contracts of managers at affiliates from rather high- to rather low- powered incentive contracts. Unfortunately, we are not able to test this prediction with our data.

3 Data

3.1 The Geographical Organization of Corporate Groups

The first ingredient of our analysis is the information system allowing us to recover the structure of French corporate groups. We rely on the LIFI[9] files and use the information on the (direct and indirect) equity stakes of headquarters in affiliate companies reported in this data source. Prior to 1999, the LIFI files only covered companies of the private sector whose size was above at least one of three different thresholds, defined in terms of financial stakes in other firms (higher than 1.2 million euros), sales (60 million euros) or employment (500 workers). From 1999 onwards, these files are complemented with the Diane-Amadeus (Bureau Van Dijk) dataset, which is constructed from commercial court records and which covers smaller business groups. For most of our period of analysis, our file therefore contains almost exhaustive information about corporate groups operating in France.

We follow the standard approach in corporate finance since the classic contribution by La Porta et al. (1999) and define headquarters of potentially complex group structure as the main plants of units having the actual ultimate control over all assets in the group, *via* the direct or indirect ownership of more than half of the equity in any of the group affiliates.[10] Affiliates correspond to all other plants of the considered group. However, previous empirical work (e.g. Aubert and Sillard, 2005; Picart, 2004) has documented that establishments (and even companies within groups) might be created, terminated and replaced for reasons that are uncorrelated with the human resource management practices we want to focus on.[11] We choose to abstract from such phenomena by aggregating the information across all plants of a same group, having the same activity (at the 1 digit level) and located in the same municipality ("commune") into a single "affiliate" unit.[12]

This dataset allow us to complement figure 1 in the introductory part and provide in figure 2 a synthetic description of the geography of remote control, as of 2011. Panel (A) provides, for each commuting zone, the share of businesses that are under the control of headquarters located outside the commuting zone, i.e. further away than the standard daily commuting patterns. This share is higher than 15% in most commuting zones, and above 20% in a number of zones located in the northern half of the country. This fact is driven by the disproportionate "sphere of corporate influence" of Paris over this part of the country.[13] The employment weighted version of the indicator presented in panel (B) shows that in most of the country, more than 30%

[9]The acronym "LIFI" stands for "LIaisons FInancières" (financial linkages). See e.g. Boutin et al. (2013) for a previous use of this dataset. Complementary exhaustive fiscal data (BRN files, also used in Boutin et al., 2013) provide the accounting information required in our empirical analysis.

[10]In cases where these headquarters are non-employer holdings, we rather choose the employer company that is most directly related to the holding, in terms of rank of control, and in cases where several companies meet this criterion, we select those having the largest share of executives (see section 3.2 below). The aim of this procedure is to locate (probabilistically) the upper management team of the entire group structure.

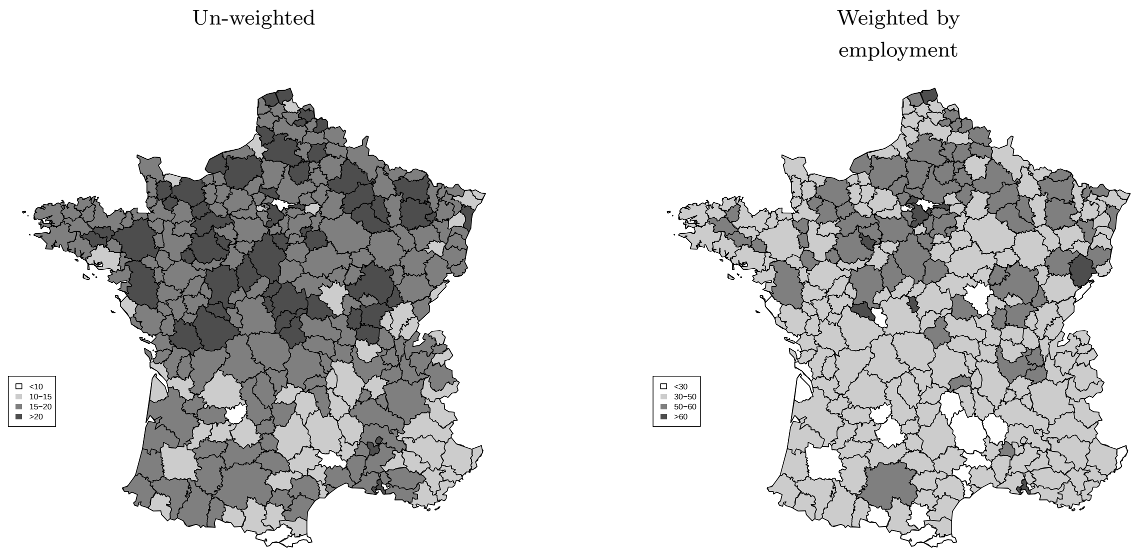
[11]In particular, firm and plant identifiers also change when the legal status of companies evolves, most often because of regulatory constraints (e.g. upper bounds on the admissible number of shareholders for certain legal forms, *etc.*) or for fiscal or administrative reasons which are entirely orthogonal to the mechanisms described in section 2. Our aggregation procedure also enables to abstract from plant transfers occurring on very short distances (within the same municipality), for reasons related to e.g. building capacity, etc.

[12]This aggregation is not drastic, since there are ca. 36,000 such municipalities across France. Its main benefit is to increase by a little bit the power of our setting by increasing the number of years an affiliate unit is observed - 3.2 years on average. Notice also that the variations of travel time induced by HSR line openings are homogenous within municipalities, since they are typically served by only one single station.

[13]See appendix B for a comparison of the "spheres of corporate influence" of different French cities showing the disproportionate weight of Paris, as compared with any other French city.

of employment is managed at arm's length. This share rises to rates above 50% in a significant number of commuting zones, mostly located in the northern part of the country.

Figure 2: Share of Affiliates Under Control of a HQ Located Outside the Considered Commuting Zone
In percentages, by 2011



Sources: Matched DADS files and LIFI survey, covering the for-profit sector (except agricultural activities and workers of the personnel service industries directly employed by households).
Notes: The left panel describes the number of affiliates in each commuting zone that are under the control of a HQ located outside the zone, as a share of the total number of businesses (affiliates and HQs) located in each zone. The right panel describes the share of private employment in each commuting zone that is under control of an external HQ. This indicator can be interpreted as an employment weighted version of the previous.

3.2 The Organization of the Workforce within Corporate Groups

We complement the previous files with exhaustive worker level information sourced from the DADS[14] files. These files are available from 1993 onwards, and include roughly 14 million workers per year in the recent period. They allow us to track economically active plants within each group and provide us with a rich description of their internal workforce and wage structure.

Most importantly, the classification of occupations in the DADS files allows us to contrast the workforce allocated to production activities with the workforce allocated to managerial activities, both at headquarters and affiliates. This distinction is in particular required to test the empirical predictions of section 2.2. We interact this typology of functions with the indicators of hierarchical layers proposed in Caliendo et al. (2015), in order to test the predictions of section 2.3 (codes of the French classification are indicated in parentheses):

- *Functions related to management:*
  - Low-skilled: office workers (clerks, 54),
  - Medium-skilled: mid-level managers and professionals and related (42-46),

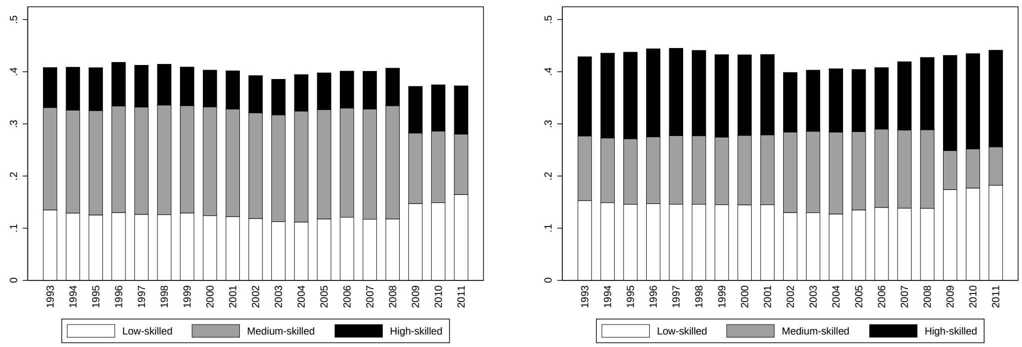
[14]The acronym "DADS" stands for "Déclarations Annuelles de Données Sociales". See e.g. Caliendo et al. (2015) for a previous use of these files.

Figure 3: Structure of the Workforce at Affiliates vs. Headquarters, 1993 - 2011

Workforce at affiliates — Workforce at headquarters

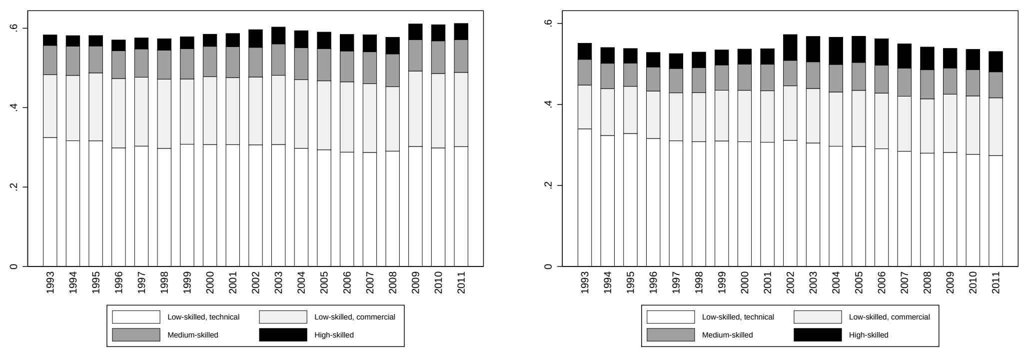
(A) Administrative functions

As a share of total employment



(B) Operational functions

As a share of total employment



Sources: Matched DADS files and LIFI survey; units which are part of geographically dispersed groups.
Notes: Employment is measured in days. The breaks in the series in 2002 and 2009 were generated by a change in the codification procedure for occupations in the DADS files.

  - High-skilled: heads of businesses (2), top managers and professionals (35, 37). These correspond to the "managers" in section 2.

- *Production functions:*
  - Low-skilled: skilled industrial and manual workers (62 and 63), drivers (64), skilled transport and wholesale workers (65), unskilled industrial workers (67),[15]
  - Medium-skilled: technicians (47), supervisors and foremen (48),
  - High-skilled: science and educational professionals (34), technical managers and engineers (38).

Figure 3 describes the structure of the workforce obtained with these definitions, both at affiliates and headquarters.[16] Unfortunately, two methodological changes in the coding of occupations occurred in 2002 and

[15]Notice that we allocate commercial low-skilled workers to production activities, which is of particular relevance for the retail and trade industries. For medium and high-skilled workers, unfortunately, the classification available in our file does not allow to distinguish between managerial and commercial activities.

[16]In these graphics, employment in each occupation is measured in days (between start and end of the labor contract of each worker) to take part time work into account.

2009 and produced two breaks in the series.[17] However, abstracting from this difficulty, panel (A) of figure 3 shows that managerial functions represent a similar share of the workforce, on average, at headquarters and affiliates. What differentiates HQs from affiliates sharply is not the weight of these activities, but the structure of skills *within* them: headquarters employ 15 to 20% of their workforce in higher management positions, against 5 to 10% in the case of affiliates. Conversely, affiliates employ around twice as many middle managers (ca. 20%) as headquarters. In contrast, the structure of the workforce allocated to production activities (panel B in figure 3) is not highly contrasted between headquarters and affiliates: headquarters only tend to concentrate more high-skilled production workers. However, unreported complementary descriptive statistics confirm (unsurprisingly) that the structure of the workforce at affiliates is highly differentiated across industries. For example, skilled production and managerial workers represent 11% of the workforce in manufacturing industries and 21% in business services. In contrast, the share ranges between 6 and 8% in the personnel services, retail and trade, or transport industries. The share of managers (high-skill managerial workers) is around 4% in all industries, except in the business services (10%).[18]

3.3 HSR Network and Rail Travel Times

The last ingredient for our empirical analysis is the detailed information about the evolution of the rail network over time, which allows us to compute rail travel times between any two points of the French metropolitan territory - and more specifically, between the headquarters and affiliates of French corporate groups. We collected detailed information from the archives of the French national rail company and from its open-data platform, and complemented it with various technical publications available from rail fan web sites to reconstruct the expansion of the HSR network over time. The outcome of this task is represented on figure 4: the first HSR segment was opened in 1981 on the track between the two French largest cities, Paris and Lyon. This line was subsequently extended in 1994 and 2001 to ultimately reach Marseille on the Mediterranean Coast. The network was also extended towards the Atlantic coast in 1989-1990, towards Lille and London in 1993 and 1994, and towards Strasbourg and Frankfurt (in Germany) in 2007.[19]

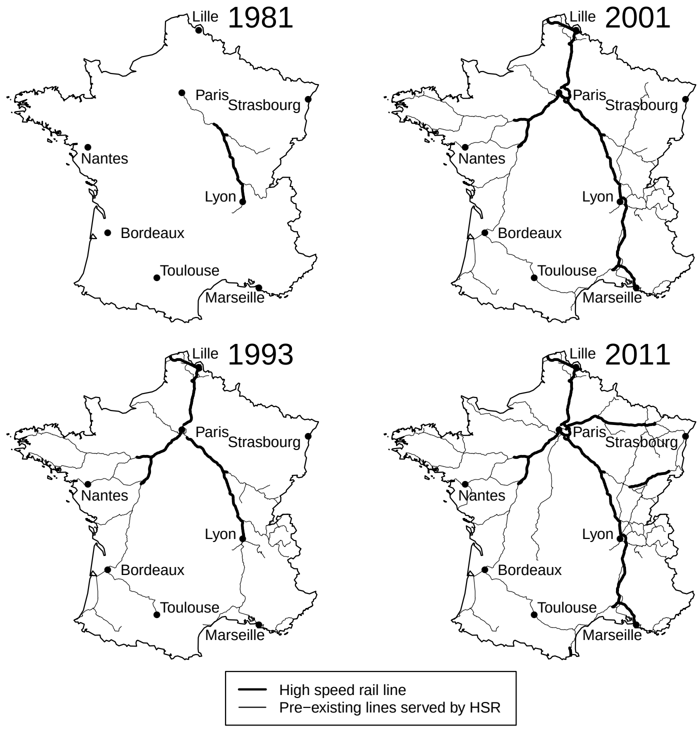
The expansion of the HSR network had a huge impact on rail travel times across the territory because high-speed trains operate at twice the maximum standard rail speed: ca. 320km/h on the dedicated infrastructure. While the actual procedure we implemented to compute rail travel times is relegated to appendix C, figure 5 shows how the expansion of the HSR network translated into reductions in travel times for selected destinations over our period of analysis. Between 1993 and 2011, new line openings mainly benefited the Eastern and Southern regions, which experienced the largest accessibility gains, both in terms of time and geographical range. Paris experienced the symmetric gains towards the Mediterranean zone and the Eastern zone. A few examples enable to gauge orders of magnitude: rail travel time between Marseille and Paris decreased from 6h40 to 4h40 in 1982, to 4h18 in 1994 and ultimately to 3h00 in 2001. Between Strasbourg and Paris, travel time decreased from 3h55 to 2h20 in 2007, when the Eastern line opened.

[17] Our empirical strategy, which saturates each regressions with rich temporal fixed effects, is relatively immune to this measurement issue (see section 4).

[18] In the latter case, most probably part of them are in fact allocated to production (but non "technical") activities, which might unfortunately generate some attenuation bias in our analysis.

[19] As of today, high-speed rail service also includes cross-border services to UK, Belgium, Netherlands, Germany, Switzerland, Italy and Spain. However, this feature of the network in not analyzed in the present paper, since we are not able to locate HQs abroad with our data.

Figure 4: Evolution of the French HSR Network between 1981 (resp. 1993) and 2011



Sources: Archives and open-data platform of the French national rail company; rail fan web sites. Authors' computations.

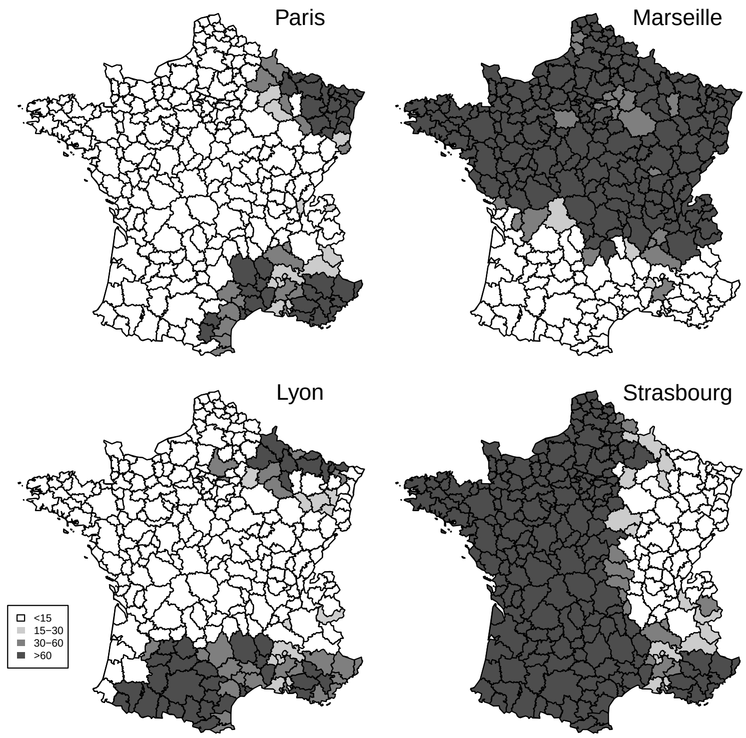
In our empirical analysis, all of the indicators of travel times between headquarters and affiliates are based on the above rail travel time computations, and all travel time variations (reductions) are driven by the opening or extension of new HSR lines. One important concern is of course that our indicator misses all travel time reductions which might be driven by other means of transportation - and more specifically, by airlines. Appendix A however shows that over our period of analysis, HSR became one of the most popular means of transportation for long distance travels, such that rail travel times became of practical relevance to managers. Appendix A also shows that the airline industry did not seem to be a strong competitor of HSR over the same period, since it rather lost market shares in spite of the liberalization episode of the 90s. This is most presumably because travel time by air (incorporating access time to airports, which are often located in the outskirts of cities while train stations are typically located at city centers) is not lower than rail travel time for most domestic trips.[20] In all cases, as also argued in detail in appendix A, we expect our approximation to bias our regression results against finding any impact of travel time on management practices.

A second, more minor problem is that HSR line openings were almost always associated with improved rail service beyond travel time:[21] for example, new and more comfortable coaches were most of the time

[20]See Behrens and Pels (2012) for a similar argument in the case of the London-Paris passenger market.

[21]A related concern is that our results might be driven by standard market access mechanisms rather than by those described in section 2 if the new HSR infrastructure was accessible to freight and also impacted the transport of goods. This is however not the case of the dedicated HSR infrastructure, which is too fragile and sometimes too steep to be accessible to freight trains (because of their weight). Note furthermore that our empirical strategy would anyway address this potential concern (see

Figure 5: Reduction in Rail Travel Times to Selected Destinations
in minutes, between 1993 and 2011



Sources: Archives and open-data platform of the French national rail company; rail fan web sites. Authors' computations.

introduced, with increased "workability" and a higher frequency of train services, at least for terminal cities.[22] Conversely, the quality of service offered by standard rail might have suffered from the reallocation of resources of the rail company towards HSR. In our empirical analysis, such unobserved differential evolution of the rail services provided by HSR and standard rail (which is correlated with our indicator of travel time variation) would bias our estimates somewhat upwards.

4 Empirical Strategy

4.1 Baseline Identification Strategy

Our equations of main interest are estimated at the affiliate level, and investigate the correlations between travel time and the various outcome variables discussed in section 2, typically: affiliate employment, the share of employment allocated to production activities, or the wages of those production workers. They take the following generic specification:

sections 4.1 and 4.3).

[22]This last point is more debated for the case of certain smaller or middle size cities, more precisely those that are bypassed by HSR services while they were previously served by traditional rail service (FNAUT, 2011; Emangard and Beaucire, 1985). For example, the number of direct services per day from Paris to Charleville - Mézières fell from 7 to 3 in 2007, and from 9 to 4 between Paris and Tourcoing.

$$y_{ijlt} = \beta.T_{ijlt} + \varepsilon_{ijlt} \tag{1}$$

where subscript i denotes the affiliate, j its headquarters, l denotes the commuting zone were the affiliate is located and t denotes time. T_{ijlt} denotes travel time between the affiliate and its headquarter and y_{ijlt} is the outcome of interest.

We first argue that travel time variations, which are all driven by the evolution of the HSR network, are less likely to be endogenous in our setting than *levels* of travel times, since the location of affiliates (relative to their headquarters) is potentially endogenously driven by unobserved characteristics that are also correlated with the outcome variables. For example, a higher specificity of the production of the affiliate[23] might be correlated with both a higher proximity of the considered affiliate to its headquarters, and higher wages paid to its production workers. To address these concerns, we insert affiliate level fixed effects α_{ijl} into our regression framework, such that in all regressions, the relation between travel time and the various outcome of interest is identified by *changes* in travel time, namely those generated by the expansion of the HSR network over time.

However, this regression framework is still affected by the fact that the placement of the HSR infrastructure might be endogenous. For example, there might exist some local unobserved heterogeneity, e.g. local growth potential, which could have determined the governmental decision to build the HSR infrastructure, and which might be also correlated with our outcome variables, thus biasing our results. Furthermore, the HSR infrastructure itself might have boosted local growth, a phenomenon we want to control for in our regressions. We address these two issues using an identification strategy similar to Giroud (2013) and Giroud and Mueller (2015), by introducing large sets of commuting zone × time "fixed" effects (α_{lt}), on top of the affiliate level fixed effects (α_{ijl}):

$$y_{ijlt} = \alpha_{ijl} + \alpha_{lt} + \beta.T_{ijt} + \gamma.X_{jt} + \varepsilon_{ijlt} \tag{2}$$

These many dummy variables capture the time varying *local* heterogeneity which could generate the above endogeneity problems. Notice that all of these fixed effects are identifiable in our setting, because the impact of variation in travel times on the outcomes of interest is identified *jointly* from the locations of affiliates *and* from the location of their headquarters, i.e. travel time is a *dyadic* variable. More intuitively, our identification strategy amounts to use as a control group, the set of local affiliates located in the same commuting zone as the considered affiliate: indeed, these affiliates are therefore exposed to the same local shocks, but they are unaffected (or differently affected) by travel time reductions because of a different location of their headquarters[24].

Such specifications that are saturated with fixed effects require the explanatory variables to be measured accurately, since fixed effects tend to amplify the attenuation bias arising from measurement errors.[25] However, we argue in appendix C.3 that if travel times might be affected by some measurement problems, *variations* in travel times are likely to be measured much more accurately. Since identification in equation 2

[23] Regressions are estimated industry by industry to further address this concern and to investigate industry level heterogeneity.

[24] In the reported regressions, we exclude affiliates which are not part of a multi-implantation group, mainly for practical reasons (this reduces drastically our file size and the associated computing time). However, these observations could serve as additional controls for local shocks. Un-reported regressions show that results are basically unaffected by this choice.

[25] This problem is well known in the literature about the estimation of production functions, where capital is typically not measured accurately (Griliches and Hausman, 1986).

is in differences, this is what is required. Furthermore, this problem should if anything lead us to minimize the true impact of travel time on our outcome variables.

In terms of the estimation method, the inclusion of several sets of high-dimensional fixed effects renders estimation non-trivial, despite the fact that equation 2 is fully linear. We choose to apply the iterative procedure proposed by Guimaraes and Portugal (2010): its principle is to iterate on sets of normal equations that are conveniently defined. The only practical constraint in our implementation of their methodology is to use *continuous* empirical proxies for the explanatory variables of main interest, in order to insure identification (see appendix E for full details).

4.2 Robustness Checks

We also provide a bunch of checks to test the robustness of our results to additional potential sources of endogeneity. First, additional controls for group level market conditions X_{jt}, both on the domestic and the international markets, are incorporated in all specifications to control for group-wide shocks which might be spuriously temporally correlated with travel time reductions (and our outcome variables) in our sample. This strategy is however not sufficient in cases where group-wide shocks are *endogenously* correlated with HSR line openings: this would happen, for example, in cases where the group lobbied in favor of certain HSR line openings and extensions.[26] To mitigate this concern, we first estimate regressions where we simply remove the most "suspicious" observations, namely the largest affiliates in each area. Second, we experiment with specifications where we remove large HSR beneficiaries, i.e. affiliates benefiting from HSR for more than 50% of the rail track to their headquarters.[27]

4.3 Further Evidence from Un-Realized Lines

To mitigate an even broader set of endogeneity concerns, but at the cost of discarding a larger fraction of the sample, we also implement an additional strategy along the lines of Donaldson (2014). This strategy makes use of the fact that a governmental plan was drafted in 1991 (ahead of our period of analysis) and endorsed by the Prime Minister of the time. It described an ambitious network of HSR lines to be built in the years to come, based on local development and profitability criteria (Ministère de l'Équipement, 1991).[28] However, some of the lines were not implemented (Zembri, 1997). In some cases it was because their expected profitability was deemed too low:[29] we choose to discard these lines. For the remainder, non-implementation was explained by the fact that budgetary constraints imposed some phasing and rescheduling of projects, or

[26] Giroud (2013) also considers the possibility of lobbying at the affiliate (rather than group) level. We think that this case is very unlikely for HSR given the cost of the infrastructure. However, the specifications suggested in the previous case, where we remove the largest affiliates or discard affiliates benefiting from HSR on a too large proportion of the track to their headquarters, would also mitigate the concern of lobbying at the affiliate level.

[27] This strategy is very similar to what is implemented in Giroud (2013), in specifications where he only considers indirect flights where either the last leg of the flight (involving the plant's home airport) or the first leg of the flight (involving headquarters' home airport) remains unchanged.

[28] See appendix D for a map of the foreseen infrastructures. The lines which were ultimately realized as of 2011 are: the Eastern line, the Rhin/Rhone connection, the Parisian inter-connection, the Provence and Rhone-Alps line. Unrealized lines are: the Auvergne, Limousin and Normandy lines (featuring low expected profitability even in the initial blueprint document of 1991), and our actual "counterfactual lines": Aquitaine, Brittany, Far South, inter-connection in the Alps, Mediterranean Coast (French Riviera), Languedoc-Rousillon, Midi-Pyrénées, Pays de la Loire and Picardy.

[29] This is the case of lines connecting Paris to the center of the country (Auvergne, Limousin), or to Normandy, which all had expected profitability below 4.3% - the minimum attained for actually implemented lines (Eastern line).

because of unexpected technical difficulties[30] that are arguably exogenous in our empirical setting.

We suggest that affiliates which would have benefited from the latter subset of the 1991 plan are likely to have the same un-observables (potentially correlated with travel time reductions) as affiliates which actually benefited from realized HSR lines. In more technical terms, this would imply that conditional on being part of the 1991 plan, travel time is orthogonal to the error term in equation 2. We therefore propose to estimate our baseline specification on the corresponding sub-sample, after discarding affiliates which could never have expected benefiting from the HSR technology because of their location relative to their headquarters. This is an even more flexible procedure than simply inserting the variable indicating insertion into the 1991 plan as a new control, as a strict implementation of the Donaldson (2014) methodology would imply. In our specific setting, it also clarifies the fact that the coefficient of interest is in fact mainly identified from this sub-sample of affiliates. Indeed, the actually implemented HSR network is broadly nested into the 1991 plan, such that there remains very little variation in travel times in the sub-sample of affiliates outside the 1991 plan to contribute to identification. Notice that this procedure is not strictly speaking an instrumental variable strategy. Indeed, we do not argue that the placement of the 1991 plan was more exogenous than the placement of the actually implemented network, as would have been required for an instrumental variable. We only suggest that the factors determining actual implementation (i.e. the mapping between the 1991 plan and the actually implemented network) are likely to be relatively orthogonal to our relation of interest, such that the information about insertion into the 1991 plan captures the unobserved heterogeneity potentially generating remaining endogeneity issues.

4.4 Sample Descriptive Statistics

Table 1 provides a comprehensive description of our sample. About 40% of the affiliates of geographically dispersed corporate groups benefit from HSR on the track to their headquarters. This high share is mainly driven by the fact that the first HSR lines, opened between 1981 and 1993, connected particularly dense areas (Paris and Lyon). Only 4% of affiliates of geographically dispersed corporate groups benefited from the rail travel time reductions induced by the HSR network expansion which occurred between 1993 and 2011. In terms of corporate groups, we obtain that a slightly higher share (7%) were affected via at least one of their affiliates.[31] These affiliates are on average located further away from their respective headquarters than affiliates which did not experience any rail travel time reduction: this is due to the fact that HSR is typically a long distance mean of transportation (section 3.3 and appendix A). Their headquarters are also more often located in Paris, which is explained by the shape of the HSR network: it is typically organized as a spider web centered on the capital city (see our earlier comment of figure 4). Table 1 shows that the average travel speed between an affiliate and its headquarters is around 80 km/h when the HSR technology is not available, and around 110-120km/h when it is available on at least part of the track. The latter value is much lower than the HSR commercial speed (320km/h), which indicates that most affiliates only benefit from HSR on a small portion of the track to their headquarters.

Table 1 also provides a breakdown of the industry structure of our sample. It shows that the sample of

[30] For example, in some cases, expensive art works or deviations were required by local authorities or lobbyists to preserve the environment (e.g. protected areas, vineyards, *etc.*) - see Zembri (1997).

[31] Figures 10 and 12 in appendix F complement table 1 and provide a full description of the distribution of travel time reductions at the dates of the main line openings, as well as the precise geographical location of affiliates which benefited from them.

affiliates which benefited from the 1994 line opening was somewhat specific and presented a higher share (than the population average) of affiliates active in manufacturing and transport industries. This specificity is explained by the industrial specialization of the areas which became connected to the HSR network at that date, and translates into somewhat differentiated structural characteristics: larger affiliate sizes, and somewhat lower shares of production workers.

Table 1: Summary statistics
Affiliates of multi-location firms, 1993-2011

	Affiliates experiencing reductions in travel time between 1993 and 2011				**Affiliates never affected**
		At main years of change:			
	1993-2011	**1993/1994**	**2000/2001**	**2006/2007**	
Geography:					
Distance to HQ (km)	402	475	482	326	195
HQ in Paris	40%	46%	37%	37%	34%
Travel times (hours):					
Travel time [variation $t-1/t$]	3.84 [-]	4.13 [-0.21]	4.11 [-0.69]	3.10 [-0.88]	2.06 [0]
Speed [variation $t-1/t$]	-	115 [6]	117 [17]	105 [23]	95 [0]
HSR user [variation $t-1/t$]	82% [-]	100% [7%]	100% [15%]	100% [64%]	41% [0]
Workforce and wages at affiliates:					
Employment	38	40	31	31	32
Share of production workers	65%	61%	63%	66%	66%
Annual wage of prod. workers (k€)	15.5	14.8	14.5	16.9	15.9
Share of managers	6%	8%	7%	6%	7%
Indsutry affiliation:					
Manufacturing industries	19%	24%	17%	16%	19%
Personnel services	9%	12%	9%	7%	11%
Retail and trade	48%	35%	46%	51%	46%
Business services	17%	20%	20%	19%	18%
Transport	7%	10%	8%	6%	6%
Counts of business units:					
Nb observations (aff. × year)	198,088 [9%]	5,802	9,728	7,253	2,109,167 [91%]
Nb affiliates	28,207 [4%]	//	//	//	699,928 [96%]
Nb HQs (groups)	9,114 [7%]	2,161 [2%]	3,568 [3%]	2,429 [2%]	126,745 [93%]

Sources: Matched DADS files and LIFI survey; business units (HQs or affiliates - see section 3.1 for definition) which are part of multi-location groups between 1993 and 2011. Employment is measured in days of work but is reported in this table as headcount equivalents (days divided by 360).
Notes: The main "years of change" correspond to the opening dates of the Northern line (1993/1994), of the connection to Marseille (2000/2001) or of the Eastern line (2006/2007).

5 Results at the Affiliate Level

5.1 Main Specification

Table 2 contains our main results at the affiliate level. Petersen and Rajan (2002) suggest that the mechanisms relating organizational structure and the use of information presented in section 2 are most relevant in industries where information (e.g. about investment opportunities) to be transmitted is particularly "soft". In their view, this is the case when activity relies heavily on relationship building, such as consulting, research and new product development, and more generally service industries. Consistently with this hypothesis, we obtain that the negative relationship between the functional specialization of affiliates and travel times (column 1) and between affiliate size (as measured by production workers, in column 4) and travel times are significant in all industries, but highest in industries related to services: personnel services, business services and transport. In the latter industries, the functional specialization of affiliates into production activities increases by around 2 percentage point when travel times to their headquarters decrease by one hour. In the personnel and business service industries, the functional shift is associated with increases in production capacity (as measured by production workers) of more than 5 percent by hour saved on travel times. Since the average travel time between affiliates and headquarters is around 2 hours (table 1) and given that average affiliate size is around 15 and 30 in the personnel and business services industries respectively, this indicates that the average cost of geographical dispersion in terms of production capacity amounts to roughly 1.5 production jobs in the personnel services industries, and to 4 production jobs in the business services industries. However, these effects are exactly compensated by the symmetric decreases in managerial jobs (most often, high-skilled managerial jobs), such that the overall impact on total affiliate employment is not significant.

In the manufacturing, retail and trade industries, point estimates are lower, but still highly significant. In these sectors, the functional specialization of affiliates into production activities increases by a little less than 1 percentage point when travel times to their headquarters decrease by one hour. Production capacity as measured by production workers increases by around 2 percent per hour saved, which translates into an average cost of the geographical dispersion of around 2 jobs in manufacturing industries and two thirds of a job in the retail and trade industries. These results broadly confirm the empirical findings of Giroud (2013) and Giroud and Mueller (2015) for the US manufacturing industry.

Last, in column (5) of table 2, we investigate the relationship between travel times and the wage of production workers. The obtained coefficients are most often positive, but only significant in the manufacturing and business services industries. This seems unsurprising, since we expect the knowledge based mechanism in section 2.3 to be more relevant in those most skill intensive industries, which feature twice as many skilled workers as other industries.[32] Associated magnitudes are relatively large: the average geographical dispersion within French corporate groups, requiring 2h of travel time between affiliates and headquarters, would translate into a 2% increase in production costs driven by the higher wages paid out.

5.2 More on Economic Magnitudes: an Illustrative Quantification Exercise

Table 3 enables to gauge the magnitudes implied by the regression results in table 2 in a more intuitive way.

[32]See section 3.2 for basic descriptive statistics.

Table 2: Travel Time to HQ and the Structure of the Workforce at Affiliates
1993-2011, affiliates of multi-location corporate groups only

Dependent variable:	**Structure of the workforce (shares)**		**Affiliate employment (ln)**		**Wage (ln)**
	Production workers	**Managers (high-skilled)**	**Total**	**Production workers**	**Production workers**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
			(A) Manufacturing Industries		
Travel time (hours)	-0.009***	0.002*	-0.013	-0.019*	0.008**
	(0.002)	(0.001)	(0.009)	(0.010)	(0.004)
Mean of unlogged dep. var.	0.753	0.046	60.670	48.915	18,334
Observations	426,595	426,595	426,595	408,861	408,861
			(B) Personnel Services		
Travel time (hours)	-0.020***	0.018***	0.005	-0.055***	0.009
	(0.005)	(0.002)	(0.016)	(0.019)	(0.008)
Mean of unlogged dep. var.	0.733	0.047	23.089	15.835	13,204
Observations	241,846	241,846	241,846	227,936	227,936
			(C) Retail and Trade		
Travel time (hours)	-0.008***	-0.002***	-0.022***	-0.030***	-0.004
	(0.002)	(0.001)	(0.005)	(0.006)	(0.002)
Mean of unlogged dep. var.	0.660	0.060	16.848	11.094	13,925
Observations	1,045,869	1,045,869	1,045,869	965,013	965,013
			(D) Business Services		
Travel time (hours)	-0.018***	0.000	-0.009	-0.070***	0.013*
	(0.003)	(0.002)	(0.011)	(0.015)	(0.008)
Mean of unlogged dep. var.	0.515	0.114	45.814	29.755	19,538
Observations	401,844	401,844	401,844	329,680	329,680
			(E) Transport		
Travel time (hours)	-0.016***	0.012***	0.018	0.006	0.001
	(0.005)	(0.003)	(0.016)	(0.022)	(0.009)
Mean of unlogged dep. var.	0.584	0.052	38.610	26.857	17,811
Observations	138,865	138,865	138,865	115,205	115,205

Sources: Matched DADS files and LIFI survey; affiliates (see definition in section 3.1) which are part of multi-location groups between 1993 and 2011.
Note: All regressions include affiliate × headquarter level fixed effects, as well as local (commuting zone) × time fixed effects to control for the local market conditions. Regressions also include group level exports in total sales to capture the cycle on international markets (but all results are robust to the exclusion of these controls).

In this table, we report the adjustments that we attribute to the HSR network, for the population of affiliates which are in activity in the last year of our panel (2011). Two counterfactual exercises are proposed: the first compares the HSR network in 1980 and 2011 and therefore computes adjustments associated with the entire HSR network. The second only considers the impact of the lines opened during our estimation period, i.e. between 1993 and 2011. Of course, this simple exercise does not take account of the potential response of competing modes of transportation. It is also essentially a partial equilibrium exercise, but as we will show, the aggregate impacts we estimate are not large enough to be likely to generate large general equilibrium effects, even on local labor markets.

Results obtained from this simple exercise are suggestive:[33] for the average affiliate in the service industries,

[33]The specific impact associated with the subset of HSR lines opened after 1993 is unsurprisingly lower (about one fourth) than those discussed in the main text. This is explained by the fact that many affiliates only benefit from the first lines, opened between 1981 and 1993, and not from the most recent lines, opened between 1993 and 2011.

Table 3: Magnitudes at the Affiliate Level: Organizational Impact of HSR as of 2011
2011, affiliates of multi-location corporate groups only

Average gains per affiliate			**Manuf. indus. (1)**	**Person. serv. (2)**	**Retail, trade (3)**	**Bus. serv. (4)**	**Transport (5)**
Nb affiliates	number		10,698	8,322	30,274	15,566	4,489
benefiting from HSR	share		0.438	0.413	0.435	0.518	0.491
Average travel time	in 2011		3.307	3.315	3.347	3.351	3.502
to HQ	with 1993 network		3.721	3.732	3.775	3.792	3.956
	with 1980 network		4.673	4.801	4.714	4.861	4.996
Production jobs	2011 / 1993	jobs	0.196***	0.224***	0.057***	0.342***	0.288***
		ppt	0.004***	0.008***	0.003***	0.008***	0.007***
	2011 / 1980	jobs	0.633***	0.787***	0.212***	1.168***	1.020***
		ppt	0.012***	0.030***	0.011***	0.026***	0.024***
Manager jobs	2011 / 1993	jobs	-0.046*	-0.204***	0.017***	-0.005	-0.212***
		ppt	-0.001*	-0.008***	0.001***	-0.000	-0.005***
	2011 / 1980	jobs	-0.150*	-0.719***	0.064***	-0.018	-0.750***
		ppt	-0.003*	-0.027***	0.003***	-0.000	-0.017***
Wages of	2011 / 1993	€	-4,224**	-1,142	327	-3,978*	-438
production jobs		ppt	-0.003	-0.004	0.002	-0.006	0.001
	2011 / 1980	€	-13,744**	-4,108	1,234	-14,687*	-1,574
		ppt	-0.011	-0.013	0.005	-0.020	-0.002

Sources: Sources: Matched DADS files and LIFI survey; affiliates (see definition in section 3.1) which are part of multi-location groups between 1993 and 2011. Magnitudes are computed using estimates reported in table 2.

the functional shift induced by the availability of the HSR network (as a whole) amounts to the shift of roughly one job from managerial (and more precisely, high-skill managerial) activities to production activities. This represents a reallocation of ca. 3% of the workforce for the average affiliate size. In the other industries, given the differences in the estimated coefficients in table 2 and the differences in average affiliate sizes, the magnitude of the functional shift is only 20% of a job. Furthermore, we obtain that total savings in terms of production labor costs induced by the HSR network are of the order of magnitude of half the cost of a production job for the average affiliate in the manufacturing and business services industries.

5.3 Common Trend Assumption and Non-Linearities

The discussion of our identification strategy in section 4.1 shows that our setting is similar to a difference-in-differences setting, where we contrast affiliates experiencing changes in travel times to their headquarters with affiliates located in the same area which did not experience the same changes, because of a different location of their headquarters. To test the common trend identifying assumption underlying such a setting, and to investigate potential anticipation effects (or conversely, lagged adjustment processes), we run a specification where we include lags and leads of our indicator of travel time. For compactness, we only discuss here the results obtained for our indicator of functional specialization (the share of employment allocated to production activities) in the first three columns of table 4, but the discussion would also hold for our other outcome variables.

If anything, we detect anticipation effects in the business and personnel services industries;[34] lagged adjustments only occur in the transport industry. Overall, although the simultaneous inclusion of three indicators of travel times is probably too demanding in our setting, this experiment shows that the response to changes

[34]Unreported regressions using a wider time window show that these anticipation effects do not exceed one year.

in travel times occurs mostly in the year where affiliates experience them in the manufacturing, personnel services, retail and trade and business services industries.

Columns (4) to (6) in table 4 propose a different experiment. In this second specification, we investigate whether our main results in table 2 might hide potential non-linearities. We split our travel time variable into three different classes: short travels, lasting less than 3 hours, medium length travels, lasting between 3 and 5 hours and which would still be feasible (round trip) in one day, and longer travels, lasting more than 5 hours. We obtain that in all industries, the relation between travel time and functional specialization is low and insignificant for the shortest travels. In contrast, the relation is always highly significant for medium range travels, as well as for the longest trips (except in the case of the retail and trade industry). These findings are consistent with the fact that the market share of HSR is highest for the longest trips, as shown in table A of appendix 11.

Table 4: Anticipation *vs.* Adjustment Effects, Non-Linearities
1993-2011, affiliates of multi-location corporate groups only

(Dependent variable: share of production jobs)	**Anticipations and adjustments**			**Non-linear impact of travel time**		
	Travel time at:			**Travel time at t:**		
	$t-1$	t	$t+1$	**shorter than 3h**	**3h to 5h**	**longer than 5h**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Manufacturing industries	0.000	-0.008*	-0.001	-0.004	-0.009**	-0.015***
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)
Personnel services	-0.012*	-0.011	-0.002	-0.008	-0.030***	-0.024**
	(0.007)	(0.008)	(0.007)	(0.007)	(0.007)	(0.009)
Retail and trade	-0.004*	-0.006**	0.002	-0.001	-0.020***	-0.004
	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)
Business services	-0.012***	-0.010**	0.001	-0.008*	-0.010**	-0.038***
	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)
Transport	0.011	-0.007	-0.023***	-0.009	-0.023***	-0.021**
	(0.007)	(0.008)	(0.007)	(0.006)	(0.007)	(0.009)

Sources: Sources: Matched DADS files and LIFI survey; affiliates (see definition in section 3.1) which are part of multi-location groups between 1993 and 2011.
Note: All regressions include affiliate × headquarter level fixed effects, as well as local (commuting zone) × time fixed effects to control for the local market conditions. Regressions also include group level exports in total sales to capture the cycle on international markets. Same samples and numbers of observations as in table 2.

5.4 Alternative Identification Strategies

Table 5 presents a series of important experiments, where we vary the identification strategy in order to test the robustness of our findings. As previously, for compactness, results are only presented for our indicator of functional specialization (the share of employment allocated to production activities). Column (1) simply replicates the results of table 2 as a benchmark. In columns (3) and (5), we only use each third or fifth year in our panel, in order to identify the impact of travel time on longer time differences than in the baseline specification. The cost of this strategy is obviously the drastic decrease in sample size that is induced, but results are fully preserved in this experiment: we actually tend to obtain higher point estimates when increasing the length of the time difference. This finding might however partly be driven by the selection of survivors that is induced by this experiment.

In columns (5) and (6), we provide two experiments aiming at testing whether our results might be driven by "lobbyists", i.e. by a very specific sub-population of affiliates which might have influenced the placement of the HSR infrastructure because they would receive disproportionate benefits from HSR, as explained in section 4.2. In columns (5), we estimate a specification where we remove the largest affiliates in each commuting zone, assuming that the latter are most likely to be at the source of the endogeneity concerns related to potential lobbying activity. Our results are however fully preserved in this regression. In column (6), we propose another experiment which is directly inspired from Giroud (2013).[35] In this specification, we only use affiliates which only benefit from HSR for less than 50% of the track to their headquarters. These observations are less likely to have lobbyied in favor of the HSR line than those benefiting from it on the entire track to their headquarters. Again, results are fully preserved in this experiment: if anything, we obtain higher point estimates than in the baseline specification.

Last, column (6) of table 5 contains the evidence obtained from unrealized lines (see section 4.3). The rationale behind this alternative strategy is almost opposite to the two previous experiments: here, we restrict our estimation sample to affiliates having the same probability to have behaved as lobbyists when the 1991 governmental plan was decided. Again, results are preserved, and somewhat amplified in the cases of the manufacturing and business services industries.

Overall, results obtained from the different identification strategies in columns (4) to (6) suggest that our baseline specification with high-dimensional fixed effects controlling for shocks at the commuting zone level seem to be sufficient to address the problem of the endogenous placement of the HSR infrastructure.

5.5 Adverse Effect of Travel Time to Other Affiliates

In table 6, we follow Giroud and Mueller (2015) and investigate whether the adjustments described in table 2 might be affected by travel time reductions affecting the other affiliates of the group. To that end, we insert into the regression variables describing average gains in travel time for other affiliates in the group.

Columns (1) and (2) investigate potential adverse effects on affiliates' production capacity (as measured by employment allocated to production). Theory on internal capital markets predicts that if the group is financially constrained, then a decrease in the relative cost of operating other affiliates should boost their growth, but lead to a decline in the resources allocated to other affiliates (Stein, 1997), which would negatively affect their size. Consistently with this mechanism, we obtain that while our earlier estimates of table 2 are preserved in column (1) for the relationship between affiliates' own travel time and affiliate size, their production capacity is on average negatively affected by gains in travel times at other affiliates. Point estimates for the latter coefficient are of the same order of magnitude as those obtained for affiliates' own travel time, which suggest that the reallocations of production capacity are of the same order of magnitude.

In contrast, columns (3) and (4) show that functional specialization tends to be slightly fostered (but not impaired) by gains in travel time at other affiliates, except in the business services industries. This finding

[35]The setting in Giroud (2013) is very similar to ours, since this author estimates the effects of headquarters' proximity to plants on plant-level investment and productivity using the opening of US airlines. To mitigate concerns related to lobbying, he proposes specifications where he only considers indirect flights where either the last leg of the flight (involving the plants home airport) or the first leg of the flight (involving headquarters home airport) remains unchanged.

Table 5: Alternative Identification Strategies

1993-2011, affiliates of multi-location corporate groups only

Dependent variable: share of production jobs		**Baseline**	**Longer time differences:**		**Removing largest**	**Partial HSR track only**	**1991 plan only**
			3 years	**5 years**			
		(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Manufacturing industries	Coef.	-0.009***	-0.009**	-0.017**	-0.008***	-0.014***	-0.019***
		(0.002)	(0.005)	(0.008)	(0.002)	(0.003)	(0.004)
	Obs.	426,595	156,189	86,121	423,677	369,587	209,537
Personnel services	Coef.	-0.020***	-0.009	-0.049***	-0.020***	-0.022***	-0.026***
		(0.005)	(0.011)	(0.018)	(0.005)	(0.007)	(0.007)
	Obs.	241,846	89,653	53,552	238,931	209,326	116,566
Retail and trade	Coef.	-0.008***	-0.006*	-0.002	-0.008***	-0.008***	-0.007**
		(0.002)	(0.003)	(0.005)	(0.002)	(0.002)	(0.003)
	Obs.	1,045,869	382,129	230,819	1,043,053	917,541	464,929
Business services	Coef.	-0.018***	-0.016**	-0.035***	-0.017***	-0.030***	-0.025***
		(0.003)	(0.006)	(0.012)	(0.003)	(0.004)	(0.005)
	Obs.	401,844	148,698	90,025	399,065	334,041	202,592
Transport	Coef.	-0.016***	-0.032***	-0.024*	-0.016***	-0.024***	-0.015*
		(0.005)	(0.009)	(0.015)	(0.005)	(0.007)	(0.008)
	Obs.	138,865	50,795	30,714	136,052	117,185	65,123

Sources: Matched DADS files and LIFI survey; affiliates (see definition in section 3.1) which are part of multi-location groups between 1993 and 2011.

Note: All regressions include affiliate × headquarter level fixed effects, as well as local (commuting zone) × time fixed effects to control for the local market conditions. Regressions also include group level exports in total sales to capture the cycle on international markets.

might be driven by the fact that HQ manager time that is saved at other affiliates (due to shorter travels)[36] is partially reallocated to remote affiliates, thus decreasing the need for local managers and fostering their functional specialization. Overall, table 6 suggests that HQ managerial time might be a particularly scarce resource (or a particularly costly input) in large and spatially dispersed groups.

[36]We will show in section 6 that managerial jobs which disappear at affiliates are in fact on average transferred to HQs, such that gains in travel times increase the resources in HQ managerial time both *via* time saved during travels and *via* transfers of managerial jobs to HQs.

Table 6: Impact of Travel Time to Other Affiliates in Group

1993-2011, affiliates of multi-location corporate groups only

Dependent variable:	**Production jobs (ln)**		**Share of production workers**	
	Own travel time	**Gains at other affiliates**	**Own travel time**	**Gains at other affiliates**
	(1)	**(2)**	**(3)**	**(4)**
Manufacturing industries	-0.023**	-0.023***	-0.009***	-0.000
	(0.010)	(0.002)	(0.002)	(0.000)
Personnel services	-0.058***	-0.026***	-0.020***	0.002**
	(0.019)	(0.004)	(0.005)	(0.001)
Retail and trade	-0.053***	-0.035***	-0.007***	0.002***
	(0.021)	(0.005)	(0.002)	(0.000)
Business services	-0.088***	-0.066***	-0.018***	-0.002***
	(0.015)	(0.004)	(0.003)	(0.001)
Transport	-0.008	-0.021***	-0.016***	0.002**
	(0.022)	(0.005)	(0.005)	(0.001)

Sources: Matched DADS files and LIFI survey; affiliates (see definition in section 3.1) which are part of multi-location groups between 1993 and 2011.

Note: All regressions include affiliate × headquarter level fixed effects, as well as local (commuting zone) × time fixed effects to control for the local market conditions. Regressions also include group level exports in total sales to capture the cycle on international markets. Same samples and numbers of observations as in table 2.

6 Descriptive Extensions at the Group Level

6.1 Specification

Some important theoretical predictions hold at the group level rather than at the affiliate level, most notably predictions relating travel time to overall group size and profitability (section 2.4). We therefore complement the previous regressions with specifications at the level of the entire group:

$$y_{jt} = \alpha_j + \sum_r \alpha_{rt}.\delta_{jrt} + \beta.T_{jt} + \gamma.X_{jt} + \varepsilon_{jt} \tag{3}$$

In this equation, identification of the impact of average travel time to affiliates T_{jt} on group size or profitability is still identified from variations thanks to the inclusion of the group level fixed effects α_j. We also insert a set of dummy variables[37] α_{rt} capturing market conditions in the areas where the group operates. However, since corporate groups in our sample are typically geographically dispersed, these dummy variables are not mutually exclusive, such that it is not possible to implement the same estimation procedure as previously (appendix E). To render estimation computationally tractable with standard OLS routines, we have to aggregate the circa 300 commuting zones into the 22 French metropolitan regions prevailing over the period. Additional controls X_{jt} in equation 3 include the number of sites to be managed (including the headquarters themselves, in logarithm), such that all results are to be interpreted "per implantation". As for regressions at the affiliate level, we also insert export intensity (as previously) to capture international market conditions when relevant.

An important concern for these regressions estimated at the group level is that average travel time to affiliates T_{jt} might evolve for two different types of reasons: either because travel times decrease as the HSR network expands (as previously), or because the scope of the group evolves, i.e. affiliates enter or exit. This aspect is the main weakness of our regressions at the group level: indeed, we show in appendix G that adjustments on this "extensive margin" are not orthogonal to the variations in travel times induced by the HSR network, but this concern is difficult to address (Giroud, 2013).[38] As a first attempt to control for this problem, we split the travel time term into two parts:

$$\begin{aligned} T_{jt} &= \frac{\sum_{i\in\mathcal{F}_{jt}} T_{(ij)t}}{\text{Card } \mathcal{F}_{jt}} - \underbrace{\frac{\sum_{i\in\mathcal{F}_{jt_0}} T_{(ij)t_0}}{\text{Card } \mathcal{F}_{jt_0}}}_{\substack{\text{Normalization term} \\ \text{(factored out by group level fixed effects)}}} \\ &= \underbrace{\left(\frac{\sum_{i\in\mathcal{F}_{jt}} T_{(ij)t}}{\text{Card } \mathcal{F}_{jt}} - \frac{\sum_{i\in\mathcal{F}_{jt}} T_{(ij)t_0}}{\text{Card } \mathcal{F}_{jt}}\right)}_{\text{Change in average travel time}} + \underbrace{\left(\frac{\sum_{i\in\mathcal{F}_{jt}} T_{(ij)t_0}}{\text{Card } \mathcal{F}_{jt}} - \frac{\sum_{i\in\mathcal{F}_{jt_0}} T_{(ij)t_0}}{\text{Card } \mathcal{F}_{jt_0}}\right)}_{\text{Change in group spatial dispersion}} \end{aligned} \tag{4}$$

where $\mathcal{F}_{jt}$ denotes the set of affiliates in group j at date t and $\mathcal{F}_{jt_0}$ the set of affiliates in group j in the first year the group is observed in our data (date t_0). As previously, T_{ijt} is travel time between affiliate i and

[37] Results are robust to the use of employment shares in each zone rather than simply dummy variables indicating where the group operates.

[38] This concern was already present, though less severe, in section 5.5.

the headquarters of group j at date t. Of course, the spatial dispersion term is affected by variations in travel times induced by the wider availability of the HSR technology, but most likely only marginally, as suggested in appendix G: for example, travel times only explain around 5 percentage point of a total of 43% of affiliate exits to be explained.[39] In spite of this limitation, this term allows us to purge the term measuring changes in travel times from changes in geographic dispersion at the group level.

6.2 Results

Results depicting the correlations between travel times or geographic dispersion and group size and profit are reported in table 7. We obtain first that the indicator of spatial dispersion is consistently negatively correlated with all indicators: group size as measured by value added, employment or investment, and profit margin. Since all regressions include controls for the number of affiliates, this means that on average, the production units of geographically dispersed corporate groups are smaller, and present a lower operational profit margin than production units of concentrated corporate groups.[40]

Table 7: Spatial Dispersion and Performance at the Group Level
1993-2011, corporate groups which are geographically dispersed only

	Value Added (ln)		**Employment (ln)**		**Investment (ln)**		**Profit Margin**	
	Travel time (1)	**Spatial disp. (2)**	**Travel time (3)**	**Spatial disp. (4)**	**Travel time (5)**	**Spatial disp. (6)**	**Travel time (7)**	**Spatial disp. (8)**
Manufacturing ind.	-0.067***	-0.017***	-0.026*	-0.032***	-0.037	-0.020***	-0.008**	-0.003***
(225,942 obs.)	(0.014)	(0.002)	(0.014)	(0.002)	(0.035)	(0.004)	(0.003)	(0.000)
Personnel services	-0.107***	-0.044***	-0.074***	-0.042***	-0.064	-0.003	-0.010*	-0.004***
(131,829 obs.)	(0.024)	(0.002)	(0.025)	(0.002)	(0.067)	(0.006)	(0.006)	(0.001)
Retail and trade	-0.049***	-0.017***	-0.049***	-0.028***	-0.146***	-0.013***	-0.011***	-0.004***
(406,310 obs.)	(0.013)	(0.001)	(0.012)	(0.001)	(0.034)	(0.004)	(0.003)	(0.000)
Business services	0.029**	-0.041***	0.082***	-0.059***	-0.015	-0.066***	-0.007**	-0.003***
(249,263 obs.)	(0.014)	(0.002)	(0.015)	(0.002)	(0.030)	(0.004)	(0.003)	(0.000)
Transport	-0.017	-0.008**	0.040*	-0.025***	-0.232***	-0.034***	-0.017***	-0.002***
(52,936 obs.)	(0.024)	(0.003)	(0.024)	(0.003)	(0.059)	(0.007)	(0.005)	(0.001)

Sources: Matched DADS files and LIFI survey; groups owning affiliates in different locations (commuting zones) for at least one year between 1993 and 2011.
Note: All regressions include group level fixed effects, as well as dummy variables describing in which region the group operates, interacted with years (to capture local market conditions). Regressions also include the logarithm of the total number of sites (HQ and affiliates) as well as group level exports in total sales to capture the business cycle on international markets.

In terms of our indicator of main interest, travel times, the most robust pattern is the negative relationship that is obtained between travel times and profit margin across all industries. Table 8 provides the associated orders of magnitude using the same counterfactual exercise as in section 5.2: we obtain that if multi-location groups active in 2011 could not rely on HSR for some reason and only used the 1980 rail network, then their profit margin would decrease by 0.5 percentage point on average (and even by 2 percentage points in the transport industry), which is sizable. The correlation obtained between investment and travel times is also consistently negative, which is consistent with Giroud (2013), but results are only significant in the retail, trade and transport industries. Last, we obtain a negative relationship between travel times and group size as

[39]Market conditions have much more explanatory power in the regressions modeling affiliate reshuffling of appendix G.
[40]Note however that it does not imply that *total profits* of geographically dispersed groups are lower: by revealed preferences, if such structures exist, then the converse is necessarily true.

Table 8: Magnitudes at the Group Level: Operational Impact of HSR as of 2011
1993-2011, corporate groups which are geographically dispersed only

Average gain per group			Manuf. Indus. (1)	Person. Serv. (2)	Retail, Trade (3)	Bus. Serv. (4)	Transp. (5)
Nb groups	**number**		2,723	1,303	4,527	5,216	869
benef. from HSR	**share**		0.461	0.333	0.363	0.513	0.527
Average travel time	**in 2011**		2.544	2.447	2.242	2.406	2.858
to HQ	**with 1993 network**		2.811	2.704	2.494	2.710	3.232
	with 1980 network		3.384	3.287	2.966	3.402	3.972
Employment	**2011 / 1993**	**jobs**	3.082*	4.456***	2.134***	-6.193***	-4.031*
		ppt	0.007*	0.019***	0.012***	-0.025***	-0.015*
	2011 / 1980	**jobs**	11.031*	16.706***	7.777***	-20.174***	-14.062*
		ppt	0.022*	0.062***	0.036***	-0.082***	-0.045*
Investment	**2011 / 1993**	**k€**	114	27	51***	7	2488***
		ppt	0.010	0.016	0.037***	0.004	0.087***
	2011 / 1980	**k€**	429	103	194***	36	5136***
		ppt	0.031	0.054	0.106***	0.015	0.258***
Profit margin	**2011 / 1993**	**ppt**	0.002**	0.003*	0.003***	0.002**	0.006***
	2011 / 1980	**ppt**	0.006**	0.008*	0.008***	0.007**	0.019***

Sources: Matched DADS files and LIFI survey; groups owning affiliates in different locations (commuting zones) for at least one year between 1993 and 2011. Magnitudes are computed using estimates reported in table 7.

measured by value added or employment in the manufacturing, personnel services and retail and trade industries. In those sectors, point estimates that are obtained for value added are consistently higher than those obtained for employment, which implies that higher travel times are associated with lower labor productivity - or conversely, that reduced travel times allow managerial organizations to be more efficient and parsimonious in labor. In the business services and transport industries, we do not obtain negative correlations between group size and travel times, but the result for labor productivity still holds.[41]

To conclude, table 9 provides a simple test at the headquarter level of the overall delegation story that was suggested by regressions at the affiliate level. More precisely, we check that the geographical dispersion of corporate groups is associated with fewer administrative workers, and more precisely fewer high-skilled managers at HQs relative to affiliates, which would be consistent with increased delegation of authority to local managers of affiliates when travel times are higher. The obtained patterns are fully consistent with this hypothesis in all industries. Furthermore, point estimates are higher than those that were reported for adjustments at the affiliate level in table 2: this would imply that the downward adjustments in managerial resources at remote affiliates induced by decreases in communication costs are more than compensated by the symmetric adjustments in managerial resources at headquarters.

7 Conclusion

In this paper, we documented the impact of travel time between affiliates and headquarters for the population of French geographically dispersed corporate groups on the management of such business organizations. We used the expansion of the High Speed Rail network as an arguably exogenous shock on internal travel times and obtained that reduced travel times are associated with increases in affiliates size and foster functional

[41] In the business services and transport industries, we actually obtain a positive correlation between size and travel times, which could be driven by a particularly strong productivity effect.

Table 9: Spatial Dispersion and the Balance of Managerial Jobs at HQ *vs.* Affiliates
1993-2011, corporate groups which are geographically dispersed only

Managerial jobs at HQ:	**Total (ln)**		**Share in total managerial jobs**		**High-skilled (ln)**		**Share of high-skilled**	
	Travel time (1)	**Spatial disp. (2)**	**Travel time (3)**	**Spatial disp. (4)**	**Travel time (5)**	**Spatial disp. (6)**	**Travel time (7)**	**Spatial disp. (8)**
Manufacturing ind.	-0.045**	0.004*	-0.012***	0.004***	-0.095***	-0.009***	-0.026***	0.000
(225,942 obs.)	(0.018)	(0.002)	(0.004)	(0.000)	(0.018)	(0.002)	(0.005)	(0.001)
Personnel services	-0.114***	-0.034***	-0.041***	-0.011***	-0.163***	-0.046***	-0.027***	-0.008***
(131,829 obs.)	(0.038)	(0.004)	(0.008)	(0.001)	(0.048)	(0.005)	(0.009)	(0.001)
Retail and trade	-0.085***	-0.018***	-0.035***	-0.004***	-0.167***	-0.025***	-0.022***	-0.001***
(406,310 obs.)	(0.016)	(0.002)	(0.004)	(0.000)	(0.017)	(0.002)	(0.005)	(0.001)
Business services	0.001	-0.009***	-0.040***	-0.003***	-0.057***	-0.019***	-0.025***	0.001*
(249,263 obs.)	(0.016)	(0.002)	(0.003)	(0.000)	(0.018)	(0.002)	(0.005)	(0.001)
Transport	0.010	0.008**	-0.008	0.008***	-0.041	-0.009**	-0.019**	0.000
(52,936 obs.)	(0.029)	(0.004)	(0.007)	(0.001)	(0.033)	(0.004)	(0.008)	(0.001)

Sources: Matched DADS files and LIFI survey; groups owning affiliates in different locations (commuting zones) for at least one year between 1993 and 2011.
Note: All regressions include group level fixed effects, as well as dummy variables describing in which region the group operates, interacted with years (to capture local market conditions). Regressions also include the logarithm of the total number of sites (HQ and affiliates) as well as group level exports in total sales to capture the business cycle on international markets.

specialization, particularly in the service industries where information to be transmitted is arguably softer (Petersen and Rajan, 2002). Results are however also significant in the trade and manufacturing industries, but point estimates are lower. Our estimates allow to quantify the impact of the expansion of the HSR network on the management of remote affiliates: we obtain that for the average affiliate benefiting from the infrastructure, moving back to the 1980 rail network without HSR would induce a shift of roughly one job from administrative to operational activities in service industries (with the associated increase in the productive capacity of the considered affiliate), against 20% of a job in other industries (retail, trade or manufacturing). We also obtain that affiliates in the manufacturing and business services industries experienced decreases in production labor costs, of around half the cost of a production job for the average affiliate. At the group level, our regressions suggest that the impact on the operational profit margin ranges from 0.5 to 1.5 percentage points depending on the industry.

We think our analyzes provide precise evidence about the nature of the managerial costs implied by the geographic dispersion of corporate groups, but leave several questions open. First, our descriptive analyzes of affiliate openings and closures suggest that the question of the relationship between communication costs and the decisions relating to corporate groups' overall geographic organization is most likely a fruitful domain of research. We leave the thorough rigorous economic and econometric treatments of these aspects for future research. Second, we focused in this paper on within group, HQ to affiliate communication. Natural extensions of our work would consider communication between affiliates, and more importantly, communication with external stakeholders, such as: suppliers and customers as in Bernard et al. (2015) and investors (banking relationships as in Bernstein et al. (2015), access to public programs, etc.). These aspects could drive large productivity and profitability impacts as well.

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Appendices

A The Business Travels of Managers: HSR or Air?

A.1 Managers Represent a Significant Share of the Customers HSR

Table 10 is constructed from the most recent survey data about transports and provides a breakdown of the clients of each mode of transportation in 2008[42]. It shows that most HSR travels have a private motivation, with only 35% of them having a business motivation - which is a lower share than in the case of air or standard rail travels. However and strikingly in the case of HSR, this contribution of business travels to total HSR traffic is largely driven by managers: they account for 20% of *total* HSR domestic travels, and to more than half of *business* HSR travels. Altogether, these figures suggest that managers, despite their low weight in the workforce (typically 9 to 10%) are a non-negligible segment of HSR customers, in particular among "business" customers.

Table 10: Break-down of Long Distance Domestic Travels by Main Purpose, in 2008
For each mode of transportation, by type of user (%)

Main purpose:	Private Trips			Business Trips	
Type of users:	All	*(High income)*	*Managers*	All	*Managers*
Car	86	*(33)*	*10*	14	*5*
HSR	65	*(29)*	*11*	35	*20*
Other Rail	46	*(13)*	*5*	54	*19*
Bus	89	*(20)*	*1*	12	*1*
Air	54	*(28)*	*14*	45	*32*

Sources: SOES, Transport and travel survey, 2008.
Note: This survey was collected at the household level. Income is measured at the household (not respondent) level. "High income" corresponds to the top quartile of the income distribution (total household income, normalized by units of consumption). The category "Managers" describes the occupation of the respondent.
Managers account for 20% of all HSR trips. This represents 20/35 = 57% of HSR business trips.

The disproportionate contribution of managers to HSR travels is first driven by the fact that they travel more in absolute terms: they contribute more to business travels, whatever the mean of transportation, than their relative weight in the workforce. Second, their contribution is even more disproportionate for means of transportation dedicated to long distance travels: HSR and planes.

A.2 The Market Share of HSR for Long Distance Business Travels: 1994 *vs.* 2008

Table 11 investigates what is the precise "market" of HSR, and what are its main competitors[43]. First, the market share of HSR is highest, among domestic business travels, for the longest trips: it reaches 42% on the segment of very long distance travels (longer than 800km), on which airlines capture the second largest market share (33%). For travels of intermediate length, the market share of HSR is still of 24%, but the contribution of other rail is larger (31%), while it is negligible in the category of the longest trips. Symmetrically, air becomes a residual category in the range of travels of intermediate length. Altogether, these results suggest that over the recent period, HSR is one of the most popular mean of transportation for the longest domestic business travels.

Table 11 also provides some information about market shares at an earlier period, 1994, which corresponds to the beginning of our period of observation. It shows that the extension of the HSR network and its wider availability was

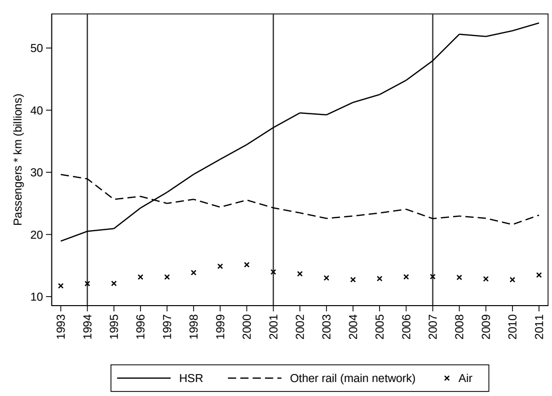
[42]For homogeneity concerns, we restrict the analysis to domestic trips, since in this paper we focus on domestic HSR routes.
[43]Unfortunately, the sample size of the survey does not allow to analyze the break-down of managers' travels by distance in a statistically meaningful way, especially for the shortest trips. Therefore, we only provide a description of the aggregate of all business travels and assume that the discrete choice patterns of managers does not deviate too much from them (which for the longest trips at least is a reasonable assumption).

Table 11: "Market Share" of Each Mode of Transportation by Market Segment
Domestic Business Travels Only

	Market shares in 1994					Market shares in 2008				
Distance:	<200km	200 to 800km	> 800km	all	all	<200km	200 to 800km	> 800km	all	all
Weight:	trips	trips	trips	trips	km	trips	trips	trips	trips	km
Car	77	62	17	68	56	76	37	15	56	42
HSR	0	19	12	8	14	2	24	42	13	26
Other Rail	21	11	9	16	12	21	31	9	25	20
Bus	1	2	7	2	2	1	2	0	1	2
Air	0	6	43	5	13	0	6	33	4	10
Not answered	1	1	11	2	3	0	2	0	1	1
Total	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Sources: Insee, Transport and communication survey, 1994, and SOES, Transport and travel survey, 2008.
Note: Both surveys are collected at the household level.
In 2008, HSR travels account for 13% of all trips (26% when weighted by distance), while air travels account for 4% of all trips (10% when weighted by distance).

Figure 6: Market Shares of Rail and Air for the Passenger Market
Business and Non-Business, 1993 - 2011



Sources: compiled by SOeS - Ministry in charge of Transports from rail operators and DGAC.

accompanied by large gains in market shares. This fact is further confirmed by figure 6, which shows that HSR traffic experienced a steep growth while traffic by air and standard rail did not increase much.

This large market penetration by HSR is consistent with the fact that HSR was adopted quickly by a significant share of professional users when it was introduced as a new transportation device.

A.3 Further Evidence from the Evolution of the Airline Industry

This section documents the aggregate evolution of the airline industry over our period of study: in spite of a structural liberalization episode between 1994 and 2000, the evolution of the industry did not affect massively the options available to managers for their business travels during the period.

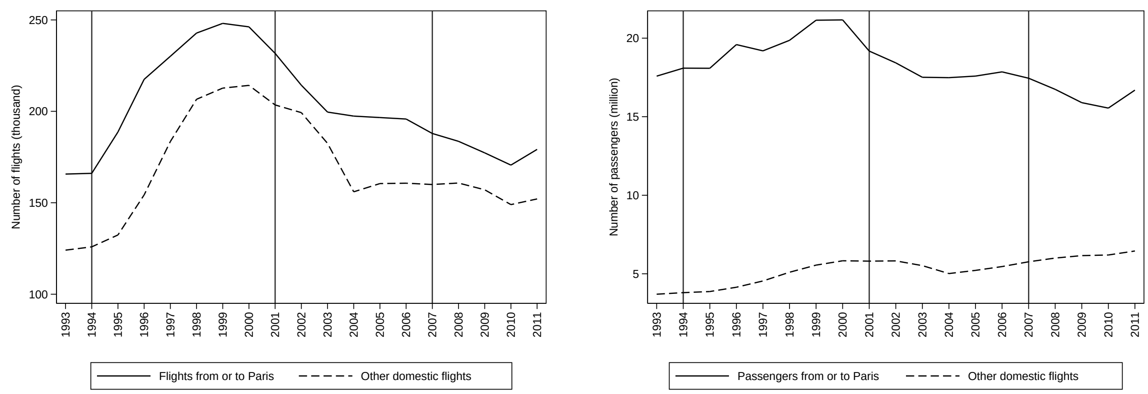
The airline industry was marked by an important liberalization episode between 1994 and 2001[44], which witnessed the entry of several airlines on the French market (including the domestic market), and the global increase of the

[44]For a description, see for example the report to the French Senate Senate (2001).

supply of domestic flights. This pattern is documented on figure 7, which shows that while entry (and the supply of new flights) increased steeply between 1994 and 2000 (panel (A)), the number of air passengers however did not follow the same pattern and remained almost stable over the period (panel (B)). Due to a lack of demand, the number of domestic flights decreased quickly between 2000 and 2004, to go back to the supply level of 1993. Figure 6 shows that in contrast, transport by rail experienced a massive increase over the period, with implied volumes that are several orders of magnitude larger than total air traffic (as measured by total number of passengers, even when weighted by distance traveled).

Figure 7: Supply and Demand in the Airline Industry, 1993 to 2011

(A) Number of domestic flights (capacity supplied) (B) Passengers of domestic flights

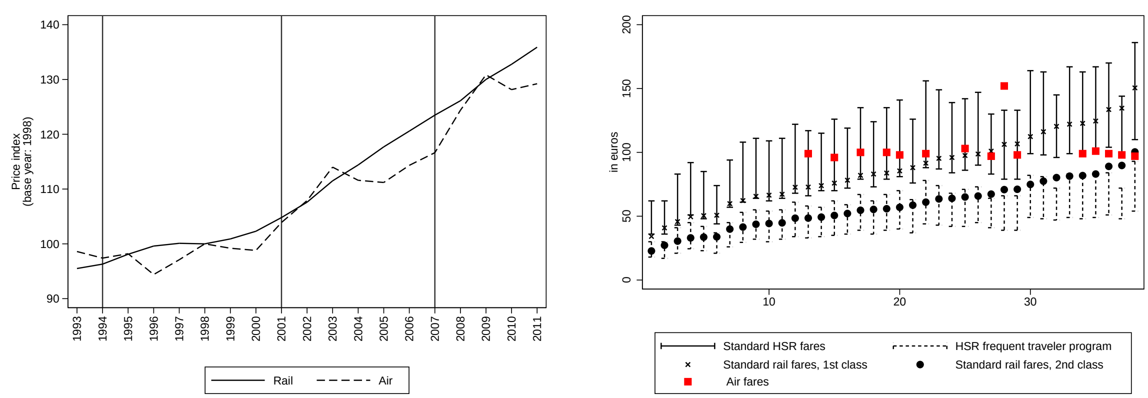


Sources: *Flux de Trafic Commercial (Commercial Traffic Flows), 1986 - 2013*, DGAC (published in June 2014).

Figure 8: Prices of Transport by Rail and Air, between 1993 and 2011

(A) Aggregate Consumption Price Indices Computed by the Statistical Institute *(base year 1998)*

(B) Selected Prices Posted Online as of March 2015 for 38 Destinations with Departure from Paris



Sources: Panel (A): French National Statistical Institute (Insee).
Panel (B): Online available prices as of March 2015, for 38 selected destinations (with departure from Paris) sorted by distance: Reims, Arras, Le Mans, Tours (St-Pierre-Des-Corps), Lille, Valenciennes, Dijon, Angers St-Laud, Metz, Poitiers, Nancy, Mâcon-Loché TGV, Rennes, Besanon-Viotte, Nantes, Niort, Lyon Part-Dieu, Angoulême, Lyon St-Exupéry TGV, Strasbourg, La Rochelle, Mulhouse, Valence TGV, Chambéry Challes-les-Eaux, Annecy, Grenoble, Bordeaux St-Jean, Lorient, Brest, Avignon TGV, Nîmes, Dax, Aix-en-Provence TGV, Montpellier, Marseille St-Charles, Toulon, Toulouse-Matabiau, Nice. Air fares are retrieved from the website of Air France (Hop!), the leading airline company.

These patterns are suggestive of the fact that in spite of the liberalization episode, airlines did not actually gain large market shares over other means of transportation, in particular rail. Figure 8 shows that there was no huge change in the relative price advantage of airlines over rail, neither over our period of analysis (given the parallel evolution of the two respective price indices), nor today (when comparing fares for selected destinations). Over the recent period, the number and frequency of connections by air is lower than the number and frequency of connections by rail, and many destinations served by HSR are simply not served by airlines.

A.4 Discussion of Potential Biases

What is the likely impact of overlooking air connections in our computations of travel times? If anything, this should produce an attenuation bias, which we expect to be small given the previous developments. More precisely:

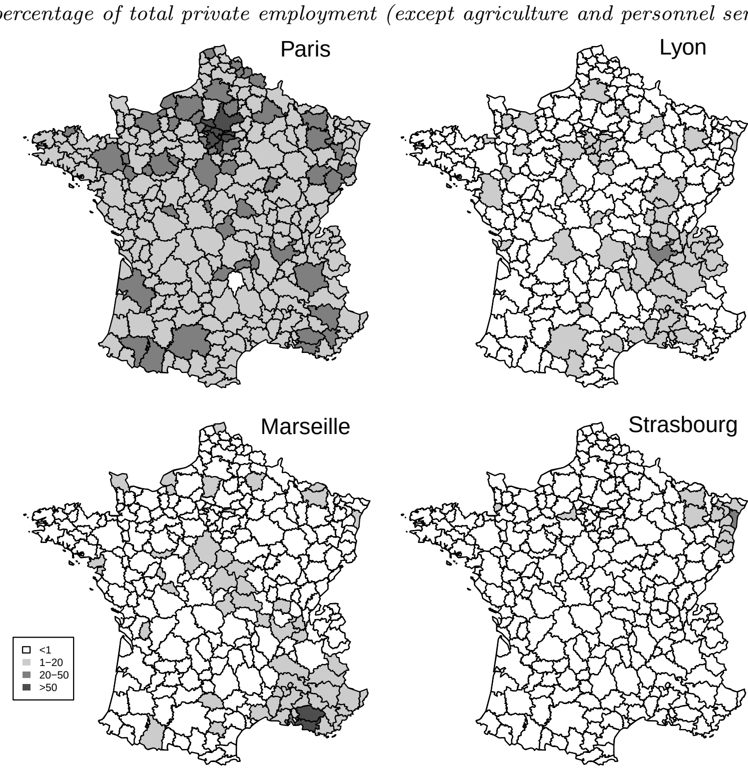
- Whenever managers use air connections (be they new or not) rather than rail, then HSR travel time reductions are irrelevant, which generates attenuation bias in our setting.
- When airline connections appear (resp. disappear), then managers' demand might reports to air (resp. rail) in absence of rail travel time reduction. Travel time might change (increase or decrease) in absence of HSR travel time variation, which would also generate attenuation bias in our setting.
- When airline closures are related to HSR line openings, then actual travel time might decrease by less than what we compute, or even increase. This would also generate attenuation bias in our setting.
- Amplification biases could be generated by airline openings as *simultaneous* responses to the opening of new HSR lines, in association with shorter travel times by air than by rail. We however think that these events were relatively rare. Furthermore, these upward biases are most likely low if travel time achieved by HSR is close to travel time by air (including access to airport or train station, see the discussion in section 3).

B Remote Corporate Control in France: the Disproportionate Weight of Paris

Figure 9 provides a break-down of the indicator of figure 2 (section 3.1) and describes in each commuting zone, the share of employment under control of HQs located respectively in Paris, Lyon, Marseille or Strasbourg. The main take-away of this comparison is the disproportionate weight of Paris in terms of corporate control. In terms of geographical range, the map shows that its sphere of "corporate influence" is particularly wide ranging, since most of the territory is reached by Parisian headquarters. Lyon and Marseille also reach very distant areas, but only occasionally and with a lower weight in terms of local employment.

Figure 9: Sphere of "Corporate Influence" of 4 of the Largest French Cities, in 2011

Share of private employment in each zone that is under control of HQs located in the respective cities in percentage of total private employment (except agriculture and personnel services)



Sources: Matched DADS files and LIFI survey, covering the private sector (except agricultural activities and workers of the personnel service industries directly employed by households).
Notes: the four maps describe the share of private employment in each "employment zone" that is under control of HQs located, respectively, in Paris, Lyon, Marseille or Strasbourg (i.e. the sphere of "corporate influence" of these four large French cities.

C Computation of Rail Travel Times

This section describes the construction of rail travel times between headquarters and affiliates. We relied on a two-step procedure:

- First, we simplify the network of trains stations and select only one "main station" by commuting zone.
- Second, we collected and constructed time tables for the resulting list of 316 stations.

Rail travel time between an affiliate and its headquarters is then measured by rail travel time between the respective "main stations" of the commuting zones where they are located. Travel time between headquarter or affiliate and "main station" is neglected for two reasons:

- It is typically short, and it does not vary over time (while our identification strategy typically relies on *variations* in travel times - see section 4).
- Furthermore, managers who are asked to travel for professional reasons might depart from home rather than from work: in such cases, travel time between headquarter or affiliate and "main station" is not the relevant quantity. In absence of precise information about the location where managers live, and from which station they might depart, the main station in each commuting zones is by construction[45] the best statistical guess we can get about it.
  This fact therefore also motivates our choice to allocate each headquarter and affiliate to the main station in their commuting zone, although the alternative of choosing the closest station is discussed in detail in section C.3 below (it does not make much difference since the two candidate stations under each alternative are typically very close).

C.1 Selection of the "Main Station(s)" in Each Commuting Zone

We select a set of 316 "main stations", among the set of stations which existed in 1993, using the following criteria:

- In cases where only one station in the considered commuting zone is served by HSR, we select it as its "main station".
- In cases where several stations in the considered commuting zone are served by HSR, we select the station having the highest long distance traffic using an adequate score based on the number of long distance services that are available in each station.[46]
- In cases where none of the stations in the considered commuting zone is directly served by HSR, we select the station having the highest long distance traffic score.
- In the rare cases of ties, we select the station located in the most populated municipality.
- Stations that were specifically built to accommodate HSR services during our period of estimation replace the previous "main station" in their employment zone from the date they enter into service.
  Overall, these "new HSR stations" have a large impact on rail travel times.[47]

C.2 Time Tables Between "Main Stations"

We then collected past and current timetables in order to recover the fastest train service between any two directly connected "main stations":

- Travel times for train services which remained "local" over the entire period (i.e. those implying no HSR service) were simply approximated by the 2013 timetables, which are available on the open-data platform of the national rail company.

[45] Commuting zones are defined "as the geographical area within which most of the labor force lives and works, and in which establishments hire most of their workforce".

[46] To be more precise, we computed traffic scores as of 2013 (for data availability reasons), based on the total number of services available in each station, but giving less weight to services with many local stops. The score is computed as the sum of the squared average distance between any two consecutive stops for each service available in the considered station.

[47] Which legitimates the investment required by their construction...

- For long distance services, we relied on rail fan web sites and the archives of the national rail company, as well as on the evaluation reports of the French Ministry for Transportation (LOTI reports). These sources enable us to assess train travel times both *before* and *after* HSR line openings.

The obtained database contains travel times between any two directly connected stations, at any date between 1980 and 2013[48]. We then complement it with travel times between any two *indirectly* connected stations, assuming that each train change takes 15 minutes (a rather lower bound).

C.3 Discussion

In table 12, we compare travel times obtained with our baseline procedure, where we allocate each affiliate or headquarter to the main station in their respective commuting zone, with an alternative procedure where we allocate each affiliate or headquarter to the closest main station (not necessarily located in the same commuting zone). The main take-away of this table is that *absolute* travel times are somewhat altered by this alternative choice of measurement, since the average discrepancy for treated affiliates is 12 minutes (while the median is only 2 minutes). However, *changes (reductions)* in travel times are far less affected, since they only occur via new HSR line openings and therefore fundamentally rest on stations served by HSR, which are the same in the two procedures. The precise distribution of these changes in our estimation sample is plotted on figure 10.

Table 12: Travel Times with Alternative Computing Procedures

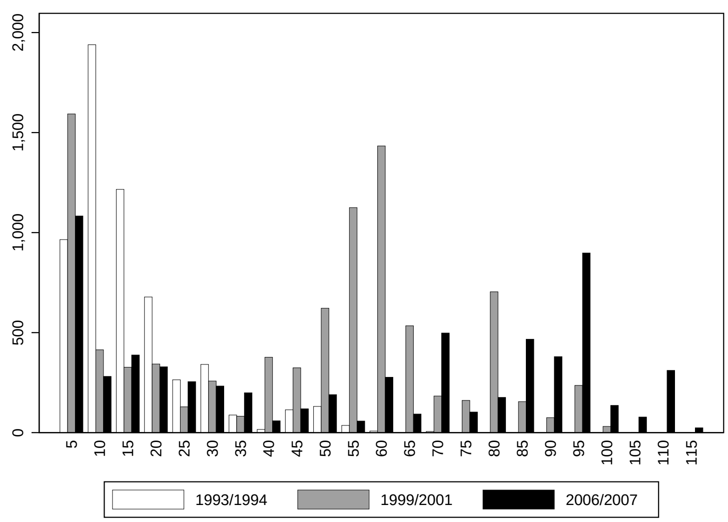
Affiliates × years	**No travel time change in our sample**			**Reduction in travel time in our sample**		
Computation of travel time from/to:	Com. Zone	Closest	Difference	Com. Zone	Closest	Difference
Distance to HQ (km)	160		-	450		-
HQ in Paris	29%		-	36%		-
Comparison of computing procedures:						
Same zone (station) as HQ	42%	40%	(4%)	0%	0%	(0%)
Travel time after change (minutes)	95	98	7	232	240	12
Variation in travel time (minutes)	0	0	0	35	32	6
Share of firms with travel time change	0%	0%	(0%)	100%	81%	(19%)
Share of aff. benefiting from HSR service	33%	32%	(2%)	100%	96%	(4%)
Share of new HSR users	0%	0%	(0%)	19%	16%	(5%)
Direct track	72%	68%	(7%)	47%	37%	(13%)
1 change	14%	16%	(8%)	25%	26%	(16%)
2 changes or more	12%	15%	(4%)	28%	37%	(11%)

Sources: Matched DADS files and LIFI survey; affiliates (see section 3.1 for definition) which are part of multi-location groups between 1993 and 2011.
Notes: The classification in columns between affiliates × years experiencing (or not) changes in travel times is based on the computation of travel time between commuting zone which is actually used in our regressions. Notice that around 40% of the affiliates × years experiencing no change in travel time are located in the same commuting zone as their headquarters. For the 60% which are not located in the same commuting zone as their headquarters: average distance to HQ is 273km, average travel time (between employment zones) is 162.3 minutes, and the share of direct tracks (between employment zones) is 52.5%.

[48] This time span encompasses our period of analysis and enables us to run the "placebo" robustness checks presented in section **??**.

Figure 10: Distribution of travel time reductions at main dates of HSR line openings

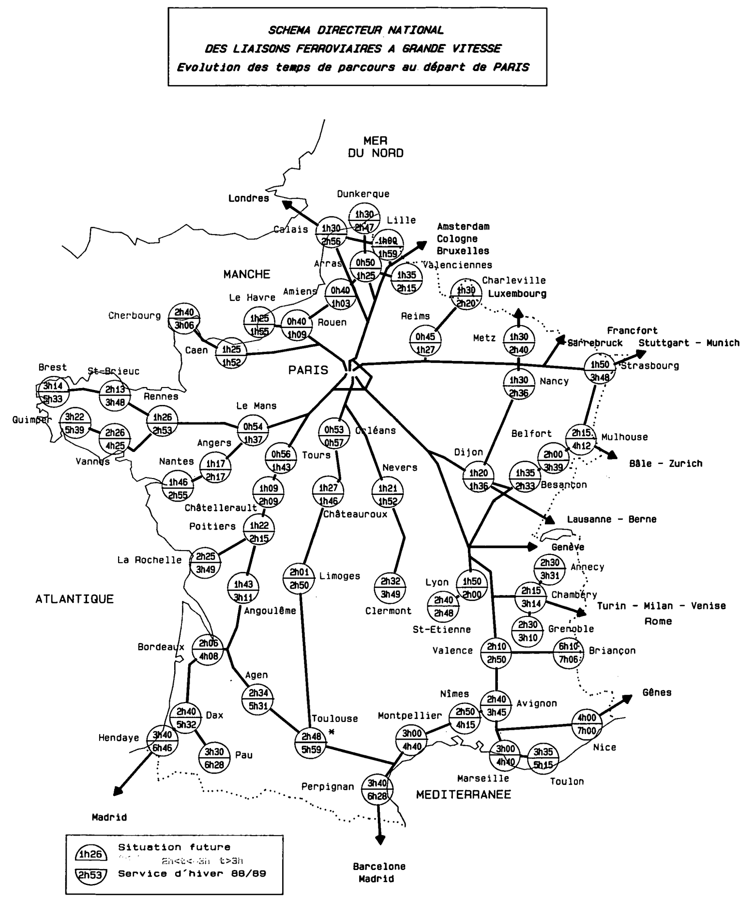
Northern line (1993/94), connection to Marseille (2000/01) and Eastern line (2006/07)



Sources: Matched DADS files and LIFI survey; affiliates (see definition in section 3.1) which are part of multi-location groups between 1993 and 2011.
Note: Values are expressed in minutes. Firms which did not experience any change in rail travel time at the respective dates were excluded: observations in the bin labeled by “0” correspond to strictly positive travel time reductions, but that are smaller than 5 minutes.

D Map from the 1991 Governmental Blueprint Document

Figure 11: Map of the HSR Lines Proposed in the 1991 Governmental Blueprint Document



Sources: Ministère de l'Équipement (1991), French Ministry for Equipment.

E Details of the Estimation Method (Guimaraes and Portugal, 2010)

The principle of the estimation method is to iterate on three sets of normal equations that are conveniently defined. Let us first rewrite equation 2 in matrix format as:

$$\underbrace{Y}_{y_{ijlt}} = \underbrace{X\ B}_{\beta.T_{ijt}+\gamma.X_{(ij)lt}} + \underbrace{D_I\ A^I}_{\alpha_{ij}} + \underbrace{D_{LT}\ A^{LT}}_{\alpha_{lt}} + \underbrace{\epsilon}_{\varepsilon_{ijlt}} \tag{5}$$

where X is a vector encompassing our *continuous* treatment variable and additional *continuous* explanatory variables (typically group exposure to international demand conditions, i.e. export intensity), D_I is the vector of the affiliate level dummies (α_i), D_{LT} the vector of the commuting zone $\times$ year dummies (α_{lt}), B, A^I and A^{LT} are the corresponding parameters to be estimated. The three sets of normal equations are defined as follows:

$$\left(\begin{array}{c} B = (X'X)^{-1}X'(Y - D_I\ A^I - D_{LT}\ A^{LT}) \\ A^I = (D_I'D_I)^{-1}D_I'(Y - X\ B - D_{LT}\ A^{LT}) \\ A^{LT} = (D_{LT}'D_{LT})^{-1}D_{LT}'(Y - X\ B - D_I\ A^I) \end{array}\right)$$

The algorithm is initiated at $A^I_{(0)} = 0$ and $A^{LT}_{(0)} = 0$. The first of equation provides the first estimated value for $B_{(1)}$, which is plugged into the second set of equations to get $A^I_{(1)} = A^I_{(1)}\left(B_{(1)}, A^{LT}_{(0)}\right)$. Then $B_{(1)}$ and $A^I_{(1)}$ are plugged into the third set of equations to get $A^{LT}_{(1)}$. This procedure is iterated until the sum of squared residuals no longer decreases.

The benefit of the decomposition of normal equations into the three sets above is that it renders the estimation computationally tractable. Only the first set of equations requires an actual matrix inversion, but it is of relatively low dimension. It can be performed by simple OLS on the modified dependent variable $Y - D_I\ A^I_{(n-1)} - D_{LT}\ A^{LT}_{(n-1)}$. The two last sets of equations simply correspond to the computations of means: of the variable $(Y - X\ B_{(n)} - D_{LT}\ A^{LT}_{(n-1)})$ by affiliate across years (classes generated by D_I), and of the variable $(Y - X\ B_{(n)} - D_I\ A^I_{(n)})$ by commuting zone $\times$ time across affilaites (classes generated by D_{LT}). This algorithm, which consists in iterating sequentially across each set of equations, falls into the class of so-called "partitioned" algorithms ("zigzag" iterations) which has been analyzed in full length by Smyth (1996): while the iteration process is slow in general (unless covariates are orthogonal, but this is not the case in our setting), the zigzag iteration is found to admit a global convergence result.

To compute the correct standard errors associated with the estimate of B, Guimaraes and Portugal (2010) apply a result derived by Abowd et al. (2002), who show that the total number of identified "fixed" effects is given by $N^I + N^{LT} - G$, where G is what they call (in their application) the number of "mobility groups" (classes) generated by the two sets of fixed effects, D_I and D_{LT}. In our case, this simply corresponds to the partition by geographical zones, i.e. $G = L$. The formula for the computation of standard errors is then given by:

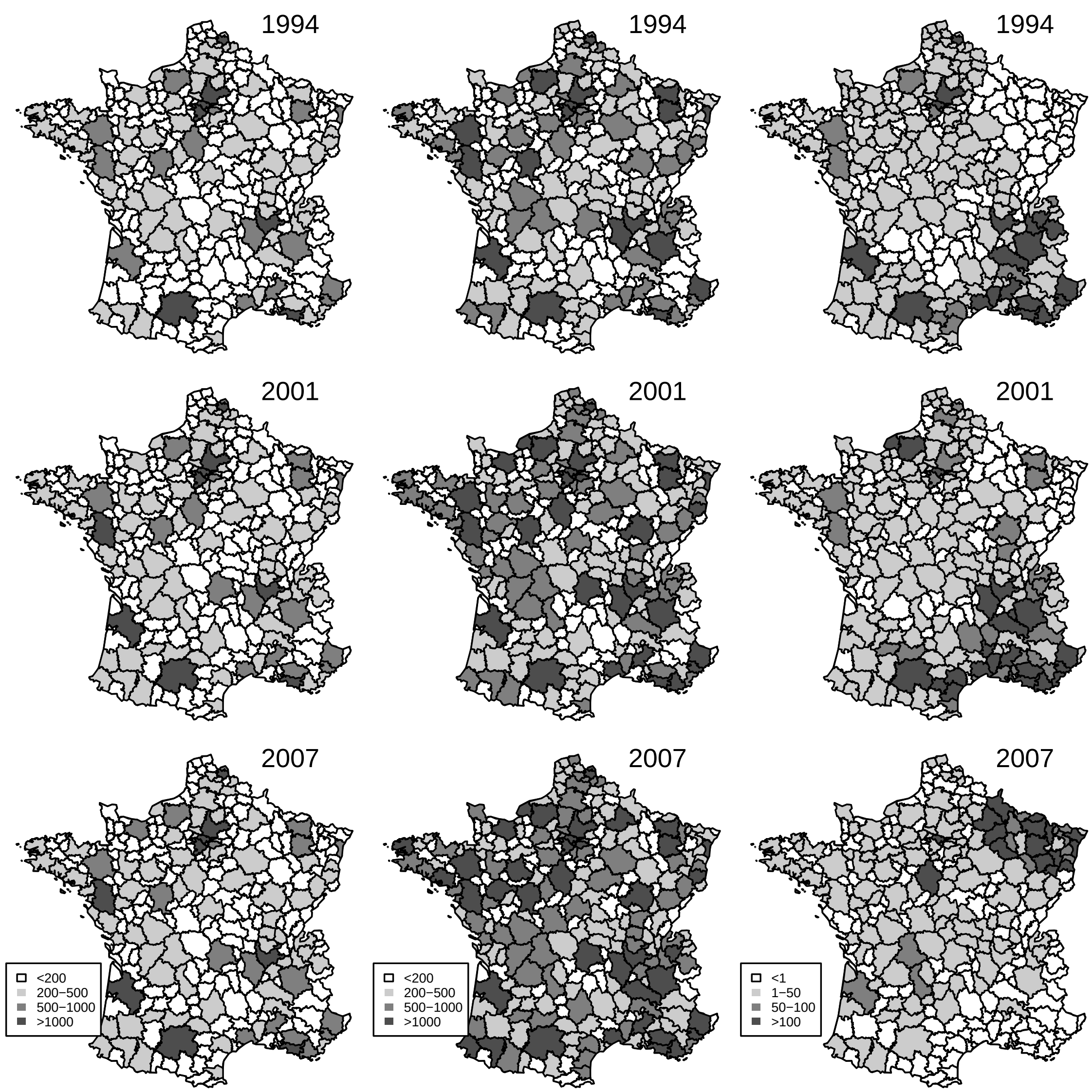
$$V(\widehat{\beta}) = \frac{SSR}{(N - N^X - N^I - N^{LT} + L).N.s^2_{\text{time}}.(1 - R^2_{\text{time}})}$$

where N is the total number of observations, N^X is the number of variables in X, N^I is the number of affiliates and N^{LT} is the number of commuting zones $\times$ time. Last, s^2_{time} is the sample variance associated with the travel time variable and R^2_{time} is the coefficient of determination obtained from a regression of travel time on all other remaining explanatory variables.

F Geographical Repartition of the Estimation Sample

Figure 12: Localization of Business Units Benefiting from Rail Travel Reductions
Estimation Sample (Population)

(A) Headquarters	*(B)* Affiliates	*(C)* Affiliates benefiting from that year's HSR line opening



Sources: Matched DADS files and LIFI survey; business units (HQs or affiliates - see section 3.1 for definition) which are part of multi-location firms between 1993 and 2011.
Note: The different dates correspond to the opening date of the Northern line (1993/1994), of the connection to Marseille (2000/2001) and to the opening date of the Eastern line (2006/2007).

G Descriptive Analysis of the Extensive Margins

If proximity between affiliates and headquarters facilitates monitoring and information transmission, one might expect that it also matters on the "extensive margin", for affiliate creations and destruction. These events are not explicitly taken into account in our main regression framework of section 4, although in practice they are well captured by the affiliate level fixed effects (which "purge" regressions from most of the selection bias which could arise). A thorough econometric treatment of these events would require the specification of a discrete choice model of implantation across commuting zones, which would not fit our identification strategy. We therefore leave this aspect for future research but propose as in Giroud (2013) a series of regressions describing the relation between affiliate creation or destruction and travel time.

G.1 Affiliate Creations

Table 13: Travel Time and the Reshuffling of Affiliates: Characteristics of Entries
1993-2011, affiliates of multi-location corporate groups only

Dependent variable:	**Distance (ln) (1)**	**Travel time (2)**	**HSR (to HQ) (3)**
Distance (ln)	-	-	0.155***
			(0.000)
Employment of affiliate	-0.058***	-0.033***	0.006***
(ln)	(0.002)	(0.002)	(0.000)
Gains in travel times	0.084***	-0.002	-0.002***
at other affiliates	(0.003)	(0.004)	(0.001)
Affiliate entry(ies)	-0.124***	-0.153***	-0.113***
in same group(dummy)	(0.009)	(0.012)	(0.002)
Affiliate exit(s)	-0.127***	-0.081***	-0.000
(dummy)	(0.009)	(0.012)	(0.002)
Other affiliates are HSR users	1.960***	1.693***	0.117***
	(0.008)	(0.011)	(0.002)
Total number of affiliates in group	0.046***	0.056***	0.011***
(ln)	(0.002)	(0.002)	(0.000)
Mean (un-logged) dependent variable	272	2.872	0.504
Observations	323,689	323,689	323,689

Sources: Matched DADS files and LIFI survey; affiliates (see definition in section 3.1) which are part of multi-location groups between 1993 and 2011.
Note: All regressions include industry (2 digits) × local (commuting zone) × time fixed effects to control for the local market conditions, as well as (4digit) industry dummies. Regressions also include the (ln) number of affiliates in the group as well as the group level exports in total sales to capture the cycle on international markets.

Our treatment of affiliate creations follows Giroud (2013). We simply choose to describe the characteristics Z_{ijlt}^{CREA} of the new affiliates[49] and investigate whether geographic distance, travel time or (conversely) the availability of HSR on the track to headquarters are related to different characteristics of the group which might also "tap" into the scarce HQ managerial resources that are to be shared across all affiliates: the size of the created affiliate, the total number of affiliates within group, *etc.* (X_{ijt}). The estimated equation writes:

$$Z_{ijlt}^{CREA} = \alpha_{lt} + \gamma . X_{ijt} + \varepsilon_{ijlt} \tag{6}$$

In this equation, commuting zone × time fixed effects (α_{lt}) are still identified and allow to control very precisely for local shocks.

Results are reported in table 13. We obtain that larger affiliates, which are likely to be more difficult to manage remotely (or for which the "size of stake" might be larger) tend to be created closer to their headquarters, whatever

[49] Affiliate "creation" correspond to actual creations or to acquisitions in our setting. We only consider affiliate creation in pre-existing groups, which were furthermore already operating in the same industry (to abstract from global market entry decisions).

the indicator of distance. Similarly, when other affiliates experienced gains in travel time, thus freeing some HQ managerial resources, then affiliates tend to be created at a greater distance, and they are less likely to be created at proximity of the HSR network. This suggests that when more managerial resources become available, then the trade-off underlying the location choice of affiliates (between higher gains from local market proximity and higher managerial costs from geographical dispersions) shifts in favor of market proximity. Last, affiliate churning (creation but also destruction), which might be demanding in terms of headquarters' managerial resources, are both negatively correlated with distant affiliate creations. Un-reported regressions show that all of these results also hold industry by industry.

G.2 Affiliate Destruction

For affiliate destruction, we propose a more powerful treatment which is a direct extension of the regression framework in section 4:

$$EXIT_{ijlt} = \alpha_j + \alpha_{lt} + \beta.T_{ijlt} + \gamma.X_{jt} + \varepsilon_{ijlt} \tag{7}$$

where $EXIT_{ijlt}$ is a dummy variable indicating that the considered affiliate is exiting from the group[50] and notations are otherwise similar to those in equation 2. The main difference with equation 2 is however that the inclusion of affiliate × group fixed effects would capture too much heterogeneity because affiliates are on average present for only 3.2 years in our panel. We therefore replace the affiliate × group fixed effects in equation 2 with group level fixed effects, which preserve the identification of the β coefficient from variations in travel time. As previously, commuting zone × time fixed effects (α_{lt}) are still identified and allow to control very precisely for local shocks. Equation 7 is then estimated as a linear probability model, using the same estimation procedure as in section 4.1, and obtained results are presented in table 14.

We obtain that everything else equal, more distant affiliates (in terms of travel times) have a higher probability to be terminated, either because they are more difficult to manage and/or because they are less profitable - or simply because they are also "politically" distant (Bassanini et al., 2015). These correlations tend to be higher in business service industries, where they could explain around 5 percentage point for the average travel time (2 hours). This remains a small part of the entire share (47%) of exits to be explained in this industry. We also obtain that affiliates who benefited from gains in travel time thanks to the HSR network expansion were less likely to get terminated, while the probability of closure was also highly significantly reduced by gains at other affiliates, which tends to confirm the resource constraints story in section 5.5.

Table 14: Travel Time and the Reshuffling of Affiliates: Exits
1993-2011, affiliates of multi-location corporate groups only

Dependent variable: probability of exit	**Manufacturing Industries (1)**	**Personnel Services (2)**	**Retail and Trade (3)**	**Business Services (4)**	**Transport (5)**
Travel time	0.017***	0.014***	0.014***	0.022***	0.017***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Gains since entry	-0.014***	0.012**	-0.024***	-0.015***	-0.023***
	(0.004)	(0.005)	(0.002)	(0.004)	(0.006)
Gains at other affiliates	-0.011***	-0.018***	-0.010***	-0.011***	-0.016***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Share of exits	0.428	0.354	0.415	0.465	0.423
Observations	426,487	241,677	1,045,416	401,694	138,778

Sources: Matched DADS files and LIFI survey; affiliates (see definition in section 3.1) which are part of multi-location groups between 1993 and 2011.
Note: All regressions include headquarter (i.e., group) level fixed effects, as well as local (commuting zone) × time fixed effects to control for the local market conditions. Regressions also include group level exports in total sales to capture the cycle on international markets.

[50] Affiliate "destruction" corresponds to actual closures or to resale of affiliates, while the group itself still operates in the same industry, with other affiliates (to abstract from more global market exit decisions).

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