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Insurance Between Firms: The Role of Internal Labor Markets*

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Abstract

We investigate how internal labor markets (ILMs) allow business groups to accommodate positive and negative shocks calling for labor adjustments. Group-affiliated units faced with positive shocks rely on the ILM for new hires, especially managers and other high-skilled workers, thus overcoming human capital bottlenecks that may curb growth. Adverse shocks affecting one unit in the organization increase workers' mobility to other units rather than external firms, with stricter employment protection causing an additional increase in internal mobility. ILMs emerge as a co-insurance mechanism, allowing organizations to bypass firing and hiring frictions and providing job stability to employees as a by-product.

Keywords: Labor Market Frictions, Internal Labor Reallocation, Business Groups
JEL Classification: G30, L22, J20

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Disclosure Statement

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To whom it may concern:

The author declares that she has no relevant or material financial interests that relate to the research described in this paper.

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1 Introduction

A long-standing question in economics is how firms adjust and which margins they exploit when business conditions change. A related question is whether some types of organizations are better able than others to swiftly adapt to changing economic conditions, in order to survive in bad times and thrive in good times. This paper addresses these questions by investigating the role of Internal Labor Markets (ILMs) in allowing complex organizations to accommodate positive and negative shocks calling for labor adjustments in their units. To the extent that hiring and firing costs affect the external labor market, labor adjustments may be less onerous to perform within the internal labor market. Units faced with profitable growth opportunities can swiftly draw on the human capital available within the ILM, curbing search and training costs; similarly, units hit by an adverse shock can avoid termination costs by redeploying part of their employees to healthier units. Hence, through the ILM, different units in diversified and complex organizations such as business groups can provide each other with mutual insurance. This unveils a new role for the ILM, as a source of resilience and flexibility for organizations in frictional environments, in contrast to the earlier focus on ILMs as career mechanisms enabling vertical mobility within firms.

In order to address the above issues we identify positive and negative idiosyncratic shocks that hit part of an organization and observe the subsequent employment flows, distinguishing the transitions that occur within the organization from those that do not. We adopt a novel empirical strategy in the identification of the positive shocks, exploiting the sudden death of a large competitor, and use episodes of closures and mass layoffs involving group affiliated firms as negative shocks. This allows us to study both the extent to which ILMs are used in response to changing business conditions and the role of labor market frictions in driving the ILM response.

The data requirements to accomplish this task are heavy. We need to observe the structure of the business organization, i.e. its constituting units; to measure workers' mobility between these units, as well as the economic situation of the origin and destination units. We are able to rely on unique data sources perfectly suited to our goal provided by INSEE (Institut National de la Statistique et des Études Économiques), that allow us to merge detailed information on the structure of business groups in France with a matched employer-employee data set and administrative fiscal data on balance sheets and income statements for virtually all French firms. Hence, we focus here on ILMs within business groups – i.e. groups of independent legal entities controlled by a common owner – which represent a widespread organizational form in both developed and developing economies.[1]

[1]Prominent examples of groups include Tata (India), Samsung (Korea), Siemens (Germany), Ericsson (Sweden), Fiat Chrysler (Italy), LVMH (France), GE (US), Virgin (UK), News Corp (Australia) and Bradesco (Brasil). There is

Our descriptive evidence shows that, for the average group-affiliated firm, the probability to absorb a worker previously employed in the same group exceeds by 9 percentage points the probability to absorb a worker not previously employed in its group. Interestingly, average ILM activity is larger in groups that are more diversified and remains high even when abstracting from promotions or demotions, i.e. focusing on horizontal job changes. This evidence suggests that ILMs do operate in French groups, and that the accommodation of shocks may be a driver of ILM activity.

To gain a deeper understanding of the functioning of ILM activity and its triggers, we explore the internal labor market reaction to idiosyncratic shocks. We first study how groups use ILMs when faced with *positive* shocks, namely when a group subsidiary experiences an unexpected growth opportunity, as captured by the death of a large competitor. To the best of our knowledge, no other paper has exploited large and unanticipated competitor exits as a source of exogenous variation: we do so to study how groups manage their human capital in response to favorable demand shocks.[2] We first exploit one event that affected the French milk sector in 2004, the demise of the Parmalat multinational due to the discovery of a major accounting fraud. Second, we identify and exploit all episodes of large firm closures that can be confidently ascribed to firm-specific (rather than industry-wide) shocks, and thus represent an expansion opportunity for the remaining firms in the same sector.

For each group-affiliated firm active in the shocked sectors, we identify the set of firms from which our firm of interest actually or potentially hires workers, and compute the flow of workers within each pair of firms in any year. We then compare the (within-pair) evolution of bilateral flows following the positive shock in pairs of firms that belong to the same group (the ILM flow), as opposed to pairs that do not (the external flow). Thus, we identify the ILM response to the shock as the *excess* flows happening within same-group firm pairs.

Our results show that positive shocks do trigger ILM activity: after the shock, the fraction of workers absorbed from each ILM partner (relative to the total intake) increases by one percentage point more than the fraction hired from an average external firm, a sizeable increase of fifty percent with respect to the baseline. Interestingly, we also find that this effect is entirely driven by the hiring of managers and other high-skill workers. We interpret this as evidence that ILMs help alleviate search and training costs that are particularly pronounced in the external market for skilled human

by now ample evidence that groups account for a consistently large fraction of the economic activity in several countries (see La Porta, Lopez-de Silanes, and Shleifer (1999), Faccio, Lang, and Young (2001) and Masulis, Pham, and Zein (2015)). Indeed, alongside large renowned groups, mid-sized business groups form the fabric of most economies in Asia, Europe and Latin America. Based on our comprehensive data, we document for instance that business groups account for 40% of total employment and 60% of value added in the French economy.

[2] This complements previous work by Giroud and Mueller (2015), who analyze how internal capital markets allow organizations to respond to positive shocks to investment opportunities.

capital (Abowd and Kramarz (2003), Kramarz and Michaud (2010), Blatter, Muehlemann, and Schenker (2012)).

To explore the role of *firing* frictions, we then study how ILMs allow groups to respond to *negative* shocks. To this purpose, we exploit episodes of closures and mass layoffs involving group-affiliated firms. We compute the employment flows in pairs of firms in which the firm of origin is a group-affiliated firm that will eventually close. We then compare the evolution of bilateral employment flows at closure relative to normal times (i.e. four years before closure) in pairs where the destination firm and the firm of origin belong to the same group (i.e. are ILM partners), as opposed to pairs where destination and origin are not part of the same group.

Closures and mass-layoffs within a group are shown to trigger ILM activity: at closure with respect to normal times, the fraction of workers redeployed to a destination firm affiliated with the same group is larger than the fraction redeployed to an external labor market destination firm by more than 11 percentage points, a threefold increase with respect to the baseline. Which labor market frictions trigger this effect? We show that the closure or downsizing of group units with just more than 50 employees – which according to French labor laws are subject to more stringent labor market regulation – generates a larger ILM response than the closure/downsizing of units with just less than 50 employees. Hence, higher firing costs and greater union power make ILMs more valuable for groups, particularly when faced with potentially large scale separations.[3] We also show that ILMs, as a side-product, provide workers with implicit employment insurance through greater job stability within the group. Additionally, we find that employees displaced from closing subsidiaries are redeployed, within the ILM, to units that enjoy better growth opportunities and are more productive. Displaced workers are instead less actively reallocated to those units that lack the financial muscle to expand their workforce.

To the best of our knowledge, this is the first paper that shows that organizations respond to the presence of labor market regulation and hiring frictions in the external labor market by operating ILMs, thereby gaining flexibility and ability to adapt to changing economic conditions. These results raise new questions on the effects of firms' organizational response to frictions. Indeed, while the use of ILMs is privately beneficial for the organizations that exploit them, whether this response is also socially beneficial remains at this stage an open question, as we discuss in the Conclusion.

By investigating the existence and the functions performed by internal labor markets in groups, where human capital is actively reallocated across subsidiaries, this paper builds a bridge across sev-

[3]This is consistent with recent evidence that business groups prevail in countries where employment protection regulations are stricter (Belenzon and Tsolmon (2015)).

eral strands of literature. Starting with the work of Doeringer and Priore (1971), the labor/personnel literature has mostly studied the functioning of *vertical* mobility *within firms*. Focusing on promotion and wage dynamics, various authors have argued that ILMs can provide effort incentives, wage insurance against fluctuations in workers' ability, and incentives to accumulate human capital.[4] Our results suggest that these motives explain only in part why organizations operate ILMs. Indeed, we present evidence that *horizontal ILMs* are used to accommodate economic shocks in the presence of labor market frictions.

Within the finance literature, some authors have claimed that business groups fill an institutional void when external labor and financial markets display frictions (Khanna and Palepu (1997), Khanna and Yafeh (2007)). Several papers have emphasized the role of internal *capital* markets in groups, showing that access to a group's internal finance makes affiliated firms more resilient to adverse shocks with respect to stand-alone firms (e.g. Almeida, Kim, and Kim (2015), Boutin, Cestone, Fumagalli, Pica, and Serrano-Velarde (2013), Maksimovic and Phillips (2013), Manova, Wei, and Zhang (2015)). Giroud and Mueller (2015) provide evidence that, by alleviating financial constraints, internal capital markets also allow conglomerates to take better advantage of positive shocks to investment opportunities.[5] In line with this large body of evidence, Matvos, Seru, and Silva (2017) find that firms diversify their scope when capital market frictions become more acute.

Little attention has been devoted so far to understand whether business groups operate internal *labor* markets to accommodate negative and positive shocks in the presence of labor market frictions. Faccio and O'Brien (2016) show that employment in group-affiliated firms (as opposed to stand-alone firms) is less sensitive to business cycle fluctuations, which suggests that groups manage their workforce differently.[6] By observing employee flows between affiliated units, we fill this gap in the literature, and show that ILMs allow group units hit by adverse shocks to save on firing costs, and units faced with positive shocks to mitigate "human capital constraints" that may considerably curb expansion.[7] Overall, our findings suggest that along with internal capital markets, ILMs represent an additional channel that makes diversified organizations better equipped to withstand challenges

[4]See, among others, Lazear and Rosen (1981), Harris and Holmstrom (1982), and the comprehensive surveys of Gibbons and Waldman (1999), Lazear (1999), Lazear and Oyer (2012) and Waldman (2012). For more recent contributions to this literature, see Friebel and Raith (2013) and Ke, Li, and Powell (2017).

[5]Giroud and Mueller (2015) find that this internal capital market activity manifests itself in increased investment and employment in the positively shocked units in the conglomerate. However, as they do not use employer-employee data, they cannot study whether human capital is reallocated towards these units through the ILM or the external labor market.

[6]Faccio and O'Brien (2016) rely on a cross-country firm level database; differently from us, they do not have employer-employee data, hence ILM activity cannot be directly documented and analyzed.

[7]The idea that a lack of skilled human capital may hamper growth is supported by a strand of literature emphasizing the important role of managers for firm performance (Bertrand and Schoar (2003), Bloom, Sadun, Van Reenen, Lemos, and Scur (2014), Bender, Bloom, Card, Van Reenen, and Wolter (2016)), and by evidence that frictions in the managerial labor market represent an important hurdle to firm expansion (Agrawal and Ljungqvist (2014)).

and seize opportunities, relative to stand-alone companies.[8]

Focusing on multidivisional firms, Tate and Yang (2015) observe that a fraction of workers displaced from closing plants is retained within the firm, and document that, among the displaced workers who switch industry, those who are reallocated internally experience a higher change in sectoral Tobin's Q growth. This can be interpreted as evidence that ILMs allocate labor more efficiently than the external market does. Our paper widens and deepens the understanding of internal labor markets, by presenting three novel results. First, we study the ILM response to positive shocks and provide direct evidence that organizations faced with growth opportunities rely on their ILMs to hire skilled human capital, which points to hiring frictions as an important determinant of ILM activity. Second, we investigate the frictions that cause ILM activity in response to negative shocks, and identify employment protection regulation as a major underlying driver. Third, besides providing evidence that workers move across units of the same organization, we quantify the extent to which internal flows change in response to shocks *in excess* to external flows.

It is worth noting that we establish that ILMs operate even across units that are separate legal entities, as is the case in business groups, where the benefits derived from actively reallocating human resources across subsidiaries must be traded off against various hurdles, such as minority shareholder protection, contractual costs, and the fear of "piercing the corporate veil" between parent and subsidiary.[9] In this respect, our paper also speaks to recent work that investigates the costs and benefits of organizing production within business groups as opposed to multi-divisional firms (Belenzon, Berkovitz, and Bolton (2009) and Luciano and Nicodano (2014)).

Our paper is also related to a growing literature that explores how firms organize production in hierarchies to economize on their use of knowledge (Garicano (2000)). Caliendo and Rossi-Hansberg (2012) predict that firms which grow substantially do so by adding more layers of management to the organization.[10] Our findings suggest that when faced with expansion opportunities, group-affiliated firms use their group's ILM to economize on the costs associated with hiring employees in the top two layers of the organization (top managers, other management and high-knowledge occupations). Whether the ILM is relied upon to add a further management layer to the organization or to expand the existing layers is a question we plan to address in the future.

[8]See "From Alpha to Omega" *The Economist*, 15 August 2015, on how "a new breed of high-performing conglomerates" is challenging the view that diversified groups are bound to do worse than their focused counterparts.

[9]The regulation of liability within corporate groups differs substantially across countries (see Hopt (2015)). In some jurisdictions, including France, it is common to hold the parent liable vis-a-vis its subsidiaries' debt holders if the parent interfered in the management of the subsidiaries, e.g. by reallocating resources across them.

[10]Using French data, Caliendo, Monte, and Rossi-Hansberg (2015) find evidence that French manufacturing firms grow by actively managing the number of layers in their organization in a way that is consistent with these predictions. See also Caliendo, Mion, Opromolla, and Rossi-Hansberg (2016).

Finally, our work contributes to a line of research looking at how firms provide insurance to their employees. Related to our finding that ILMs allow business groups to provide *employment* insurance to workers, there is evidence that family businesses in various countries (see Sraer and Thesmar (2007) and Ellul, Pagano, and Schivardi (2015)), as well as Chinese state groups (see Chen, Jiang, Ljungqvist, Lu, and Zhou (2015)), provide their employees with such insurance. We add to this literature by investigating the extent to which ILMs allow organizations to protect employment when faced with shocks. Another closely related line of research has asked whether firms provide *wage* insurance to workers against both temporary and permanent shocks (Guiso, Pistaferri, and Schivardi (2005)). The question of whether diversified groups are better able to provide wage insurance to their workers lies beyond the scope of this paper, and is among the next steps in our research agenda. However, we present some elements showing that, in groups hit by a negative shock, displaced workers' hourly wages tend to be insured while hours of work are not.

The paper proceeds as follows. Section 2 lays out a series of empirical predictions. In Section 3 we describe the data and present descriptive evidence on ILM activity within groups. We present our empirical strategy and discuss our results on the ILM response to positive shocks in Section 4, and to negative shocks in Section 5. Section 6 concludes.

2 Theoretical Background

Internal labor markets may emerge within organizations as a potential response to frictions that hamper labor adjustments made solely using the external labor market. In this section we lay out these mechanisms and show how ILMs can create value in complex organizations (business groups, in our paper) as opposed to stand-alone firms, by saving on labor adjustment costs, hence enabling a more flexible response to shocks. In Appendix A.1, we provide a simple model and the formal derivations to sustain our claims.

Consider a firm hit by an idiosyncratic shock ε and faced with hiring and firing costs. Previous work has documented that firing costs are substantial in Continental Europe (in particular in France) for all occupations, while hiring costs are small for most occupations but large for high-skilled workers (see Abowd and Kramarz (2003), Kramarz and Michaud (2010), Blatter, Muehlemann, and Schenker (2012)). These papers also show that hiring and firing costs comprise a fixed and a linear component (in the size of the adjustment). For expositional purposes, we focus on the latter component and assume that the firm bears a hiring cost H for each newly hired employee, and a firing cost F for each dismissed worker.

As shown in Appendix A.1, a stand-alone firm adjusts employment only when the magnitude of the shock is large enough. Hence, stand-alone firms are optimally inactive when the shock is within a $\{\varepsilon_L, \varepsilon_H\}$ band, in which case they incur no hiring or firing cost but have a marginal productivity of labor that differs from the workers' wage. Put differently, when $\varepsilon > 0$ but small enough these firms forfeit growth opportunities, while when $\varepsilon < 0$ but small enough they are inefficiently retaining redundant workers.[11]

Assume now that the firm hit by the idiosyncratic shock is affiliated with a business group. The firm has an additional margin of adjustment: it can absorb or redeploy workers using the group's internal labor market at substantially lower costs. Indeed, if a positive shock calls for an expansion of the labor force, search and training costs that arise in the external labor market can be mitigated within the ILM. First, the ILM is likely to suffer less from information asymmetry concerning workers' characteristics (Greenwald (1986) and Jaeger (2016)), and may perform better than the external labor market in matching a vacancy with the specific skills required. Secondly, training costs are lower for workers absorbed from the ILM whenever there is a group-specific human capital component. Analogously, when a negative shock calls for downsizing a group unit, firing costs can be bypassed altogether or alleviated by redeploying workers to other group units through the ILM. For instance, dismissals can be turned into costless voluntary separations by offering workers an alternative job within the same group. Furthermore, in some employment protection systems, transfers across firms affiliated with the same group are not treated as dismissals provided they fall below a given distance threshold (see Belenzon and Tsolmon (2015)). Also, in case of collective terminations involving more complex employment protection procedures, labor law demands can be met more easily by redeploying (part of) the dismissed workers within the group's ILM.

In the Appendix, we focus on a two-unit group. We normalize the cost of ILM adjustments to zero, while $H > 0$ and $F > 0$ capture the additional adjustment costs encountered on the external market. We study the adjustment policy of the group, which entails equalizing the marginal productivity of labor across individual group units. We show that the group resorts first to the ILM, moving workers towards (away from) the positively (negatively) shocked unit, and only combines the ILM reaction with external adjustments when faced with large enough shocks (see Proposition 1 in the Appendix). Hence, an idiosyncratic shock hitting a group unit spurs an activation of the internal labor market; this ILM reaction is more intense when external frictions are more severe.

To summarize the lessons of our theoretical analysis, in the presence of labor market frictions, the ability to use the ILM in response to a shock adds value to the group in two ways (see Corollary

[11] See also for an early exposition Bentolila and Bertola (1990).

3): (*i*) by granting flexibility, i.e. the ability to adjust the labor force more than stand-alone firms, thereby benefiting from a more efficient allocation of labor across the affiliated units when faced with positive or negative shocks, and (*ii*) by allowing to save on firing/hiring costs, in particular in the face of stringent employment protection legislation (see Corollary 2). Of course, some inefficiency is borne by the other (non shocked) units in the organization, that may end up employing an excessive amount of workers in case of a negative shock, and may lose workers whose marginal productivity is larger than the wage in case of a positive shock. However, it must be emphasized that the optimal ILM allocation ensures that the savings in adjustment costs in the shocked unit more than compensate the efficiency loss borne by the other group units. The internal labor market creates value by allowing different units within the same organization to provide each other with mutual insurance against shocks that, otherwise, would call for costly external labor adjustments.

Viewed from the workers' perspective, labor adjustments using ILMs provide implicit employment insurance. Indeed, reallocation through ILMs reduces the exposure of group-affiliated workers to unemployment risk, as compared to workers employed by stand-alone firms. The existing empirical literature has so far investigated whether *firms* provide insurance to their workers, either by insulating their wages from shocks (see Guiso, Pistaferri, and Schivardi (2005)) or by offering greater employment stability (see Sraer and Thesmar (2007) and Ellul, Pagano, and Schivardi (2015)). Thanks to their ILM, *business groups* can provide employment insurance to their employees against adverse shocks hitting their individual subsidiaries.

3 Data and Descriptive Statistics

Exploring empirically whether affiliated firms disproportionately rely on their group ILM to adjust their labor force in response to shocks requires detailed information on both workers and firms. First, we need to observe labor market transitions, i.e. workers' transitions from firm to firm. Second, for each firm, we need to identify the entire structure of the group this firm is affiliated with, so as to distinguish transitions originating from (landing into) the firm's group versus transitions that do not originate from (land into) the group. Third, we need information on firms' characteristics. We obtain this information for France putting together three data sources from the INSEE (*Institut National de la Statistique et des Études Économiques*).[12]

[12] France represents and interesting case study for investigating corporate groups. From 1999 to 2010, firms affiliated with groups accounted for around 40% of total employment, with substantial variability observed across sectors: in the financial sector affiliated firms account for more than 80% of total employment, whereas in agriculture the percentage is below 10%. Within manufacturing, on average affiliated firms account for almost 70% of total employment, but such share can be as high as 90% in automotive and energy.

Our first data source is the DADS (*Déclarations Annuelles des Données Sociales*), a large-scale administrative database of matched employer-employee information. The data are based upon mandatory employer reports of the earnings of each employee subject to French payroll taxes. These taxes essentially apply to *all* employed persons in the economy (including self-employed). Each observation in DADS corresponds to a unique individual-plant combination in a given year, with detailed information about the plant-individual relationship. The data set includes the number of days during the calendar year that individual worked in that plant, the (gross and net) wage, the type of occupation (classified according to the socio-professional categories described in the Appendix, Table A1), the full time/part time status of the employee. Moreover, the data set provides the fiscal identifier of the firm that owns the plant, the geographical location of both the employing plant and firm, as well as the industry classification of the activity undertaken by the plant/firm. The DADS Postes, the version of the DADS we work with, is not a full-fledge panel of workers: in each annual wave the individual identifiers are randomly re-assigned. Nevertheless, we are able to identify workers year-to-year transitions as each wave includes not only information on the individual-plant relationships observed in year t, but also in year $t-1$. This structure allows us to identify workers transiting from one firm to another across two consecutive years.[13]

The identification of business group structures is based on the yearly survey run by the INSEE called LIFI (*Enquête sur les Liaisons Financières entre sociétés*), our second data source. The LIFI collects information on direct financial links between firms, but it also accounts for indirect stakes and cross-ownerships. This is very important, as it allows the INSEE to precisely identify the group structure even in the presence of pyramids. More precisely, LIFI defines a group as a set of firms controlled, directly or indirectly, by the same entity (the head of the group). The survey relies on a formal definition of *direct* control, requiring that a firm holds at least 50% of the voting rights in another firm's general assembly. This is in principle a tight threshold, as in the presence of dispersed minority shareholders control can be exercised with smaller equity stakes. However, we do not expect this to be a major source of bias, as in France most firms are private and ownership concentration is strong even among listed firms.[14] To sum up, for each firm in the French economy, the LIFI enables us to assess whether such firm is group-affiliated or not and, for affiliated firms, to identify the head of the group and all the other firms affiliated with the same group.

The third data source we rely upon is the FICUS, which contains information on firms' balance

[13]If an individual exhibits multiple firm relationships in a given year, we identify his/her main job by considering the relationship with the longest duration and for equal durations we consider the relationship with the highest qualification.

[14]Bloch and Kremp (1999) document that in large private companies the main shareholder's stake is 88%. Ownership concentration is slightly lower for listed companies, but still above 50% in most cases.

sheets and income statements. It is constructed from administrative fiscal data, based on mandatory reporting to tax authorities for all French tax schemes, and it covers the universe of French firms, with about 2.2 million firms per year. The FICUS contains accounting information on each firm's assets, leverage and cash holdings, as well as capital expenditure, cash flows and interest payments.

The data span the period 2002-2010. We remove from our samples the occupations of the Public Administration (33, 45 and 52 in Table A1, Appendix A.2) because the determinants of the labor market dynamics in the public sector are likely to be different from those of the private sector. We also remove temporary agencies and observations with missing wages. Finally, we also remove from the data set those employers classified as "*employeur particulier*": they are individuals employing workers that provide services in support of the family, such as cleaners, nannies and caregivers for elderly people.[15]

Descriptive evidence on ILM activity

Our data set comprises, on average, 1,574,000 firm-to-firm transitions per year during the sample period. Out of those, 800,000 workers each year make a transition to a group-affiliated firm, and about 200,000 originate from a firm affiliated with the same group as the destination firm. Thus, approximately, one worker out of 4 hired by a group-affiliated firm was previously employed in the same group. This 25% is a sizeable figure if contrasted with the the negligible probability of coming from a firm of the same group, had the worker been randomly chosen; indeed, the average group employs a workforce equal to 0.005% of the total number of employees in the economy.

However, documenting that a large proportion of the workers hired by an affiliated firm were previously employed in the same group is not *per se* evidence that ILMs function more smoothly than external labor markets: intra-group mobility may be high simply because groups are composed of firms that are intensive in occupations among which mobility is naturally high, perhaps for technological reasons. In other words, because group structure is likely to be endogenous and therefore affect within-group mobility patterns, providing meaningful descriptive evidence on whether ILMs facilitate within-group firm-to-firm mobility requires to take care of the firm-specific – possibly time-varying – "natural" propensity to absorb workers transiting between any two given occupations. We do this by implementing the methodology described in Appendix A.3, following Kramarz and Thesmar (2013) and Kramarz and Nordström Skans (2014). This strategy allows us to estimate the *excess probability* that a worker (transiting between two given occupations) is hired by a firm affiliated with the same

[15]We remove also those employers classified as 'fictitious' because the code identifying either the firm or the plant communicated by the employer to the French authority is incorrect.

group as the worker's firm of origin, as compared to the probability that a similar worker originating from outside the group is absorbed by that destination firm.

Our results show that, for the average firm, the probability to absorb a worker already employed in the same group exceeds by about 9 percentage points the probability to absorb a worker on the external labor market (see Panel A in Table A2 in Appendix A.3). We see this as evidence (non-causal, admittedly) that business groups operate internal labor markets in "normal times", when multiple factors may trigger such ILM activity, including job rotation programs and internal career paths; however, average excess probabilities remain high (7 percentage points, Panel B of Table A2) even when we focus on transitions between the same occupations of origin and destination, i.e. ruling out all the transitions up or down the career ladder. This suggests that internal careers explain only in part why groups operate ILMs, and leads us to investigate the coinsurance role of ILMs.

Results also show that diversification both across sectors and across geographical areas is associated with more intense ILM activity, the more so the larger group (Table A3 in Appendix A.3). A priori, sectoral/geographical diversification allows group units to be exposed to unrelated sectoral/regional shocks, thus creating more scope for co-insurance to be provided via the horizontal ILM. On the other hand, moving workers across more distant sectors/geographical areas might be difficult, due to sector-specific skills, trade union resistance and employment protection regulation. Our results suggest that the former effect prevails, the more so in large groups where the internal labor market is thicker and the array of skills available wider. In the working paper version (Cestone, Fumagalli, Kramarz, and Pica (2016)) we also document that diversification only boosts horizontal ILM activity – i.e. same-occupation ILM transitions – in line with the hypothesis that groups of affiliated firms rely on the ILM as a mutual insurance mechanism.

Overall, our descriptive evidence suggests that ILMs do operate within French business groups and that the accommodation of shocks may be a major driver of ILM activity. To go a step further, in the next two sections we examine whether ILM activity intensifies in good and bad times relative to this normal times benchmark. By analyzing how shocks, both positive and negative, affect ILM flows, we go beyond the descriptive evidence examined so far and explicitly focus on causal mechanisms and their consequences.

4 The ILM Response to Positive Shocks

In this section we explore whether groups rely on their ILMs to expand the labor force in those units that face an unexpected growth opportunity, as captured by the exit of a large industry competitor.

As pointed out in earlier work (see Lang and Stulz (1992)), a competitor's death may be due to some shock specific to the exiting firm, so other firms in the industry should benefit from it, or to some industry-wide shock, which is bad news for other firms as well. Hence, we must identify those exits that are *not* due to industry-wide shocks.

To do so, we first focus on one particular event that affected the French milk industry in 2004: the collapse of a large foreign competitor following the discovery of a major accounting fraud. Second, we identify in our sample period episodes of firm closures that we can confidently ascribe to firm-specific shocks. In both cases, we investigate whether other (group-affiliated) firms in the shocked industry increased reliance on their ILM in response to the large competitor's exit.

4.1 Collapse of a large competitor: Parmalat

Until 2004 the Parmalat multinational was a major competitor for the many French firms and groups operating in the production and sale of milk products. Parmalat's fallout followed the sudden discovery, in December 2003, of a huge accounting fraud that led many commentators to rename it "Europe's Enron."[16] Following this revelation, Parmalat filed for bankruptcy and closed many of its foreign subsidiaries, including the French ones, to refocus on its Italian market (see Tayan and Rajan (2008)).[17] We believe this event is ideal to study how business groups react to exogenous positive shocks.

To verify whether the Parmalat collapse indeed represented a positive shock for its French competitors, we proceed as follows. We consider the 4-digit industries in which Parmalat was present in France (the treated industries) and all other 4-digit industries within the same broader 2-digit industry.[18] We analyze the change in a number of variables (employment, sales, total assets, and property plant and equipment) before and after Parmalat's collapse, for the ten largest competitors in each treated industry (relative to the non-top-ten firms) and we compare it with the change in the same variables for the ten largest firms in all the other industries within the same 2-digit industries.[19]

[16] By 2003, Parmalat had grown from an Italy-based family firm into a multinational giant owning over 130 subsidiaries in 30 different countries. At the end of 2002, Parmalat reported EUR 10.3 billion in assets, including EUR 3.4 billion in cash and cash equivalents. However, in December 2003, following Parmalat's default on EUR 150 millions bonds in spite of its large cash position, Bank of America revealed that a EUR 3.9 billion account held by Parmalat at the bank did not exist.

[17] Analysts commenting on the case agreed that Parmalat administrators were interested primarily in saving Italian jobs, and expected it to offload many of its overseas businesses (see Regani and Dutta (2004)).

[18] Parmalat operated in France through own local subsidiaries in five 4-digit industries: wholesale milk trade, milk production, butter, cheese, and other milk production. These industries belong to the "food sale and production" 2-digit industry.

[19] The largest firms in an industry are the best positioned to take advantage of a competitor's collapse. Our data also indicate that in most industries the largest firms are business group affiliated.

More precisely, we estimate the following equation:

$$\begin{aligned} y_{its} \;=\;& \alpha_t + \delta_s + \delta_0 Top10_{its} + \delta_1 Post2004 + \delta_2 TS_s + \delta_3 Top10_{its} \times Post2004 + \\ & \delta_4 Top10_{its} \times TS_s + \delta_5 Post2004 \times TS_s + \delta_6 Top10_{its} \times Post2004 \times TS_s + \varepsilon_{its} \qquad (1) \end{aligned}$$

where y_{its} is the (log of) employment (sales, total assets, fixed assets) of firm i, at time t, active in sector s. Sector s is a 4-digit sector that belongs to the 2-digit industry where Parmalat was present; the term α_t represents a set of year indicators; δ_s is a 4-digit industry fixed-effect; $Top10_{its}$ is an indicator equal to 1 if firm i at time t ranks among the first ten largest firms in industry s in terms of y; $Post2004$ takes the value 1 after the Parmalat collapse, and TS_s represents a set of indicators that identify the treated industries.

We let the data indicate those industries in which the Parmalat's collapse represented an expansion opportunity; to do so, we look at the coefficient δ_6 of the triple interaction, which measures the differential effect of the Parmalat shock on the major players in the treated sectors as opposed to the major players in the control industries. We then consider as "shocked" only the treated industries for which the coefficient δ_6 will turn out to be positive and significant *at least* in the employment *and* sales regressions. Table 1 reports the results of this preliminary stage. We find that δ_6 is positive and significant in the regressions for employment *and* sales in two 4-digit industries, namely "Wholesale milk trade" and "Other milk production". In addition, for those industries a positive effect also shows up for total and fixed assets. This makes us confident that, at least in these two industries, the major market players took advantage of Parmalat's collapse.

We then consider the group-affiliated firms that operate in the two shocked sectors. For each of them we identify the set of all the firms from which our firm of interest actually or potentially hires workers, and compute the bilateral employment flows within each pair of firms in each year.[20] Our unit of observation is thus a pair – firm of origin/destination firm – in a given year, in which the firm of destination is a group affiliated firm that operates in one of the "positively-shocked" industries. Using these observations, we study the evolution of the bilateral flow of workers after the positive shock within pairs affiliated with the same group (the ILM flow) as opposed to pairs not affiliated with the same group (the external labor market flow). The time dimension – i.e. the comparison between the flows before and after the positive shock – allows us to control for all the time-invariant pair-specific determinants of the bilateral flows (in other words, we take into account that two specific

[20]We consider any firm that in at least one year has been the origin of at least one employee hired by our firm of interest, firm i. Firms of origin affiliated with the same group as firm i are referred to as "ILM firms of origin", while the others as "External firms of origin".

firms may experience intense flows of workers even before the shock). The double difference, i.e. the comparison between (the change in) flows within pairs affiliated with the same group and (the change in) flows within pairs not affiliated with the same group, identifies the impact of the positive shock on ILM activity, i.e. the excess flows happening within same-group pairs.

We estimate the following equation:

$$\begin{aligned} f_{ijt} &= \alpha_t + \phi_{ij} + \phi_0 BG_{jt} + \phi_1 SameBG_{ijt} + \phi_2 Post2004 + \\ &\quad \phi_3 Post2004 \times BG_{jt} + \phi_4 Post2004 \times SameBG_{ijt} + \varepsilon_{ijt} \end{aligned} \tag{2}$$

where f_{ijt} is the ratio of employees hired by a group-affiliated firm i (active in one of the shocked sectors) in year t and previously employed by firm j, to the total number of firm-to-firm movers hired by firm i in year t; the term α_t represents a set of year indicators; ϕ_{ij} is a firm-pair fixed effect that controls, in our main specification, for all time-invariant pair characteristics, including unobserved heterogeneity due to the different composition of the bilateral flows across firm pairs. BG_{jt} is an indicator equal to 1 if the firm of origin is affiliated with any group in year t; $SameBG_{ijt}$ takes value 1 if the firm of origin is affiliated with the same group as firm i, in year t; $Post2004$ takes the value 1 after the Parmalat collapse. The variable of interest is the interaction between $SameBG_{ijt}$ and $Post2004$. Its coefficient ϕ_4 captures the ILM-driven response to the positive shock, i.e. the differential effect of the shock on the bilateral employment flows within firm-pairs that belong to the same group relative to pairs that do not. Indeed, if the ILM was as frictional as the external market (our null hypothesis), one would expect ILM partners and external labor market partners to be equally likely as a source of human capital for the shocked firm, leading us to observe, on average, equal bilateral flows within "same group" and non-affiliated pairs.

We present the estimates of equation (2) in Table 2, separately for the subsets of shocked sectors ('Wholesale milk trade" and "Other milk production"), and non-shocked sectors where the Parmalat collapse does not appear to have generated an expansion opportunity. We use the latter to provide a placebo test. Results in Table 2 show that the positive shock does trigger ILM activity: after 2004, on average, firms in the shocked industries increased the fraction of workers absorbed from their ILM partners by 2.9 to 3.5 percentage points more than the fraction of workers hired from external labor market partners (columns 1 and 2). We observe no differential effect in the three non-shocked industries (columns 3 and 4).

4.2 Closures of large competitors

To go beyond the Parmalat case, we extend the above approach to any large closure event. More precisely, we first identify all episodes in which firms experience a drop in employment from one year to the next of 90% or more during our sample period, 2002-2010. In order to eliminate false closures, i.e. situations in which firms simply change identifier relabeling a continuing activity (such as in the case of an acquisition), we exploit the matched employer-employee nature of our data and remove all the cases in which more than 70% of the lost employment ends up in a single other firm. Appendix Table A5 shows the number of closing firms, by firm size. Consistent with an extensive study of closures from INSEE (Royer (2011)), we find that the incidence of closures among firms with more than 10 employees is approximately 4%, whereas the incidence of closures among very small firms is twice as large.[21] We then focus on closures involving large firms, whose effects on the remaining competitors are likely to be non-negligible, by identifying closure episodes of firms with more than 500 workers – on average – in normal times, i.e. at least 4 years prior to the closure event (well before the closing firm starts shrinking). This allows us to track down 115 large closure events happening in 102 different 4-digit industries.

To be sure that such closures are essentially due to idiosyncratic reasons, we study whether these events benefit the main competitors in the industry, in which case we can confidently assume that they do not reflect a negative macroeconomic or sector-wide shock. As in the Parmalat case, *for each closure event*, we build a treatment group that includes all firms that operate in the same 4-digit industry as the large closing firm; the control group includes all the other firms present outside the specific 4-digit industry but in the same 2-digit industry as the closing firm.[22] We then analyze the differential evolution of the variable of interest (employment, sales, total assets and fixed assets), before and after the closure event, for the top ten firms in the market where the closing firm was present (vs. the remaining firms) and compare it with the evolution of the same variable for the ten largest firms in the other industries.

For each closure event and for each variable of interest, we run a regression similar to equation (1). We look at the coefficient δ_6 of the triple interaction $Top10_{its} \times PostClosure \times TS_s$, where s is a 4-digit industry that belongs to the 2-digit industry in which the large closing firm was present, $Top10_{its}$ is an indicator equal to one for the ten largest firms in industry s, $PostClosure$ is an indicator for the period following the closure event and TS_s is an indicator that identifies the 4-digit

[21] The data also confirm that the effect on the real economy of the 2008 financial crisis materializes in 2009, with an increase in the closure rate.

[22] We exclude from the control group all 4-digit industries (belonging to the same 2-digit category as the closing firms) in which there is a large closure event.

industry in which the closing firm operated. Consistently with the Parmalat case study, we label as "shocked" only the treated industries for which the coefficient δ_6 is positive and significant in, at least, the regressions on employment *and* sales.

Appendix Tables A6 and A7 show the results of this preliminary stage. We identify 16 industries (listed in Appendix Table A6) for which the coefficient δ_6 of the triple interaction ($Top10 \times PostClosure \times TreatedSector$) is positive and significant at least in the regressions on the evolution of employment *and* sales. In most of the cases, the coefficients for the evolution of total and fixed assets are also positive and significant. Table A8 shows some descriptive statistics for these "shocked" industries. Typically the shocked industries experience a single large closure event. In the few cases with multiple closure events, we take the year of the first closure event as the year of closure.[23] The table also shows the average size of the closing firm in normal times, i.e. at least 4 years prior to the closure event.

Table 3 provides descriptive statistics on the bilateral flows of workers hired by group-affiliated firms in these 16 shocked industries and suggests that the difference between intra and extra group flows (slightly) increases after the closure of a large competitor.[24] Results in Table 4 confirm the unconditional evidence. After the shock, within-group flows go up relative to flows from the external labor market, both in the specification with firm of origin fixed effects and in the specification with pair (firm of origin-firm of destination) fixed effects (columns (1) and (2)). When controlling for pair fixed effects, we find that firms react to the positive shock increasing the fraction of workers absorbed from ILM partners by 1 percentage point more than the fraction of workers absorbed from external labor market firms. Given that after the shock the average flow from an external labor market firm of origin is 0.0218 (see Table 3), our estimates imply that the ILM response is half of the average external flow. Column (3) of Table 4 shows that the effect is positive and significant in the three years following the shock, and that it vanishes afterwards.[25]

Interestingly, results in column (4) show that the positive shock has heterogeneous effects across different occupational categories. In this case the dependent variable f_{ijtk} is the proportion of employees of occupational category k (in the firm of destination) hired by a group affiliated firm i (active in one of the shocked sectors) in year t and originating from firm j relative to the total number of

[23] Results are robust to removing the shocked industries that experience more than a single large closure event.

[24] We remove the flows that originate from closing firms that are affiliated with groups having units active in the shocked industries so as to avoid that the hires that we measure are ILM reallocations due to negative shocks hitting the closing firms.

[25] One may also ask whether ILM adjustments in the face of positive shocks not only reduce the need for external hiring but also substitute for within-firm promotions (we thank Lorenzo Caliendo for raising this point). Indeed, we find that in affiliated firms positive shocks boost within-firm promotions less than in stand-alone firms (results available upon request).

firm-to-firm movers hired by firm i in year t. We consider four occupational categories: managers and other high-skilled workers, intermediate occupations (technicians and other intermediate administrative jobs), clerical support, and blue collars, with blue collars being the excluded category.[26] Column (4) shows that the ILM response is driven by hires in the top two layers of the organization (managerial and other high-skilled occupations). This supports our prediction that expanding group-affiliated firms rely on the ILM to alleviate search costs and informational frictions that are particularly pronounced in the external market for skilled human capital.

Finally, the last two columns of Table 4 provide a placebo test. Column (6) shows the result of the placebo on the subset of sectors in which the coefficient δ_6 in the preliminary stage regressions concerning sales and employment is not significant.[27] Column (5) shows the results of the placebo on all the sectors in which employment and sales of the top ten competitors did not *both* go up after the large closure.[28] Reassuringly, in both cases the coefficient of interest is now very small and not significantly different from zero.

5 The ILM Response to Adverse Shocks

To investigate further the co-insurance role of the internal labor market, we now study whether ILMs allow firms hit by an adverse shock to alleviate separation costs. To investigate how this mechanism operates, we exploit episodes of closures and mass layoffs that involve group-affiliated firms. To identify which frictions trigger an ILM response, we exploit variation in employment protection regulation across firms of different size.

We first identify all episodes of firm closures or mass layoffs, as described in Section 4.2. We then focus on closure episodes that involve firms affiliated with a group. As we disregard episodes in which a substantial fraction of the lost employment moves to another specific firm, we are not treating as closures those situations where an affiliated firm is acquired by another company of the same group. This means that, unless groups selectively close affiliated firms with the aim of finely redeploying their workers to other units, we are removing most of the endogeneity concern regarding closures. To further corroborate that the closure episodes we focus on are genuinely due to adverse shocks, we look at the performance of group-affiliated firms before they close or embark on a mass layoff: as displayed by Figure 1, sales, return on assets and return on sales all deteriorate in the last two-three

[26] We build these broad categories, that correspond to decreasing degrees of human capital and skill, by using the 2-digit occupational categories available in the DADS (see Table A1) in Appendix A.2.

[27] These sectors and the coefficients of the preliminary stage regression are listed in Appendix Table A7, panel A.

[28] These sectors and the coefficients of the preliminary stage regression are listed in Appendix Table A7, panels B and C.

years before the closure/mass layoff. Interestingly, closing/downsizing group subsidiaries see their coverage ratio fall below 1 in the last year, which suggests that many closures in our sample are associated with financial default. Overall, we are confident that the closure events we are considering do generate exogenous variation useful when studying the ILMs response to negative shocks.

For each eventually-closing group-affiliated firm, we identify the set of all the actual and potential destinations of its workers, and compute the bilateral employment flows within each pair of firms in each year.[29] To identify the impact of the adverse shock on horizontal ILMs, we study the evolution of bilateral employment flows at closure relative to normal times (i.e. at least four years before closure) in pairs affiliated with the same group as opposed to pairs not affiliated with the same group.[30] Formally, we estimate the following model:

$$f_{ijt} = \alpha_t + \phi_{ij} + \phi_0 BG_{jt} + \phi_1 SameBG_{ijt} + \phi_2 d_{it} + \phi_3 c_{it} \times BG_{jt} + \phi_4 c_{it} \times SameBG_{ijt} + \varepsilon_{ijt} \quad (3)$$

where f_{ijt} is the ratio of employees moving from an affiliated firm of origin i to a destination firm j in year t to the total number of firm-to-firm movers that leave firm i in year t; the term α_t represents a set of year indicators; ϕ_{ij} is a firm-pair fixed effect that, in our main specification, allows us to control for unobserved time-invariant heterogeneity at the pair level, including the heterogeneity related to the composition of the bilateral flows; BG_{jt} is an indicator equal to 1 if the destination firm is affiliated with any group in year t; $SameBG_{ijt}$ takes value 1 if the destination firm is affiliated with the same group as firm i in year t. The term d_{it} represents a set of indicators capturing the distance to closure (measured in years) of firm i. The indicator c_{it} takes the value 1 in the last two years of firm i's activity and is interacted with both BG_{jt} and $SameBG_{ijt}$. The variable of interest is the interaction between $SameBG_{ijt}$ and c_{it}. Its coefficient ϕ_4 captures the differential effect of closures on the bilateral employment flows (relative to normal times) within firm pairs that belong to the same group relative to pairs that do not.

Table 5 provides descriptive evidence on the flows of workers originating from firms that eventually close and show that the average flow towards ILM destination-firms increases dramatically in the year before closure and at closure. Table 6 presents results based on the estimation of equation (3) confirming the descriptive evidence: at closure (relative to normal times), the fraction of displaced

[29] We consider as potential destination any firm that absorbs at least one employee, in at least one year, from firm i. Destination firms affiliated with the same group as firm i are referred to as "ILM destination firms", while the others as "External destination firms", hereafter.

[30] Exploiting closure/large layoff events helps us capture the extent of the *horizontal* ILM activity, i.e. within-group moves that are *not* instrumental to the design of employee careers, as opposed to the vertical (career-related) ILM activity that plausibly takes place mostly in normal times.

workers redeployed to an internal labor market destination-firm is almost 12 percentage points larger than the fraction redeployed to a non-affiliated firm (column 2). Given that at closure the average flow to an external labor market destination-firm is 0.039 (Table 5), our estimates imply that the ILM-driven response to the shock is three times as large as the average external flow. In column 1 we also present results obtained from an alternative specification which includes only firm-of-origin fixed effects.

Results in columns 3 and 4 show that the closure shock has heterogeneous effects across different occupational categories. Results are similar across the two specifications: firm closure intensifies ILM activity most for blue collar workers and to a lesser extent for the other occupational categories. More precisely, at closure the fraction of blue collar workers (the excluded category) redeployed to an affiliated firm increases more than the fraction redeployed to a non-affiliated firm, as indicated by the positive and significant coefficient of *Closure* × *Same Group*. The triple interactions of *Closure* × *Same Group* with the other occupational categories are all negative, showing that the ILM response to the closure shock is less intense for the other types of workers.[31]

5.1 Employment protection regulation and the ILM

Within the same empirical framework, we investigate which labor market frictions spur ILM activity. Given the above evidence, labor market regulation is an obvious candidate. We therefore exploit the fact that labor market regulation in France changes discontinuously at various firm size thresholds. The consensus view is that the 50-employee threshold is critical, a size above which the regulation of employment protection and union rights becomes significantly stricter at various moments of the firm's life, including around closure.[32] Figure 2 shows the distribution of firm size in France, measured in terms of number of employees: firms seem to bunch just below 50, which suggests that the stricter EPL that applies above 50 is likely to matter when firms make decisions. Previous work has studied the distortions that this type of legislation creates by discouraging firms' expansion.[33]

We adopt a regression discontinuity-type approach and explore whether group-affiliated firms above the 50-employee threshold at closure rely disproportionately more on the ILM than firms below 50, controlling for the intensity of bilateral worker flows in normal times. We therefore estimate the

[31]In columns (3) and (4), the coefficients of the triple interactions are not significantly different from each other, but are significantly different from the coefficient of *Closure* × *Same Group* at 5%.

[32]In case of collective dismissals (i.e. dismissals of at least 10 workers during a 30 days period), firms with 50+ employees are required to formulate an "employment preservation plan" in close negotiation with union representatives. The aim of the plan is to lay out solutions to facilitate reemployment of terminated workers. In practice, the obligations entailed by the plan substantially increase termination costs (by raising both lay-off costs and union bargaining power). Note that the "employment preservation plan" must be formulated also in the event of a closure. See Appendix A.5.

[33]In their study of the impact of size-contingent labor laws, Garicano, LeLarge, and Reenen (2016) focus precisely on the French 50-employee threshold.

following model:

$$
\begin{aligned}
f_{ijt} \quad = \quad & \alpha_t + \phi_{ij} + \phi_0 BG_{jt} + \phi_1 SameBG_{ijt} + \phi_2 d_{it} + \phi_3 c_{it} \times BG_{jt} + \phi_4 c_{it} \times SameBG_{ijt} + \\
& \phi_5 D_i^{50} \times SameBG_{ijt} + \phi_6 D_i^{50} \times BG_{jt} + \phi_7 D_i^{50} \times c_{it} + \phi_8 D_i^{50} \times BG_{jt} \times c_{it} + \\
& \phi_9 D_i^{50} \times SameBG_{ijt} \times c_{it} + X_{it} + \varepsilon_{ijt} \qquad (4)
\end{aligned}
$$

where the specification in equation (3) is augmented with the time-invariant indicator D_i^{50} – equal to one for firms with 50 or more employees at closure – fully interacted with BG_{jt}, $SameBG_{ijt}$ and c_{it}. We also include two (third or fourth degree) polynomials in firm size at closure separately for normal times and closure times (in the matrix X_{it}). The coefficient of interest ϕ_9 measures the differential impact of closure on within-group flows for firms above 50 versus firms below 50 employees.

To achieve proper identification this approach requires firms to be randomly allocated above and below the 50-employee threshold. The use of firm (and pair) fixed effects already controls for all the time-invariant unobserved factors that may affect the propensity of firms to self-select into (or out of) treatment. However, fixed effects do not account for the selection due to time-varying factors. To control for such factors, following Leonardi and Pica (2013), we instrument the treatment status with the (average) firm size in normal times, i.e. at least four years before closure. The terms interacted with the treatment status – Destination-firm Business Group-affiliated (BG-affiliated, hereafter), Closure, Same Group and Closure × Same Group – are also instrumented, using as an instrument their own interaction with (average) firm size in normal times. The validity of this instrument relies on the closure being unexpected in normal times.

Table 7 shows results from the estimation of equation (4). Column (1) includes firm-of-origin fixed effects, column (2) pair fixed effects and column (3) shows IV results (with pair fixed effects) using firm size in normal times as an instrument for size at closure. The first three columns restrict to closing firms between 40 and 60 employees. The remaining two columns show robustness checks using different size windows. Interestingly, the coefficient of *Closure×Same Group* is positive and significant, indicating that closures intensify ILM activity even for closing firms with less than 50 employees, which in France are subject to lighter but non-negligible employment protection legislation. However, the coefficient of the triple interaction *Closure×Same Group×Firm Size*$>$ 50, which measures the impact of closure on ILM flows differentially for firms above 50 employees, is everywhere positive and significant (in column (2) marginally so at 5%). This suggests that group-affiliated firms hit by adverse shocks increasingly rely on the ILM when employment protection rules become more stringent. This result allows us, we believe, to establish a causal link between a specific labor market friction, namely employment protection regulation, and ILM activity.

5.2 Employment insurance provided by the ILM

Our finding that closing group units extensively redeploy labor through the internal labor market suggests that workers employed in group-affiliated firms are provided with implicit employment insurance against adverse shocks hitting their company. To corroborate this hypothesis, we study whether, upon closure, fewer employees of group-affiliated firms become unemployed as compared with stand-alone firms. Table 8 displays the average ratio of a firm's employees moving to unemployment over the total number of employees leaving the firm in the same year – in stand-alone versus group-affiliated firms. At closure (relative to normal times), the proportion of workers that become unemployed increases in stand-alone firms, whereas this proportion decreases in affiliated firms.

This unconditional evidence is confirmed by the regression results shown in Table 9, column (1): the coefficient of *Closure* × *Firm of origin group affiliated* is negative and significant. At closure (relative to normal times) the fraction of workers separating from a group-affiliated firm who become unemployed is 7.85 percentage points smaller than the fraction of workers that separate from a stand-alone firm and become unemployed. This indicates that, when the firm is hit by a closure shock, workers' exposure to unemployment is 34.2% lower in BG-affiliated firms as compared to stand-alone firms. In column (2) of Table 9 we investigate whether this effect differs across occupational categories: our results show that the effect is significantly larger for blue-collar workers (the excluded category) and becomes weaker as we move up the skill ladder. This adds further support to the view that ILMs allow groups to provide employment insurance in the face of large shocks to employees with fewer outside options and possibly stronger union support.

We then ask whether the preservation of employment ensured by the internal labor market comes at a cost for business groups' employees. Table 10 examines the change in hours worked (columns 1 and 2), in the hourly wage (columns 3 and 4) and in the annual wage (columns 5 and 6), for workers transiting from firm i to firm j at time t (the unit of observation is now the worker).

The coefficient of *Closure* × *Same Group* indicates that closures have a more detrimental effect on hours worked (as well as on the annual wage) for employees redeployed to an ILM destination-firm as compared to employees that find a new job in the external labor market, with no differential impact across the occupational categories. Instead, closure have no differential impact on the hourly wage (in our baseline specification with pair fixed effects).[34] These results suggest that the higher

[34] Managers seem to enjoy an hourly wage premium when moving within the group (*Same Group* × *Managers* in column 3), almost completely dissipated upon closure (*Same Group* × *Closure* × *Managers*). Those effects vanish in

job stability granted by the group does come at a cost: hours worked are reduced and so does the annual wage.

5.3 Employment flows at closure: Where do workers go?

We again exploit our difference-in-difference set-up to study the characteristics of those group firms that absorb a closure shock by hiring the displaced workers within their ILM. If groups run ILMs efficiently, one would expect them to reallocate displaced employees to firms that are not experiencing an adverse shock, and ideally to firms that would benefit from absorbing the workforce of closing units, i.e. well managed firms with profitable growth opportunities. Absorbing firms must also have the necessary financial muscle to expand their workforce. We explore these issues in Tables 11 and 12.[35]

In Table 11, we classify firms depending on whether they operate in a booming sector or one experiencing a downturn (columns 1 and 2), and in low- versus high-growth sectors (column 3).[36,37] As for previous results, our main specification controls for pair fixed effects (results are unchanged when we control instead for firm of origin fixed effects). Column (1) shows that ILM flows increase by 3 percentage points more (at closure with respect to normal times) if the destination firm is in a booming sector, which represents a 20% increase relative to the baseline. Column (2) shows that there is instead a negative – albeit non significant – differential effect if the destination firm is in a sector experiencing a recession.

Column (3) of Table 11 provides evidence that group ILMs reallocate displaced workers more intensely towards group affiliates operating in high-growth sectors, where firms are more likely to have profitable investment opportunities.[38] This complements the findings of Tate and Yang (2015), who document that among the displaced workers switching industry, those who do so within the same firm experience a higher change in sectoral Tobin's Q growth.[39] Their result is silent on the

column (4) in which we control for the pair fixed effect, suggesting that the wage premium in normal times is due to the managers (self) selecting into high-wage firms.

[35]A related albeit different question is whether the ILM redeploys employees more or less intensely towards subsidiaries that are directly controlled by the parent as opposed to indirectly controlled subsidiaries in pyramidal groups (we thank Bill O'Brien for raising this issue). Unfortunately, the LIFI only provides information on whether firms are controlled by a common ultimate owner (whether directly or indirectly), and thus are part of the same group. Hence, our data do not allow us to explore the relationship between the ILM and the precise hierarchical structure of each group.

[36]Booms and busts are identified from the fluctuations of real sectoral sales, where nominal sales are deflated by 2-digit industry-specific price deflators (the lower number of observations are due to missing prices for some sectors), following the Braun and Larrain (2005) peak-to-trough criterion described in detail in Table 11.

[37]Sectors are classified according to whether the average annual growth rate of real sales over our sample period fall in the first decile, above the median, or in the top decile of the distribution.

[38]The effect is 25% larger than the baseline if the destination firm operates in a sector whose real sales growth rate belongs to the top decile of the distribution, and 25% smaller if the destination firm operates in a sector whose real sales growth rate belongs to the bottom decile.

[39]Tate and Yang (2015) also find that workers displaced from closing plants of a diversified firm are more likely to be retained inside the firm the larger the average Tobin's Q in the other sectors where the firm operates. This result shows

size of internal flows and on whether they intensify when the unit of destination has better prospects. Table 11 thus adds to their evidence, by showing that the proportion of displaced workers who are reallocated internally increases if the destination firm operates in a high-growth sector.[40] More in general, our paper presents three novel results on ILM activity. First, we identify the frictions that cause ILM activity. Second, we study the ILM response not only to negative but also to positive shocks. Third, we not only provide evidence that workers move across units of the same organization; we also quantify the extent to which internal flows change in response to shocks *in excess* to the external ones.

In Table 12, we measure destination firms' characteristics at the firm-level – rather than at the industry-level – in "normal times" (i.e. before being affected by the firm of origin's closure). We are able to measure firm-level characteristics such as TFP, investment and financial strength, because we investigate the activity of ILMs within *groups* of affiliated firms, for which separate financial statements are available, rather than within multi-establishment firms.[41] In columns (1)-(3) we ask whether after a closure, groups reallocate employees mainly towards larger, more efficiently-run firms, as well as firms that have been expanding. In particular, in column (2) we classify destination firms according to their productivity, as measured by estimated TFP.[42] We find that, following closures, ILM flows increase by 5 percentage points more when destination firms have larger-than median TFPs, an effect that is twice as large as the baseline effect. Column (3) shows that following a closure in the group, the differential increase in ILM flows is 5 percentage points larger for destination firms that had undertaken larger than median capital expenditures well before the closure shock hit the group, a sizeable 56% increase.

The ability of group affiliates to absorb displaced workers through the ILM is likely to depend on their financing capacity. Thus in Table 12 we also investigate whether the reallocation of displaced workers within groups depends on the financial status of the potential ILM destination-firms. For

that internal reallocation occurs within firms but is silent on whether the retained workers actually move towards the plants operating in more promising sectors. Also, it leaves open the question of whether conglomerates rely on their internal pool of workers more (or less) than on the external labor market to fill positions in the other sectors where the firm operates, an issue we address in Section 4 by investigating the ILM reaction to positive shocks.

[40] Additionally, the richness of our data allows us to do so exploiting only the within-pair time variation, thus controlling for any unobserved heterogeneity across firm pairs.

[41] The destination firm's characteristics are averaged over the period that precedes the firm of origin's closure *by at least* four years to address the endogeneity concern due to the fact that a firm's closure is likely to affect the size, productivity, investment policy and financial status of both its external and ILM destination-firms. We do so for total assets, TFP, capital expenditure, debt/assets and interest coverage.

[42] We estimate TFP following the method of Levinsohn and Petrin (2003), which extends the Olley and Pakes (1996) approach using materials instead of investment to control for firm-level unobserved productivity shocks. Tables IA.1, IA.2, and IA.3 in the Internet Appendix display labor and capital coefficients as well as estimated TFP for each one-digit sector. The coefficients reported in Table IA.1 are in line with those estimated by Garicano, LeLarge, and Reenen (2016) on French manufacturing firms. Table IA.3 shows that group-affiliated firms across all sectors display larger TFP levels than stand-alone firms (see Boutin, Cestone, Fumagalli, Pica, and Serrano-Velarde (2013) for a similar result).

each destination firm we build two measures of financial health: leverage (book value of long-term debt divided by total assets) and interest coverage (earnings before interest, taxes and depreciation, divided by interest expense).[43] Columns (4) and (5) show that following a closure in the group, the differential increase in ILM flows varies for destination firms at different percentiles of the distribution of leverage and coverage. The difference-in-difference effect is significantly smaller for destination firms whose leverage falls in the top decile of the distribution (4.83 percentage points smaller, a 35% drop relative to the baseline), and for destination firms with an interest coverage ratio in the bottom decile (3.67 percentage points smaller, a 24% drop relative to the baseline). Overall, this suggests that while closures trigger ILM activity, groups are less prone to redeploy displaced workers to highly levered and financially distressed affiliates.

6 Conclusion

Why are some organizations more resilient to shocks than others? Which channels allow them to swiftly respond to adverse or favorable economic conditions? In this paper we address these questions by studying how some widespread organizations, namely business groups, cope with shocks using their Internal Labor Markets. To this end, we exploit individual measures of mobility (through a matched employer-employee data set), together with information on the organization's structure (i.e., the firms affiliated with a group), and the economic outcomes of the affiliated firms.

To the best of our knowledge, ours is the first paper to show that labor market regulation and hiring frictions in the external labor market induce organizations to rely on ILMs when responding to both adverse and positive shocks. Our evidence suggests that ILMs emerge as a mutual insurance mechanism across firms of diversified groups in the presence of frictions. As a by-product of ILM activity, implicit employment insurance is provided to the organizations' workers, in particular the low-skilled.

Our findings raise several issues regarding the role of business group organizations in economic systems. The evidence provided here suggests that, in the presence of frictions, groups display a higher ability to adapt to changing business conditions with respect to stand-alone firms: thanks to the ILM, groups can swiftly downsize business units hit by adverse shocks, but also overcome human capital bottlenecks that may bind when growth opportunities arise. Hence, ILMs, alongside internal capital markets, can provide groups with a competitive advantage with respect to their stand-alone

[43] Very high levels of leverage and very low interest coverage ratios may signal that a firm has limited financing capacity (possibly due to debt overhang and binding debt covenants), and thus does not enjoy the financial flexibility necessary to expand its workforce.

rivals, an imbalance that labor market frictions are bound to magnify.[44]

A second question is how group ILMs alter the allocation of labor in the economy. On the one hand, ILMs ensure the reallocation of workers to more productive uses in situations where stand-alone companies would inefficiently hoard labor to avoid adjustment costs; on the other hand, the ability of groups to rely on the ILM, while privately beneficial in the presence of frictions, may prevent more efficient matches to emerge in the external labor market. The above considerations imply that groups have multiple and complex effects on competition, factor allocation, and the efficiency of economic systems; assessing whether economies benefit from the presence of groups is an important goal that however lies beyond the scope of this paper.

Our results are likely to extend beyond the group-type organizational form. Indeed, ILMs are even more likely to operate within other types of diversified organizations such as multi-establishment firms, where coordination across units is arguably stronger than across subsidiaries of a business group.[45] Focusing on groups is a useful benchmark because it allows us to establish that ILMs operate even across units that are separate legal entities, as is the case for business group subsidiaries.[46]

We ultimately wish to understand how complex organizations come to life and why they take different forms. Why are some units added to these organizations as separate legal entities under the parent control rather than as establishments? The reasons why such organizations appear in the first place and why they succeed to grow is a long-standing question in economics. In order to understand the full nature of the benefits and costs associated to groups' existence, this paper's approach has used shocks that affected some of the firms within groups. To delve further into this comprehension, we will adopt complementary strategies in our next articles. First, we will examine how policy reforms, as opposed to shocks, affect the existence and structure of groups versus other organizations. The policy reform we have started to examine is the transition to the 35-hours workweek, that took place in France over the 2000s. The differential strategies used by groups versus multi-establishment firms when faced with such reforms should help us in our endeavor. Second, we also have started to look at how exchange-rate movements affect the structure of groups in contrast again with that of multi-establishment firms. In particular, by measuring flows of imports, exports, and purchases

[44] Our data show that groups enjoy strong positions in their product markets: 89 percent of the ten largest incumbents in French manufacturing industries are affiliated with business groups. In a previous paper, three of the four co-authors studied how reliance on internal capital markets can explain groups' ability to withstand competition, especially in environments where financial constraints are pronounced (Boutin, Cestone, Fumagalli, Pica, and Serrano-Velarde (2013)).

[45] Resource reallocation within multi-establishment firms has been the focus of much of the literature on internal capital markets. Recently, this has raised the question of whether firms' internal networks of establishments may contribute to propagate local economic shocks across regions (see Giroud and Mueller (2017)).

[46] Measurement is a further reason for studying complex organizations in the shape of groups comprising multiple firms rather than firms comprising multiple establishments: indeed, unlike for establishments, one can measure debt, earnings and coverage ratios for each separate group subsidiary (see Table 12 where these measures are exploited).

within France, together with firms' creation or destruction and their association with these flows, we will be able to assess the benefits and limits of integration. By analyzing how groups evolve when faced with the changing environments induced by exchange-rate movements, and contrasting their reactions with those of different organizations faced with similar shocks, we hope to have a better understanding of some of the reasons for firms' creation.

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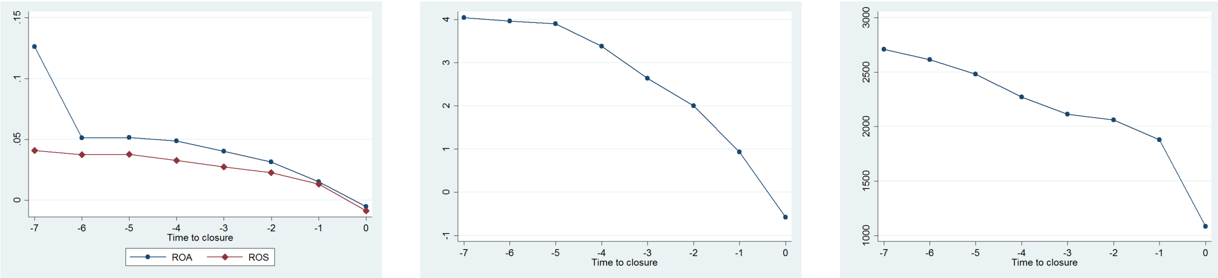
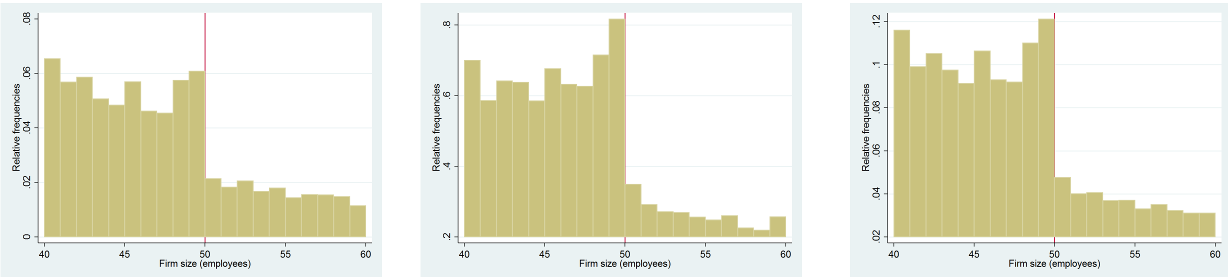
Figure 1. Evolution of performance indicators for group affiliated closing firms



(a) ROA and ROS (b) Coverage (c) Sales

Note: ROA denotes median return on assets; ROS median return on sales; coverage is the median ratio of EBITDA over interest payments. (Median) Sales are measured in thousands of Euros. Time to closure indicates the number of years before the closure event.

Figure 2. Firm size distribution around the 50 employee threshold (year 2006)



(a) Stand-alone firms (b) Business group affiliated firms (c) All firms

Table 1. Effect of Parmalat collapse on its French competitors' performance

Variables	Sales (1)	Employment (2)	Total Assets (3)	Fixed Assets (4)
Top 10 × Wholesale Milk Trade × Post2004	0.1779***	0.2383***	0.1210*	0.1278**
	(0.0459)	(0.0324)	(0.0511)	(0.0466)
Top 10 × Other Milk Production × Post2004	0.4343***	0.2282***	0.5029***	0.3438***
	(0.0466)	(0.0324)	(0.0509)	(0.0473)
Top 10 × Milk Production × Post2004	0.0124	-0.3459***	0.2670***	-0.1436**
	(0.0459)	(0.0324)	(0.0512)	(0.0468)
Top 10 × Butter × Post2004	0.1058*	0.0637	0.0661	-0.9385***
	(0.0467)	(0.0327)	(0.0539)	(0.0472)
Top 10 × Cheese × Post2004	-0.1081*	0.0253	-0.1438**	-0.0537
	(0.0465)	(0.0324)	(0.0511)	(0.0471)
N	1,489,260	1,004,524	1,321,175	1,215,149
Sector FE	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES

Note: All outcome variables are in logs. The table also includes the lower level interaction terms between *Top 10* (indicator equal to 1 if the firm ranks among the first 10 in the 4-digit industry), *Post2004* (indicator equal to 1 after the Parmalat collapse, i.e. after 2004) and the relevant 4-digit industry indicator. *Fixed Assets* is property plant and equipment. One star denotes significance at the 5% level, two stars denote significance at the 1% level, and three stars denote significance at the 0.1% level. Standard errors are clustered at the 4-digit sector level.

Table 2. Bilateral employment flows following the Parmalat 2004 shock

	Shocked Sectors		**Non Shocked Sectors**	
	Destination FE	Pair FE	Destination FE	Pair FE
Variables	(1)	(2)	(3)	(4)
Same Group	0.0135	0.0066	0.0277***	0.0230*
	(0.0096)	(0.0217)	(0.0055)	(0.0107)
Firm of origin group affiliated	0.0003	-0.0020	-0.0010	-0.0013
	(0.0037)	(0.0070)	(0.0014)	(0.0027)
Post2004 × firm of origin group affiliated	-0.0040	-0.0038	-0.0009	-0.0002
	(0.0046)	(0.0054)	(0.0017)	(0.0018)
Post2004 × same group	**0.0293***	**0.0350***	**-0.0035**	**-0.0013**
	(0.0118)	(0.0143)	(0.0066)	(0.0071)
N	22,219	22,219	50,013	50,013
Firm of destination FE	YES	NO	YES	NO
Firm of origin × firm of destination FE	NO	YES	NO	YES
Year dummies	YES	YES	YES	YES

Note: Dependent variable: fraction of employees hired by group-affiliated firm i (active in a shocked or non-shocked sector) in year t and previously employed by firm j, to the total number of firm-to-firm movers hired by firm i in year t. *Firm of origin group affiliated* is an indicator equal to 1 if firm j is group affiliated. *Same Group* an indicator equal to 1 if firm i and firm j belong to the same group. *Post2004* is an indicator equal to 1 after the Parmalat collapse, i.e. after 2004. One star denotes significance at the 5% level, two stars denote significance at the 1% level, and three stars denote significance at the 0.1% level. Standard errors are clustered at the firm of destination level.

Table 3. Descriptives on bilateral flows before and after the closure of a large competitor

	Extra group Flows	Intra group Flows
Before the shock	0.0215	0.0638
	(0.0983)	(0.1875)
	[183,429]	[6,173]
After the shock	0.0218	0.0717
	(0.1000)	(0.1957)
	[374,814]	[10,950]

Note: The table reports the average ratio of employees hired by an affiliated firm i (active in one of the shocked sectors) and originating from firm j, to the total number of firm-to-firm movers hired by firm i in the same year, separately for pairs that belong to the same group and pairs that do not.

Table 4. Bilateral employment flows and large competitors' closures

	Shocked Sectors				**Non Shocked Sectors**	
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Firm of origin group affiliated	0.0004	0.0037***	0.0043***	-0.0033***	0.0014***	0.0020***
	(0.0004)	(0.0009)	(0.0009)	(0.0004)	(0.0003)	(0.0005)
Same Group	0.0271***	0.0006	0.0005	-0.0012	0.0021	0.0032
	(0.0025)	(0.0049)	(0.0050)	(0.0016)	(0.0017)	(0.0023)
Post shock × firm of origin group affiliated	-0.0028***	-0.0037***		-0.0010	-0.0037***	-0.0044***
	(0.0005)	(0.0006)		(0.0004)	(0.0003)	(0.0004)
Post shock × Same Group	**0.0058***	**0.0115*****		**0.0013**	**0.0006**	**0.0008**
	(0.0029)	(0.0030)		(0.0015)	(0.0014)	(0.0018)
Shock year × Same Group			**0.0062**			
			(0.0040)			
Shock year + 1 × Same Group			**0.0112***			
			(0.0043)			
Shock year + 2 × Same Group			**0.0107***			
			(0.0042)			
Shock year + 3 × Same Group			**0.0200*****			
			(0.0046)			
Shock year + 4 × Same Group			**0.0116**			
			(0.0070)			
Shock year + 5 and 6 × Same Group			**0.0078**			
			(0.0069)			
Shock year × firm of origin group affiliated			-0.0013			
			(0.0008)			
Shock year + 1 × firm of origin group affiliated			-0.0005			
			(0.0008)			
Shock year + 2 × firm of origin group affiliated			-0.0066***			
			(0.0009)			
Shock year + 3 × firm of origin group affiliated			-0.0043***			
			(0.0009)			
Shock year + 4 × firm of origin group affiliated			-0.0056***			
			(0.0012)			
Shock year + 5 and 6 × firm of origin group affiliated			-0.0101***			
			(0.0013)			
Post shock × Same Group × Managers				**0.0053***		
				(0.0024)		
Post shock × Same Group × Intermediate Occupations				**-0.0010**		
				(0.0020)		
Post shock × Same Group × Clerical Support				**0.0021**		
				(0.0015)		
N	575,366	575,366	575,366	2,301,464	3,817,969	1,956,489
Firm of destination FE	YES	NO	NO	NO	NO	NO
Firm of origin × firm of destination FE	NO	YES	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES	YES	YES
Time to shock dummies	YES	YES	YES	YES	YES	YES

Note: Dependent variable in Columns (1), (2), (3) and (5) and (6): fraction of employees moving from firm j to group-affiliated firm i in year t to the total number of firm-to-firm movers hired by firm i in year t. Dependent variable in Column (4): fraction of employees moving from firm j to affiliated firm i undertaking occupation k in year t to the total number of firm-to-firm movers hired by firm i in year t. The occupational categories are the ones indicated in Table A1. The category Managers groups category 2 and 3. Firm i is a group-affiliated firm that operates in a sector in which a large competitor closes during our sample period. *Firm of origin group affiliated* is an indicator equal to 1 if firm j is group affiliated. *Same Group* is an indicator equal to 1 if firm j and firm i belong to the same group. *Post Shock* is an indicator equal to 1 starting from the closure year. We denote as the closure year the last year of activity of a given firm. *Shock year*+1 is an indicator equal to 1 in the year after the closure. All relevant second and third level interactions are included. One star denotes significance at the 5% level, two stars denote significance at the 1% level, and three stars denote significance at the 0.1% level. Standard errors are clustered at the destination firm level.

Table 5. Bilateral employment flows: descriptive statistics

	Years to closure	Extra-group flows	Intra-group flows
Normal times	-7	0.025	0.103
		(0.112)	(0.246)
		[57209]	[1728]
	-6	0.023	0.090
		(0.100)	(0.247)
		[101167]	[3240]
	-5	0.026	0.101
		(0.115)	(0.242)
		[152979]	[5339]
	-4	0.026	0.101
		(0.116)	(0.241)
		[224543]	[7423]
(Dropped in baseline)	-3	0.029	0.108
		(0.123)	(0.252)
		[281617]	[9869]
	-2	0.034	0.117
		(0.133)	(0.259)
		[328681]	[12251]
Closure times	-1	0.037	0.284
		(0.142)	(0.380)
		[362870]	[15611]
	0	0.041	0.362
		(0.152)	(0.402)
		[229778]	[9665]

Note: The years to closure indicate the number of years before the firm of origin closes down. For each year we report the average ratio of employees moving in year t from an affiliated firm of origin i to a destination firm j, to the total number of firm-to-firm movers leaving firm i in the same year, separately for pairs that belong to the same group and pairs that do not. Standard deviations are reported in parentheses and the number of observations in square brackets.

Table 6. Bilateral employment flows: closure vs. normal times

Variables	(1)	(2)	(3)	(4)
Destination firm group affiliated	-0.0013***	0.0011	-0.0021***	0.0015***
	(0.0003)	(0.0007)	(0.000)	(0.000)
Same Group	0.0334***	-0.0122**	0.0018	-0.0096***
	(0.0019)	(0.0041)	(0.001)	(0.001)
Closure × destination firm group affiliated	0.0004	0.0025***	-0.0001	0.0005
	(0.0004)	(0.0006)	(0.000)	(0.000)
Closure × Same Group	**0.1487*****	**0.1187*****	**0.0452*****	**0.0378*****
	(0.0039)	(0.0050)	(0.002)	(0.002)
Same Group × Managers			0.0161***	0.0161***
			(0.002)	(0.002)
Same Group × Intermediate Occupations			0.0093***	0.0093***
			(0.001)	(0.001)
Same Group × Clerical Support			0.0010	0.0010
			(0.001)	(0.001)
Closure × Same Group × Managers			**-0.0082****	**-0.0082****
			(0.002)	(0.002)
Closure × Same Group × Intermediate Occupations			**-0.0129*****	**-0.0129*****
			(0.002)	(0.002)
Closure × Same Group × Clerical Support			**-0.0112*****	**-0.0112*****
			(0.002)	(0.002)
N	1,171,552	1,171,552	4,686,112	4,686,112
Firm of origin FE	YES	NO	YES	NO
Firm of origin × destination firm FE	NO	YES	NO	YES
Year indicators	YES	YES	YES	YES
Time to closure indicators	YES	YES	YES	YES

Note: Dependent variable in Columns (1) - (2): fraction of employees moving from group-affiliated firm i to firm j in year t to the total number of firm-to-firm movers leaving firm i in year t. Dependent variable in Columns (3) - (4): fraction of employees originally undertaking occupation k moving from group-affiliated firm i to firm j in year t to the total number of firm-to-firm movers leaving firm i in year t. The occupational categories are the ones indicated in Table A1 in Appendix A.2. The category Managers groups category 2 and 3. Firm i is a firm that eventually closes within our sample period. *Destination firm group affiliated* is an indicator equal to 1 if firm j is group affiliated. *Same Group* is an indicator equal to 1 if firm i and firm j belong to the same group. *Closure* is an indicator equal to 1 in the last two years of firm i's activity. All relevant second and third level interactions are included. In columns (3) and (4) the coefficients of the interactions involving the occupational indicators do not vary across the two specifications because the (either firm-of-origin or pair) fixed effect is defined at the firm level and does not affect the differential effect of the occupational categories. One star 5% significance, two stars 1% significance, and three stars 0.1% significance. Standard errors are clustered at the firm of origin level.

Table 7. Bilateral employment flows and employment protection legislation

	FE estimates		IV estimates		
Firm size window	40-60	40-60	40-60	35-65	45-55
Same Group	0.0381***	0.0073	0.0325**	0.0165	0.0135
	(0.0093)	(0.0198)	(0.0113)	(0.0097)	(0.0165)
Destination firm group affiliated	-0.0023	-0.0027	-0.0029	0.0020	0.0051
	(0.0019)	(0.0045)	(0.0052)	(0.0047)	(0.0084)
Closure × destination firm group affiliated	0.0018	0.0080*	0.0072	-0.0013	-0.0131
	(0.0027)	(0.0037)	(0.0042)	(0.0042)	(0.0075)
Closure × Same Group	0.1211***	0.0785***	0.0810***	0.0970***	0.0933***
	(0.0158)	(0.0222)	(0.0107)	(0.0106)	(0.0171)
Closure × Firm size> 50	0.0016	0.0007	-0.0092	-0.0136	-0.0129
	(0.0036)	(0.0054)	(0.0235)	(0.0517)	(0.0163)
Destination firm group affiliated × Firm size> 50	-0.0019	0.0026	0.0024	-0.0044	-0.0113
	(0.0032)	(0.0072)	(0.0090)	(0.0085)	(0.0143)
Same Group × Firm size> 50	-0.0023	-0.0127	-0.0499**	-0.0241	-0.0274
	(0.0153)	(0.0295)	(0.0185)	(0.0173)	(0.0278)
Closure × destination firm group affiliated × Firm size> 50	0.0028	0.0010	0.0024	0.0140	0.0317**
	(0.0046)	(0.0056)	(0.0074)	(0.0075)	(0.0121)
Closure × same group × Firm size> 50	**0.0515***	**0.0705**	**0.0817*****	**0.0421***	**0.0647***
	(0.0261)	(0.0370)	(0.0182)	(0.0195)	(0.0312)
N	53,544	53,544	40,795	56,387	17,855
Firm of origin FE	YES	NO	NO	NO	NO
Firm of origin × destination firm FE	NO	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES	YES
Time to closure dummies	YES	YES	YES	YES	YES

Note: Dependent variable: fraction of employees moving from group-affiliated firm i to firm j in year t to the total number of firm-to-firm movers leaving firm i in year t. *Destination firm group affiliated* is an indicator equal to 1 if firm j is group affiliated. *Same Group* is an indicator equal to 1 if firm i and firm j belong to the same group. *Closure* is an indicator equal to 1 in the last two years of firm i's activity. In the first two columns $Firm\ size > 50$ is a time-invariant indicator taking the value 1 for firms with 50 or more employees at closure. In the last three columns $Firm\ size > 50$ is instrumented using the (average) firm size in normal times, i.e. at least four years before closure. All relevant second and third level interactions are also instrumented as explained in the main text. We restrict to closing firms between 40 and 60 employees in the first three columns, between 35 and 65 in the fourth column, between 45 and 55 in the last column. One star 5% significance, two stars 1% significance, and three stars 0.1% significance. Standard errors are clustered at the firm of origin level.

Table 8. Flows to unemployment: descriptive statistics

	Stand-alones	**BG-affiliated firms**
	0.18818	0.2410
Normal times	(0.3184)	(0.2643)
	[312,284]	[22,975]
Closure	0.2294	0.2188
	(0.3566)	(0.2837)
	[1,226,615]	[44,360]

Note: *Closure* indicates the year of firm closure and the previous year. *Normal times* indicates more than four years before closure. We compute the average ratio of employees moving to unemployment in year t from a firm of origin i, over the total number of employees leaving firm i in year t. Firm of origin i is a firm that eventually closes within our sample period. The table reports the average ratio at closure and in normal times, separately for stand-alone versus group-affiliated firms. Standard deviations are reported in parentheses and the number of observations in square brackets.

Table 9. Flows to unemployment: closures vs. normal times

	(1)	(2)
Firm of origin group affiliated	0.0538***	0.0143***
	(0.0030)	(0.0015)
Closure × Firm of origin group affiliated	**-0.0785*** **	**-0.0376*** **
	(0.0030)	(0.0016)
Closure × Firm of origin affiliated × Managers		**0.0324*** **
		(0.0020)
Closure × Firm of origin affiliated × Intermediate Occ.		**0.0218*** **
		(0.0020)
Closure × Firm of origin affiliated × Clerical Support		**0.0171*** **
		(0.0021)
N	1,606,734	6,593,384
Firm of origin FE	YES	YES
Year indicators	YES	YES
Time to closure indicators	YES	YES

Note: Dependent variable in column (1): fraction of employees moving from firm i to unemployment in year t, to the total number of employees leaving firm i in year t. Firm i is a firm that eventually closes within our sample period. *Closure* is an indicator equal to 1 in the last two years of firm i's activity. *Firm of origin group affiliated* is an indicator equal to 1 if the firm of origin is group affiliated. Dependent variable in column (2): fraction of employees originally undertaking occupation k and moving from firm i to unemployment in year t to the total number of employees leaving firm i in year t. The occupational categories are the ones indicated in Table A1 in Appendix A.2. The category Managers groups category 2 and 3. All relevant second and third level interactions are included. One star denotes significance at the 5% level, two stars denote significance at the 1% level, and three stars denote significance at the 0.1% level. Standard errors are clustered at the firm of origin level

Table 10. Wage changes: closures vs. normal times by occupational categories

	Change in Hours Worked		**Hourly Wage Change**		**Annual Wage Change**	
	Origin	Pair	Origin	Pair	Origin	Pair
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Destination firm group affiliated	0.0904***	0.0483	0.0426***	0.0295	0.1357***	0.0724
	(0.018)	(0.055)	(0.006)	(0.032)	(0.018)	(0.055)
Same Group	0.1667***	0.0482	0.0174	-0.0157	0.1873***	0.0374
	(0.033)	(0.046)	(0.017)	(0.028)	(0.035)	(0.054)
Closure × destination firm group affiliated	-0.0008	0.0353	-0.0123	-0.0142	-0.0136	0.0229
	(0.024)	(0.053)	(0.008)	(0.031)	(0.025)	(0.054)
Closure × Same Group	**-0.0962***	**-0.1005***	**0.0160**	**-0.0079**	**-0.0806**	**-0.1104***
	(0.043)	(0.044)	(0.019)	(0.026)	(0.045)	(0.051)
Male	0.0391***	0.0240***	0.0040**	0.0006	0.0437***	0.0246***
	(0.004)	(0.003)	(0.001)	(0.002)	(0.004)	(0.003)
Age	0.0438***	0.0304***	-0.0013	-0.0064***	0.0420***	0.0239***
	(0.003)	(0.002)	(0.001)	(0.001)	(0.003)	(0.002)
Age squared	-0.0005***	-0.0004***	0.0000	0.0001***	-0.0005***	-0.0003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Duration	-0.0045***	-0.0039***	0.0003***	0.0003***	-0.0042***	-0.0036***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Same Group × Managers	-0.0985*	0.0045	0.1079***	0.0491	0.0157	0.0629
	(0.049)	(0.044)	(0.026)	(0.038)	(0.050)	(0.053)
Same Group × Intermediate Occupations	-0.0214	0.0934	0.0370*	0.0142	0.0086	0.1085
	(0.044)	(0.062)	(0.018)	(0.024)	(0.046)	(0.065)
Same Group × Clerical Support	-0.0364	-0.0104	0.0091	0.0216	-0.0261	0.0109
	(0.057)	(0.067)	(0.022)	(0.029)	(0.062)	(0.070)
Closure × Same Group × Managers	**0.0830**	**0.0141**	**-0.0840****	**-0.0330**	**-0.0092**	**-0.0280**
	(0.051)	(0.044)	(0.028)	(0.039)	(0.051)	(0.053)
Closure × Same Group × Intermediate Occupations	**-0.0098**	**-0.0888**	**-0.0262**	**0.0019**	**-0.0280**	**-0.0873**
	(0.046)	(0.063)	(0.019)	(0.025)	(0.048)	(0.065)
Closure × Same Group × Clerical Support	**0.0415**	**-0.0047**	**-0.0238**	**-0.0175**	**0.0187**	**-0.0211**
	(0.069)	(0.068)	(0.025)	(0.031)	(0.071)	(0.071)
N	905,089	905,089	905,087	905,087	909,556	909,556
Firm of origin FE	YES	NO	YES	NO	YES	NO
Firm of origin × destination firm FE	NO	YES	NO	YES	NO	YES
Year indicators	YES	YES	YES	YES	YES	YES
Time to closure indicators	YES	YES	YES	YES	YES	YES

Note: In columns (1)-(2) the dependent variable is the percentage change in the number of hours worked of a worker transiting from affiliated firm i to firm j in year t. In columns (3)-(4) the dependent variable is the percentage change in the hourly wage of a worker transiting from affiliated firm i to firm j in year t. In columns (5)-(6) the dependent variable is the percentage change in the annual wage of a worker transiting from affiliated firm i to firm j in year t. The occupational categories are as in Table A1 in Appendix A.2 (managers include categories 2 and 3). *Destination firm group affiliated* is an indicator equal to 1 if firm j is group affiliated. *Same Group* is an indicator equal to 1 if firm i and firm j belong to the same group. *Closure* is an indicator equal to 1 in the last two years of firm i's activity. *Duration* measures the number of days spent by the worker in the firm of origin. All relevant second and third level interactions are included. One star denotes significance at the 5% level, two stars denote significance at the 1% level, and three stars denote significance at the 0.1% level. Standard errors are clustered at the firm of origin level.

Table 11. ILM flows at closure and destination firm's sector (boom/bust and growth)

Variables	(1)	(2)	(3)
Destination firm group affiliated	-0.004	-0.0004	-0.0107***
	(0.001)	(0.001)	(0.0026)
Same Group	-0.0291***	-0.0240***	-0.0345***
	(0.006)	(0.007)	(0.0157)
Closure × destination firm group affiliated	-0.0007	-0.0007	0.0084***
	(0.001)	(0.001)	(0.0025)
Closure × same group	**0.1499*** **	**0.1662*** **	**0.1255*** **
	(0.008)	(0.009)	(0.0187)
Destination firm sector in Boom	-0.0001		
	(0.001)		
Destination in Boom × Closure	-0.0007		
	(0.001)		
Destination in Boom × Same Group	-0.0028		
	(0.009)		
Destination in Boom × Closure × Same Group	**0.0314***		
	(0.014)		
Destination firm in Bust		-0.0011	
		(0.000)	
Destination in Bust × Closure		0.0005	
		(0.001)	
Destination in Bust × Same Group		-0.0141	
		(0.009)	
Destination in Bust × Closure × Same Group		**-0.0159**	
		(0.013)	
Sector Growth of Real Sales below 10pct × Closure × Same Group			**-0.0317***
			(0.0135)
Sector Growth of Real Sales above 50pct × Closure × Same Group			**-0.0098**
			(0.0153)
Sector Growth of Real Sales above 90pct × Closure × Same Group			**0.0318***
			(0.0143)
N	688,390	688,390	844,031
Firm of origin × destination firm FE	YES	YES	YES
Year indicators	YES	YES	YES
Time to closure indicators	YES	YES	YES

Note: Dependent variable: fraction of employees moving from group-affiliated firm i to firm j in year t to the total number of firm-to-firm movers leaving firm i in year t. Firm i is a firm that eventually closes within our sample period. *Destination firm group affiliated* is an indicator equal to 1 if firm j is group affiliated. *Same Group* is an indicator equal to 1 if firm i and firm j belong to the same group. *Closure* is an indicator equal to 1 in the last two years of firm i's activity. *Destination firm in a Boom (bust)* is an indicator equal to 1 if the destination firm operates in a (3-digit) sector that is experiencing a boom (bust) in the year following the closure. Booms and busts are identified from the fluctuations of real sectoral sales, where nominal sales are deflated by industry-specific price deflators, following the Braun and Larrain (2005) peak-to-trough criterion. Troughs occur when (the log of) real sales are below their trend (computed using a Hodrick-Prescott filter with a smoothing parameter of 100) by more than one standard deviation. For each trough, we go back in time until we find a local peak, which is defined as the closest preceding year for which (detrended) real sales are higher than in the previous and posterior year. A bust goes from the year after the local peak to the year of the trough. The same procedure is used to identify sectoral booms. A peak occurs when current real sales are more than one standard deviation above their trend. Once a peak is identified, we go back in time until we find a local trough, i.e., the closest preceding year for which (detrended) real sales are lower than in the previous and posterior year. The years falling between a local trough and a peak are labelled as a boom. *Sector Growth of Real Sales* is a variable that measures the growth rate of real sales over the sample period in each 3-digit sector. *Sector Growth of Real Sales below 10pct* is an indicator that takes the value 1 if the destination firm j operates in a (3-digit) sector that belongs to the bottom decile of the distribution of *Sector Growth of Real Sales*. One star 5% significance, two stars 1% significance, and three stars 0.1% significance. Standard errors are clustered at the firm of origin level.

Table 12. ILM flows at closure and destination firm's size, TFP, investment, and financial health

Variables	(1)	(2)	(3)	(4)	(5)
Destination firm group affiliated	0.0059	-0.0019	0.0012	0.0020	0.0017
	(0.0042)	(0.0028)	(0.0021)	(0.0011)	(0.0016)
Same Group	-0.0132	-0.0205	-0.0055	-0.0086	-0.0062
	(0.0228)	(0.0181)	(0.0127)	(0.0065)	(0.0087)
Closure × destination firm group affiliated	0.0020	0.0042	0.0050**	0.0023**	0.0008
	(0.0039)	(0.0024)	(0.0018)	(0.0009)	(0.0011)
Closure × same group	**0.0562***	**0.0622****	**0.0933*****	**0.1416*****	**0.1541*****
	(0.0256)	(0.0218)	(0.0155)	(0.0081)	(0.0094)
TA below 10pct × Closure × Same Group	**-0.0188**				
	(0.0925)				
TA above 50pct × Closure × Same Group	**0.0561***				
	(0.0216)				
TA above 90pct × Closure × Same Group	**0.0570*****				
	(0.0118)				
TFP below 10pct × Closure × Same Group		**-0.0296**			
		(0.0674)			
TFP above 50pct × Closure × Same Group		**0.0528***			
		(0.0245)			
TFP above 90pct × Closure × Same Group		**0.0187**			
		(0.0145)			
CAPEXbelow 10pct × Closure × Same Group			**-0.0290**		
			(0.0253)		
CAPEX above 50pct × Closure × Same Group			**0.0528****		
			(0.0179)		
CAPEX above 90pct × Closure × Same Group			**-0.0122**		
			(0.0104)		
LEV below 10pct × Closure × same group				**-0.0456**	
				(0.0236)	
LEV above 50pct × Closure × same group				**0.0133**	
				(0.0118)	
LEV above 90pct × Closure × same group				**-0.0483***	
				(0.0233)	
COV below 10pct × Closure × same group					**-0.0367****
					(0.0107)
COV above 50pct × Closure × same group					**-0.0004**
					(0.0130)
COV above 90pct × Closure × same group					**-0.0153**
					(0.0156)
N	705,413	495,042	788,004	700,253	637,665
Firm of origin × destination firm FE	YES	YES	YES	YES	YES
Year indicators	YES	YES	YES	YES	YES
Time to closure indicators	YES	YES	YES	YES	YES

Note: In columns (1)-(3) the dependent variable is the fraction of employees moving from group-affiliated firm i to firm j in year t to the total number of firm-to-firm movers leaving firm i in year t. In columns (4)-(5) the dependent variable is the fraction of employees moving in year t from group-affiliated firm i to any destination-firm j *not* operating in the financial sector, divided by the total number of firm-to-firm movers leaving firm i in year t. Firm i is a firm that eventually closes within our sample period. *Destination firm group affiliated* is an indicator equal to 1 if firm j is group affiliated. *Same Group* is an indicator equal to 1 if firm i and firm j belong to the same group. *Closure* is an indicator equal to 1 in the last two years of firm i's activity. The variable *TA* measures the (average) book value of assets of destination firm j in "normal times", i.e. more than four years before the closure of firm i. Since a destination firm j can be the labor market partner of different firms of origin, each identifying different 'normal times', the normal time value is averaged over all the possible pairs involving firm j. *TA below* $10pct$ is an indicator equal to 1 if the destination firm j belongs to the bottom decile of the distribution of *TA*. *TA above* $50pct$ is an indicator equal to 1 if the destination firm j's *TA* is above the median. *TA above* $90pct$ is an indicator equal to 1 if the destination firm j belongs to the top decile of the distribution of *TA*. Similar results hold if we measure firm size by the book value of Property, Plants and Equipment. The variable *TFP* measures the (average) value of TFP of destination firm j in normal times. Firm j's TFP is recovered from the labor and capital coefficients estimated using the Levinsohn and Petrin (2003) methodology by 1-digit sectors (according to the NAF 2008 classification). The estimation has been done on the population of French firms appearing in FICUS between 2002 and 2010. *CAPEX* measures (average) investment in tangible assets of destination firm j in "normal times". *LEV* measures the (average) ratio of long-term debt to total assets of destination firm j in "normal times". *COV* measures the (average) ratio of EBITDA to interest expense of destination firm j in "normal times". All relevant second and third level interactions are included. One star 5% significance, two stars 1% significance, and three stars 0.1% significance. Standard errors are clustered at the firm of origin level.

A Appendix

A.1 A simple model of ILM activity

In this section we lay out a simple model to study the optimal labor adjustment response to a (permanent) shock in a business group and in a stand-alone firm. The model allows us to study how the group's adjustment differs from that of a stand-alone, what triggers the use of the ILM in the group, and how the ILM creates value. We will focus here on the case where only one firm in the group is hit by a shock, while the other affiliated firm is not.

We describe here the production technology. Each firm produces using labor only, and output is given by

$$Y_i = \theta_i f_i(L_i) \tag{5}$$

where θ_i is a parameter capturing total factor productivity, and the function f satisfies $f' > 0$, $f'' < 0$. Without loss of generality we also assume that $lim_{L\rightarrow 0} f'(L) \rightarrow \infty$.[47] The price for the firm's product is $p = 1$ and there is perfect competition both in the product and in the input markets. We denote firm i's stock of labor at the beginning of the period as L_{0i}. In what follows we will omit the subscript i when referring to the stand-alone firm, while denoting with $i = A, B$ the two firms affiliated with the business group.

A.1.1 Labor adjustment in the stand-alone firm

Following the realization of a shock, the firm's total factor productivity is: $\theta' = \theta + \varepsilon$, with $\varepsilon \in (-\infty, +\infty)$. The firm can adjust its labor force by an amount e, and in doing so it faces firing and hiring costs in the external labor market. We assume that adjustment costs are linear, but our results generalize to the case of non-linear adjustment costs: $C(e) = He$ if $e > 0$ and $C(e) = Fe$ if $e < 0$. We also assume, without loss of generality, that the initial stock of labor L_0 satisfies $\theta f'(L_0) \in (w - F, w + H)$. The following Lemma shows that in this second best environment the optimal adjustment policy consists of not adjusting unless the shock is large. In other words, the presence of labor market frictions makes the firm's labor demand less flexible.

Lemma 1. *The stand-alone firm hires workers when the shock is positive and large, fires workers when the shock is negative and large, and does not adjust for moderate realizations of the shock (inaction corridor):*

$$\begin{aligned}
&e^* > 0 \quad s.t.(\theta + \varepsilon) f'(L_0 + e^*) = w + H && if \quad \varepsilon > \varepsilon^H \\
&e^* = 0 && if \quad \varepsilon \in [\varepsilon^L, \varepsilon^H] \\
&e^* < 0 \quad s.t.(\theta + \varepsilon) f'(L_0 + e^*) = w - F && if \quad \varepsilon < \varepsilon^L
\end{aligned}$$

$\varepsilon^H > 0$ *is such that* $(\theta + \varepsilon^H) f'(L_0) = w + H$ *and* $\varepsilon^L < 0$ *is such that* $(\theta + \varepsilon^L) f'(L_0) = w - F$.

A.1.2 Labor adjustment in a business group

Consider now a group composed of two units with production function $Y_i = \theta_i f_i(L_i)$ and $i = A, B$. The group's headquarters has control over labor adjustment decisions in each of the group's units. Suppose that unit A is hit by a shock $\varepsilon \in (-\infty, +\infty)$, hence $\theta_A' = \theta_A + \varepsilon$, while unit B is not, hence its productivity is unchanged and equal to θ_B. Following the shock, the group can adjust unit A's labor force using the external labor market (ELM), but also rely on the internal labor market (ILM), moving workers across units. ILM adjustments are less costly than external ones (we discuss this hypothesis at length in Section 2): for simplicity, we assume here that internal adjustments are costless. We denote with e_i the external labor market adjustment and with i the internal labor

[47] This assumption simplifies the analysis by allowing us to disregard corner solutions without altering the qualitative results.

market flow. We adopt the convention that $i > 0$ when workers are reallocated from unit B to unit A, and $i < 0$ when the flow has the opposite direction. Without loss of generality, we assume that $\theta_A f'_A(L_{0A}) = \theta_B f'_B(L_{0B}) = \theta f'(L_0) \in (w - F, w + H)$,[48] and that $\theta_B f'_B(L_{0A} + L_{0B}) < w - F$.[49]

The headquarters choose e_A, e_B and i so as to maximize the total value of the group:

$$\max_{e_A, e_B, i} [(\theta_A + \varepsilon) f_A(L_{0A} + e_A + i) - w(L_{0A} + e_A + i) - C(e_A)$$
$$+\theta_B f_B(L_{0B} + e_B - i) - w(L_{0B} + e_B - i) - C(e_B)]$$
$$s.t.\ e_A + i \geq -L_{0A}\ ,\ e_B - i \geq -L_{0B}$$

The first order conditions of the above problem are:

$$\frac{\partial V}{\partial e_A} = \begin{cases} (\theta_A + \varepsilon) f'_A(L_{0A} + e^*_A + i^*) = w + H & \text{if } e^*_A > 0 \\ (\theta_A + \varepsilon) f'_A(L_{0A} + e^*_A + i^*) \in [w - F, w + H] & \text{if } e^*_A = 0 \\ (\theta_A + \varepsilon) f'_A(L_{0A} + e^*_A + i^*) = w - F & \text{if } e^*_A < 0 \end{cases} \tag{6a}$$

$$\frac{\partial V}{\partial i} = (\theta_A + \varepsilon) f'_A(L_{0A} + e^*_A + i^*) - \theta_B f'_B(L_{0B} + e^*_B - i^*) = 0 \tag{6b}$$

$$\frac{\partial V}{\partial e_B} = \begin{cases} \theta_B f'_B(L_{0B} + e^*_B - i^*) = w + H & \text{if } e^*_B > 0 \\ \theta_B f'_B(L_{0B} + e^*_B - i^*) \in [w - F, w + H] & \text{if } e^*_B = 0 \\ \theta_B f'_B(L_{0B} + e^*_B - i^*) = w - F & \text{if } e^*_B < 0. \end{cases} \tag{6c}$$

The following Proposition shows that when group unit A is hit by a shock while B is not, the size and the mode of the adjustment in unit A depend on the magnitude and the sign of the shock. When the shock is moderate, the group only relies on the ILM to adjust A's labor force. After a large enough positive (negative) shock, the group combines external hiring (firing) in the affected unit with ILM flows to (from) the unit.

Proposition 1. *The optimal adjustment policy in the group entails $e^*_B = 0$ for any ε. There exist two thresholds for ε, $\overline{\varepsilon}$ and $\underline{\varepsilon}$, such that:*

$$\begin{array}{llll} e^*_A > 0,\ i^* > 0, & s.t.(\theta_A + \varepsilon) f'_A(L_{0A} + e^*_A + i^*) = \theta_B f'_B(L_{0B} - i^*) = w + H & if & \varepsilon > \overline{\varepsilon} > 0 \\ e^*_A = 0,\ i^* = \widehat{i}, & s.t.(\theta_A + \varepsilon) f'_A(L_{0A} + i^*) = \theta_B f'_B(L_{0B} - i^*) \in [w - F, w + H] & if & \varepsilon \in [\underline{\varepsilon}, \overline{\varepsilon}] \\ e^*_A < 0,\ i^* < 0, & s.t.(\theta_A + \varepsilon) f'_A(L_{0A} + e^*_A + i^*) = \theta_B f'_B(L_{0B} - i^*) = w - F & if & \varepsilon < \underline{\varepsilon} < 0 \end{array}$$

Proof. Define as $\widehat{i}(\varepsilon)$ the ILM flow that equalizes marginal productivities across the two units absent external adjustments: $(\theta_A + \varepsilon) f'_A(L_{0A} + \widehat{i}(\varepsilon)) = \theta_B f'_B(L_{0B} - \widehat{i}(\varepsilon))$. From concavity of the production functions, $\theta_A f'_A(L_{0A}) = \theta_B f'_B(L_{0B})$ and $lim_{L_i \to 0} f'_i(L_i) \to \infty$ it follows that $\widehat{i}(\varepsilon)$ exists, it is unique and strictly increasing in ε, and it is positive if (and only if) $\varepsilon > 0$. Moreover, $\theta_A f'_A(L_{0A}) = \theta_B f'_B(L_{0B}) < w + H$ and $lim_{L_B \to 0} f'_B(L_B) \to \infty$ imply that there exists a threshold level of the shock $\overline{\varepsilon} > 0$, such that when $\varepsilon = \overline{\varepsilon}$, it is: $\theta_B f'_B(L_{0B} - \widehat{i}(\overline{\varepsilon})) = (\theta_A + \overline{\varepsilon}) f'_A(L_0 + \widehat{i}(\overline{\varepsilon})) = w + H$ with $\widehat{i}(\overline{\varepsilon}) > 0$. (See also Figure 3.) For that positive realization of the shock the ILM reallocation from

[48]If one relaxes this assumption, similar qualitative results obtain by re-scaling the threshold levels of the shock in the main Proposition. Also, allowing the marginal productivity of labor to be smaller than $w - F$ (larger than $w + H$) would entail an additional case where unit B optimally reduces (increases) its workforce at the same time as A, hence both units adjust using the external labor market only.

[49]This assumption ensures that when A is hit by a sufficiently large shock, it is not optimal to fully adjust its workforce via the ILM, hence the group must combine ILM reallocations with external firing. Formally, this means that the threshold $\underline{\varepsilon}$ always exists (see below).

unit B to A equalizes marginal productivities across the two units and to $w+H$. In this case it is optimal not to hire from the external labor market. When $\varepsilon > \bar{\varepsilon}$, $\widehat{i}(\varepsilon) > \widehat{i}(\bar{\varepsilon})$ and the internal reallocation that equalizes marginal productivities without external adjustments would make such marginal productivities larger than $w+H$. Then, the FOCs can only be satisfied if external hiring is combined with ILM activity. Indeed, under the assumptions that firing/hiring costs are linear and that internal reallocations are costless, multiple solutions exist in which different amounts of internal flows are combined with external hiring in both units. The introduction of a small cost of internal reallocation would pin down as the unique solution the one indicated above, where $i^* < \widehat{i}(\varepsilon)$ and only the positively shocked unit hires on the external market. Similarly, $\theta_A f'_A(L_{0A}) = \theta_B f'_B(L_{0B}) > w-F$ and $\theta_B f'_B(L_{0B}+L_{0A}) < w-F$ implies that there exists a threshold level of the shock, $\underline{\varepsilon} < 0$, such that when $\varepsilon = \underline{\varepsilon}$, it is: $\theta_B f'_B(L_{0B} - \widehat{i}(\underline{\varepsilon})) = (\theta_A + \underline{\varepsilon}) f'_A(L_0 + \widehat{i}(\underline{\varepsilon})) = w - F$ with $\widehat{i}(\underline{\varepsilon}) < 0$. For that negative realization of the shock the ILM reallocation from unit A to B equalizes marginal productivities across the two units and to $w-F$. In this case it is optimal not to hire from the external labor market. When $\varepsilon < \underline{\varepsilon}$, $\widehat{i}(\varepsilon) < \widehat{i}(\underline{\varepsilon})$ and the internal reallocation that equalizes marginal productivities without external adjustments makes such marginal productivities smaller than $w-F$. Then, the FOCs can only be satisfied if external firing is combined with ILM activity. The same caveat concerning multiplicity of optimal allocations also applies; with a small ILM reallocation cost, the unique solution is such that $|i^*| < |\widehat{i}(\varepsilon)|$ and only the negatively affected unit fires workers. □

Corollary 1. – ***ILM flows and size of the shock*** – *The size of the internal labor market flow is (weakly) increasing in the size of the shock.*

Proof. By Proposition 1, when $\varepsilon \in [\underline{\varepsilon}, \bar{\varepsilon}]$, the optimal ILM allocation i^* is equal to $\widehat{i}(\varepsilon)$, which is strictly increasing in ε. When $\varepsilon < \underline{\varepsilon}$ or $\varepsilon > \bar{\varepsilon}$, from the FOCs it follows that (i) $e^*_A + i^*$, the total adjustment in unit A, is strictly increasing in ε, but (ii) i^* is constant and equal to $\widehat{i}(\underline{\varepsilon})$ (for $\varepsilon < \underline{\varepsilon}$), or $\widehat{i}(\bar{\varepsilon})$ (for $\varepsilon > \bar{\varepsilon}$). This second property of $i^*(\varepsilon)$ is due to the linearity of the adjustment costs: it is easily shown that $i^*(\varepsilon)$ would be strictly increasing in a model with convex adjustment costs. □

A.1.3 ILM response to an adverse shock and firing costs

The following result describes how the magnitude of firing costs determines the ILM flows following an adverse shock. It underpins our prediction that the ILM response to negative shocks is larger when employment protection regulations are stricter, which we test in Section 5.1.

Corollary 2. *Following an adverse shock, the flow of workers reallocated from unit A to the rest of the group is increasing in the unit firing cost F. In particular, for any shock $\varepsilon < 0$ there exist a cutoff $\underline{F}$ such that the proportion of workers reallocated through the ILM over the total outflow of workers from firm A is strictly increasing in F for $F < \underline{F}$ and equal to 1 if $F \geq \underline{F}$.*

Proof. From the concavity of production functions, and $\theta_B f'_B(L_{0B} - \widehat{i}(\underline{\varepsilon})) = (\theta_A + \underline{\varepsilon}) f'_A(L_0 + \widehat{i}(\underline{\varepsilon})) = w - F$, it follows that $\underline{\varepsilon}$ is strictly decreasing in F. This in turn implies that, for any shock ε, there exists a unique threshold value $\underline{F}(\varepsilon)$ that defines two regions.

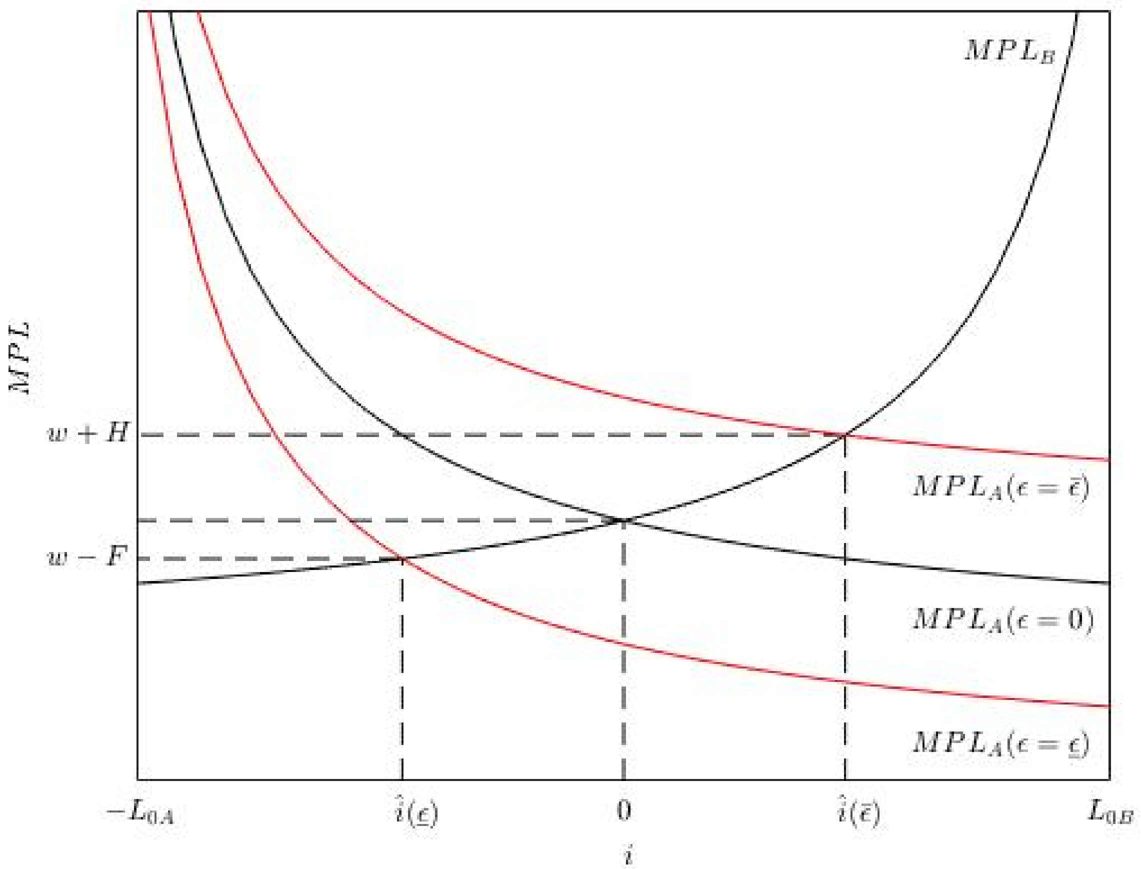
First, when $F < \underline{F}$ it is $\varepsilon < \underline{\varepsilon}$, hence by Proposition 1, i^* and e^*_A are defined by $(\theta_A + \varepsilon) f'_A(L_{0A} + e^*_A + i^*) = \theta_B f'_B(L_{0B} - i^*) = w - F$. Applying the implicit function theorem, one obtains $\partial i^*/\partial F = 1/(\theta_B f'') < 0$, $\partial e^*_A/\partial F = -1/((\theta_A + \varepsilon) f'') > 0$, and $\partial(\frac{i^*}{i^* + e^*_A})/\partial F > 0$.

Second, when $F \geq \underline{F}$, it is $\varepsilon \geq \underline{\varepsilon}$, hence by Proposition 1, $e^*_A = 0$ and $i^* = \widehat{i}$ is defined by $(\theta_A + \varepsilon) f'_A(L_{0A} + i^*) = \theta_B f'_B(L_{0B} - i^*) \in [w - F, w + H]$. Therefore, the size of the ILM flow from A to B is independent of F and the fraction $\frac{i^*}{i^* + e^*_A}$ is constant and equal to 1. □

A.1.4 Value creation through the ILM

To understand how the ILM creates value, we compare here the optimal labor adjustment response of a group composed of units A and B with that of two identical, but not affiliated, firms. To

Figure 3. Graphic Representation of Proposition 1's proof. The horizontal axis measures the ILM flow from unit B to unit A, the vertical axis displays the marginal productivity of labor of the two units (MPL_A, MPL_B). The optimal ILM response to a productivity shock of size ε hitting unit A is found by identifying the intersection between MPL_B and the relevant MPL_A. All MPL_A curves above (below) the black one correspond to positive (negative) shocks.



this purpose, it is useful to compare the threshold levels of the shock that characterize the group's optimal adjustment policy with those of a stand-alone firm identical to unit A (i.e. $\theta_A = \theta$, $f_A = f$ and $L_{0A} = L_0$). The stand-alone firm identical to unit B is not hit by a shock and, by the assumption $\theta_B f'_B(L_{0B}) \in (w - F, w + H)$, it does not adjust.

Corollary 3. *The threshold levels of the shock for the stand-alone firm and for the group are such that:* $\bar{\varepsilon} > \varepsilon^H > 0$ *and* $\underline{\varepsilon} < \varepsilon^L < 0$.

Proof. The threshold level $\bar{\varepsilon} > 0$ is such that $(\theta_A + \bar{\varepsilon})f'(L_{0A} + \widehat{i}(\bar{\varepsilon})) = w + H$, whereas $\varepsilon^H > 0$ is such that $(\theta + \varepsilon^H)f'(L_0) = w + H$. Since $\widehat{i}(\bar{\varepsilon}) > 0$ (in the ILM workers flow towards the positively affected unit (Unit A)), then $f'(L_{0A} + \widehat{i}(\bar{\varepsilon})) < f'(L_0)$. This implies that $\bar{\varepsilon} > \varepsilon^H > 0$. Similarly, the threshold level $\underline{\varepsilon} < 0$ is such that $(\theta_A + \underline{\varepsilon})f'(L_{0A} + \widehat{i}(\underline{\varepsilon})) = w - F$, whereas $\varepsilon^L < 0$ is such that $(\theta + \varepsilon^L)f'(L_0) = w - F$. Since $\widehat{i}(\underline{\varepsilon}) < 0$, i.e. the ILM makes workers flow away from the adversely affected unit, then $f'(L_0 + \widehat{i}(\underline{\varepsilon})) > f'(L_0)$. This implies that $\underline{\varepsilon} < \varepsilon^L < 0$. □

This result allows us to identify three regions. First, when the shock is small (i.e. $\varepsilon \in [\varepsilon^L, \varepsilon^H]$), the presence of hiring/firing costs in the external market induces the stand-alone firm not to adjust, whereas the group adjusts its labor force using the ILM. The availability of a cheaper internal channel allows the group to reallocate its labor force towards more productive uses, thereby increasing value by removing differences in the marginal productivities of labor across the two units.

Second, for intermediate levels of the shock (i.e. either $\varepsilon \in [\varepsilon^H, \overline{\varepsilon}]$) or $\varepsilon \in [\underline{\varepsilon}, \varepsilon^L]$), the stand-alone firm A adjusts on the external market, stand-alone firm B does not adjust, while the group unit relies uniquely on the ILM. The use of the ILM increases the group value not only because it allows the group to save on the external adjustment cost born by stand-alone firm A and to improve the allocation of labor across the two units, but also because it allows the group to adjust in unit A more than in the identical stand-alone firm. The intuition is that the stand-alone adjusts until it reaches the level of employment such that the marginal productivity is equal to either $w - F$ or $w + H$. Instead unit A adjusts more because it uses a cheaper channel and there is scope for increasing the group value by reducing further the difference between the marginal productivities across the two units.

Finally, for large values of the shock (i.e. either $\varepsilon > \overline{\varepsilon}$ or $\varepsilon < \underline{\varepsilon}$), the total adjustment in unit A is the same as in the stand-alone ($i^* + e_A^* = e^*$). However, the use of the ILM increases value because it allows the group to improve the allocation of labor across the two units and to avoid firing/hiring costs in unit A.

The above result highlights two different channels through which the ability to operate an ILM creates value: *(i) Flexibility:* The ILM allows affiliated firms to adjust their labor force more than stand-alones and to take advantage of a more efficient allocation of labor across the affiliated units; *(ii) Lower adjustment costs:* The ILM allows affiliated firms to bear lower firing and hiring costs. This effect is evident in the region where the stand-alone and the affiliated firm perform the same level of total adjustment, yet the affiliated firm relies in part on the cheaper internal channel. Evidently, while the ILM allows to bypass firing (or hiring) costs, some inefficiency is borne by unit B in the organization, that may end up employing an amount of workers larger (or smaller) than individually optimal, i.e. such that the marginal productivity of labor is smaller (larger) than w. It is however worth emphasizing that the optimal ILM allocation ensures that the efficiency loss in unit B is more than offset by the gain in unit A. Hence, the value of a group with an ILM is larger than the value of a set of identical stand-alone companies.[50]

[50]Note that although for brevity we studied here the optimal response to a shock hitting only one unit in the organization, our simple analysis points to the coinsurance value of ILMs; in a more general model where both group units are exposed to idiosyncratic shocks ex-ante, the ILM would create value in all states of nature where only one unit is hit by a shock, and a fortiori in states of nature where two units are hit by shocks of opposite sign.

A.2 Professional categories in the DADS

Table A1. Professional categories in the DADS

CODE	CATEGORY
10	Farmers
2	**Top manager/Chief of firms**
21	Top managers/chiefs of handicraft firms
22	Top managers/chiefs of industrial/commercial firms with less than 10 employees
23	Top managers of industrial/commercial firms with more than 10 employees
3	**Management and superior intellectual occupations**
31	Healthcare professionals, legal professionals and other professionals
33	Managers of the Public Administration
34	Professors, researchers, scientific occupations
35	Journalists, media, arts and entertainment occupations
37	Administrative and commercial managers
38	Engineers and technical managers
4	**Intermediate occupations**
42	Teachers and other education, training and library occupations
43	Healthcare support occupations and social services occupations
44	Clergy and religious occupations
45	Intermediate administrative occupations in the Public Administration
46	Intermediate administrative and commercial occupations in firms
47	Technicians
48	Supervisors and 'agents de maitrise'
5	**Clerical Support and Sales occupations**
52	Clerical support occupations in the Public Administration
53	Surveillance and security occupations
54	Clerical support in firms
55	Sales and related occupations
56	Personal service occupations
6	**Blue collar occupations**
62	Industrial qualified workers
63	Handicraft qualified workers
64	Drivers
65	Maintenance, repair and transport qualified workers
67	Industrial non qualified workers
68	Handicraft non qualified workers
69	Agricultural worker

Source: INSEE

A.3 (Conditional) descriptive evidence on ILMs: Are group firms more likely to hire on the ILM rather than on the external labor market?

We provide here descriptive evidence that French groups operate internal labor markets. We do so by asking whether group affiliated firms disproportionately rely on their group's ILM in order to adjust their labor force.

Because group structure may be endogenous, for instance in terms of occupations, and may affect within-group mobility patterns, providing descriptive – yet meaningful – evidence on whether ILMs facilitate within-group firm-to-firm mobility faces a challenge. In fact, documenting - as done in Section 3 of the main text – that a large proportion of the workers hired by an affiliated firm were previously employed in the same group is not *per se* evidence that ILMs function more smoothly than external labor markets: intra-group mobility may be high simply because groups are composed of firms that are intensive in occupations among which mobility is naturally high, perhaps for technological reasons.

Thus, to provide a descriptive assessment of the contribution of the ILM to the probability that a worker is hired by a firm affiliated with the same group, we need to take care of the firm-specific – possibly time-varying – "natural" propensity to absorb workers transiting between any two given occupations. To this purpose, we select all workers that move from *any* firm in year $t-1$ to *any* firm in year t, and denote as c the subset of movers employed in occupation o at time $t-1$ and in occupation z at time t. We then model the probability that worker i – belonging to the set c – finds a job in the group-affiliated firm j at time t as follows:

$$E_{i,c,k,j,t} = \beta_{c,j,t} + \gamma_{c,j,t} BG_{i,k,j,t} + \varepsilon_{i,k,j,t} \tag{7}$$

where $E_{i,c,k,j,t}$ takes value one if worker i, moving from occupation o in any firm of origin (indexed by k) to occupation z, finds a job in firm j at time t and zero if she finds a job in any other firm. $BG_{i,k,j,t}$ takes value one if worker i's firm of origin k belongs to the same group as destination firm j, and zero otherwise. The term $\beta_{c,j,t}$ is a firm-occupation pair specific effect that captures the time-varying natural propensity of firm j to absorb workers transiting from occupation o to occupation z: it accounts for the fact that occupation o may allow a worker to develop skills that are particularly suitable to perform occupation z in firm j at time t.

The parameter $\gamma_{c,j,t}$ measures the *excess* probability that, conditional on belonging to the set c, worker i finds a job in firm j if the firm of origin k is affiliated with the same group as j, as compared to a similar worker originating from some firm k outside the group.[51] The error term $\varepsilon_{i,k,j,t}$ captures all other factors that affect the probability that such a worker finds a job in firm j, and is assumed to have, conditional on observables, zero mean.

A.3.1 Methodology

Notice that the parameter $\gamma_{c,j,t}$ is specific to each occupation pair $\times$ group-affiliated firm of destination $\times$ year, i.e. we want a measure of ILM activity for each pair of occupations, for each firm of destination and for each year. Such a measure is identified only for BG-affiliated firms of destination (because the variable $BG_{i,k,j,t}$ has no variation in the case of non BG-affiliated firms), but the estimation sample of course includes workers who move from any (BG- and non BG-affiliated) firm to any (BG- and non BG-affiliated) firm.

Thus, direct estimation of equation (7) would require a data set with one observation for each combination of firm-to-firm mover and group-affiliated firm for each year. As our data set contains about 1,574,000 firm-to-firm transitions and approximately 40,000 group-affiliated firms per year, direct estimation of the model would require the construction of a data set with as many as 62 billion observations per year.

In order to estimate the parameters of equation (7) while keeping the dimensionality of the

[51] By definition, the parameter $\gamma_{c,j,t}$ is identified only for BG-affiliated firms of destination, because there is no variation in $BG_{i,k,j,t}$ for non BG-affiliated firms.

problem reasonable, following Kramarz and Thesmar (2013) and Kramarz and Nordström Skans (2014) we define:

$$R^{BG}_{c,j,t} \equiv \frac{\sum_{i \in c,k} E_{i,c,k,j,t} BG_{i,k,j,t}}{\sum_{i \in c,k} BG_{i,k,j,t}} = \beta_{c,j,t} + \gamma_{c,j,t} + \widetilde{u}^{BG}_{c,j,t} \tag{8}$$

where $R^{BG}_{c,j,t}$ is the fraction of workers that, in year t, find a job in firm j among all firm-to-firm movers transiting from occupation o to z whose firm of origin k belongs to the same group as firm j. This fraction might be high because firm j tends to overhire workers moving between occupations o and z and happens to be part of a group intensive in occupation o. In this case, one observes many transitions from occupation o to occupation z in firm j originating from j's group, but this cannot be ascribed to the internal labor market channel.

We then compute the fraction of workers that find a job in firm j among all firm-to-firm movers transiting from occupation o to z and whose firm of origin k does *not* belong to the same group as firm j:

$$R^{-BG}_{c,j,t} \equiv \frac{\sum_{i \in c,k} E_{i,ck,,j,t}(1 - BG_{i,k,j,t})}{\sum_{i \in c,k}(1 - BG_{i,k,j,t})} = \beta_{c,j,t} + \widetilde{u}^{-BG}_{c,j,t} \tag{9}$$

Notice that the subscript k disappears since we sum over all firms of origin, hence over all k's. Notice also that summing up the denominators in equations (8) and (9) one obtains the total number of workers (moving from occupation o to z) that move from *any* firm in year $t-1$ to *any* firm in year t.

Taking the difference between the two ratios eliminates the firm-occupation pair-year effect $\beta_{c,j,t}$:

$$G_{cj,t} \equiv R^{BG}_{c,j,t} - R^{-BG}_{c,j,t} = \gamma_{c,j,t} + u^{G}_{i,j,t}. \tag{10}$$

We estimate the parameter $\gamma_{c,j,t}$ for each occupation pair-firm as the difference between two probabilities: first, the probability that a worker, belonging to the set c and originating from a firm affiliated with the same group as firm j, finds a job in firm j; second, the probability that a worker, belonging to the set c and originating from a firm that is not affiliated with the same group as firm j, finds a job in firm j.

Estimation procedure: In order to estimate our parameter of interest, $\gamma_{c,j,t}$, for each year t and each occupation pair $\{o, z\}$, we identify the set of firm-to-firm movers c transiting from occupation o to occupation z between year $t-1$ and year t. Then, we associate each occupation pair $\{o, z\}$ with a firm j. For each triplet $\{o, z, j\}$, we separate those transitions that originate from the same group as firm j from those transitions that do not. This allows us to compute the denominators of the ratios $R^{BG}_{c,j,t}$ and $R^{-BG}_{c,j,t}$ defined in (8) and (9).[52] For each triplet $\{o, z, j\}$, we then compute the number of firm-to-firm movers, transiting from occupation o to occupation z, that find a job in firm j, distinguishing between those that originate from the same group as firm j and those that do not. This allows us to compute the numerators of the ratios $R^{BG}_{c,j,t}$ and $R^{-BG}_{c,j,t}$ defined in (8) and (9), and ultimately to estimate our parameter of interest $\gamma_{c,j,t}$ for each triplet.

To ensure that the internal and external labor markets are as homogeneous as possible, we restrict attention to the transitions occurring between occupation o and occupation z originating from firms k that are in geographical areas (French departments) where firm j's group is active.[53]

A broader definition of c is the set of firm-to-firm movers transiting within a given occupation pair in the *whole French economy.* This definition may raise the concern that the subset of workers originating from firm j's group and the subset originating from any other firm in France are

[52]We then drop the triplets in which this distinction cannot be drawn because either all the transitions originate from j's group or all the transitions originate from the external labor market. Trivially, on those sets of workers it is not possible to identify the excess probabilities. This restriction is without loss of identifying variation since the discarded observations are uninformative conditional on the fixed effects.

[53]In the administrative division of France, *departments* represent one of the three levels of government below the national level, between the region and the *commune.* There are 96 departments in mainland France and 5 overseas departments. We focus on mainland France.

not homogeneous. This is particularly relevant if a group's units are all located within the same department: then, all the transitions originating from the group will also originate from that particular department, whereas the transitions originating from outside the group may come from any department in France. In this respect, the two pools of workers firm j can draw upon are not fully comparable. Excess probabilities $\gamma_{c,j,t}$ computed using this broader definition of c turn out to be slightly higher than the ones obtained imposing the department restriction. The same holds when we compute excess probabilities imposing a region restriction, i.e. define c as the set of workers moving within an occupation pair in the same *regions* where firm j's group operates. The corresponding tables are available upon request.

Equivalence result: *The coefficient* $\widehat{\gamma}_{c,j,t}$ *estimated in equation* (10) *is equal to the coefficient obtained from direct estimation of equation* (7).

Proof. The coefficient from the linear probability model in equation (7), estimated on a sample of N individuals, for given occupations of origin and destination, and a given firm of destination j, in year t (subscript t dropped), is the standard OLS coefficient:

$$\begin{aligned}
\gamma_{c,j}^{OLS} &= \frac{Cov(E_{i,c,j}, BG_{i,j})}{Var(BG_{i,j})} = \frac{\sum_{i=1}^{N}(E_{i,c,j} - \overline{E}_{c,j})(BG_{i,j} - \overline{BG}_j)/N}{\sum_{i=1}^{N}(BG_{i,j} - \overline{BG}_j)^2/N} \\
&= \frac{\sum_{i=1}^{N} E_{i,c,j}BG_{i,j}/N - \overline{E}_{c,j}\overline{BG}_j}{\sum_{i=1}^{N} BG_{i,j}^2/N - \overline{BG}_j^2} = \frac{\sum_{i=1}^{N} E_{i,c,j}BG_{i,j}/N - \overline{E}_{c,j}\overline{BG}_j}{\overline{BG}_j - \overline{BG}_j^2} \qquad (11)
\end{aligned}$$

where N is the number of workers belonging to the set c.

Since $\beta_{c,j}^{OLS} = \overline{E}_{c,j} - \gamma_{c,j}^{OLS}\overline{BG}_j$, we get:

$$\begin{aligned}
\gamma_{c,j}^{OLS} + \beta_{c,j}^{OLS} &= \frac{\sum_{i=1}^{N} E_{i,c,j}BG_{i,j}/N - \overline{E}_{c,j}\overline{BG}_j}{\overline{BG}_j - \overline{BG}_j^2} + \overline{E}_{c,j} - \gamma_{c,j}^{OLS}\overline{BG}_j \\
&= \frac{\sum_{i=1}^{N} E_{i,c,j}BG_{i,j}/N - \overline{E}_{c,j}\overline{BG}_j + \overline{E}_{c,j}(\overline{BG}_j - \overline{BG}_j^2) - \gamma_{c,j}^{OLS}\overline{BG}_j(\overline{BG}_j - \overline{BG}_j^2)}{\overline{BG}_j - \overline{BG}_j^2} \\
&= \frac{\sum_{i=1}^{N} E_{i,c,j}BG_{i,j}/N - \overline{E}_{c,j}\overline{BG}_j^2 - \gamma_{c,j}^{OLS}\overline{BG}_j(\overline{BG}_j - \overline{BG}_j^2)}{\overline{BG}_j - \overline{BG}_j^2} \\
&= \frac{\sum_{i=1}^{N} E_{i,c,j}BG_{i,j}/N - \overline{BG}_j^2(\overline{E}_{c,j} + \gamma_{c,j}^{OLS} - \gamma_{c,j}^{OLS}\overline{BG}_j)}{\overline{BG}_j - \overline{BG}_j^2} \\
&= \frac{\sum_{i=1}^{N} E_{i,c,j}BG_{i,j}/N - \overline{BG}_j^2(\beta_{c,j}^{OLS} + \gamma_{c,j}^{OLS})}{\overline{BG}_j - \overline{BG}_j^2}
\end{aligned}$$

Hence,

$$\begin{aligned}
(\overline{BG}_j - \overline{BG}_j^2)(\gamma_{c,j}^{OLS} + \beta_{c,j}^{OLS}) &= \sum_{i=1}^{N} E_{i,c,j}BG_{i,j}/N - \overline{BG}_j^2(\beta_{c,j}^{OLS} + \gamma_{c,j}^{OLS}) \qquad (12) \\
\gamma_{c,j}^{OLS} + \beta_{c,j}^{OLS} &= \frac{\sum_{i=1}^{N} E_{i,c,j}BG_{i,j}/N}{\overline{BG}_j} = \frac{\sum_{i=1}^{N} E_{i,c,j}BG_{i,j}}{\sum_{i=1}^{N} BG_{i,j}} \qquad (13)
\end{aligned}$$

as in equation (8). Next, substituting (11) into $\beta_{c,j}^{OLS} = \overline{E}_{c,j} - \gamma_{c,j}^{OLS}\overline{BG}_j$, we get:

$$\begin{aligned}
\beta^{OLS}_{c,j} &= \overline{E}_{c,j} - \frac{\sum_{i=1}^{N} E_{i,c,j} BG_{i,j}/N - \overline{E}_{c,j}\overline{BG}_j}{\overline{BG}_j - \overline{BG}_j^2}\overline{BG}_j \\
&= \frac{\overline{E}_{c,j}(1-\overline{BG}_j) - \sum_{i=1}^{N} E_{i,c,j} BG_{i,j}/N + \overline{E}_{c,j}\overline{BG}_j}{1-\overline{BG}_j} \\
&= \frac{\sum_{i=1}^{N} E_{i,c,j}(1-BG_{i,j})}{\sum_{i=1}^{N}(1-BG_{i,j})}
\end{aligned}$$

as in equation (9). □

A.3.2 Descriptive evidence: results

The excess probability $\gamma_{c,j,t}$ is a measure of ILM activity for each triplet (occupation pair × destination firm) and for each year. We estimate approximately one million of such ILM measures for each year. We aggregate them at the firm×year level, taking both simple and weighted averages of the estimated $\widehat{\gamma}_{c,j,t}$ across occupation pairs. This allows us to estimate, for each group-affiliated firm in our sample, time-varying but firm-specific *average excess probabilities* $\widehat{\gamma}_{j,t}$. Table A2 (Panel A) presents descriptive statistics of these firm-level average measures of ILM activity. For the average firm, the probability to absorb a worker already employed in the same group exceeds by about 9 percentage points the probability to absorb a worker on the external labor market between 2003 and 2010. The weighted averages are very similar to the unweighted results (bottom part of the panel).

We next start exploring the conjecture that groups may operate an *horizontal* ILM as a way to adjust their labor force in response to idiosyncratic shocks hitting some of their units. Panel B of Table A2 focuses on the subset of excess probabilities computed for firm-to-firm transitions between identical occupations of origin and destination. This rules out all the job transitions up or down the career ladder, to the extent that a promotion (or a demotion) often results in a move across different occupational categories. Results show that even when focusing on *same occupation* transitions, average excess probabilities remain high (7 percentage points).

The figures shown in Table A2 display an enormous amount of heterogeneity. The estimated ILM parameter $\widehat{\gamma}_{j,t}$ is positive only for firms belonging to the top quartile of the distribution and is negative for firms in the bottom decile: clearly, not all group-affiliated firms rely on the internal labor market. Indeed, the population of French groups is also highly heterogeneous along many dimensions: there exist relatively few, very large groups, with many large affiliates that are diversified both from a sectoral and geographical perspective; and many small groups, with few small affiliates, that are hardly diversified.[54]

In Table A3 we investigate whether our estimated measures of ILM activity are larger for firms affiliated with more diversified groups. We do so by regressing $\widehat{\gamma}_{j,t}$ on a number of firm and group characteristics, controlling for firm×group fixed effects to account for unobserved heterogeneity at the firm×group level,[55] and year dummies to control for macroeconomic shocks common to all firms. Overall, columns 1-8 show that diversification both across sectors (macro sectors in columns 1-2 and 4-digit sectors in columns 3-4) and geographical areas (Paris vs non-Paris in columns 5-6, and across regions in columns 7-8) is associated with more intense ILM activity, the more so the larger

[54] The distribution of group size in France, as measured by the total number of full time employees, is highly asymmetric. Groups belonging to the top decile have on average 20 affiliates, employ 800 workers per unit, operate in 7 different four-digit industries and in 4 different regions. Instead, groups in the rest of the population have on average less than 5 units, employ less than 50 workers per-unit, operate in less than 3 different four-digit sectors and mostly in the same region.

[55] Since firms may change the group they are affiliated with, firm effects do not capture the firm×group match-specific unobserved heterogeneity.

group.[56,57]

A priori, sectoral/geographical diversification allows group units to be exposed to unrelated sectoral/regional shocks, thus creating more scope for co-insurance to be provided via the horizontal ILM. On the other hand, moving workers across more distant sectors/geographical areas might be difficult, due to sector-specific skills, trade union resistance and employment protection regulation. Our results suggest that the former effect prevails, the more so in large groups where the internal labor market is thicker and the array of skills available wider. The effect of diversification is sizeable: for example, in a group of average size, a one-standard deviation increase in (4-digit) sectoral diversification (see Appendix Table A4) boosts ILM activity by 0.0081 percentage points, which represents a 8.9% increase in the average excess probability. In a group which is one-standard deviation larger than the average, the increase in ILM activity equals 0.0246 percentage points, which represents as much as 27% of the average excess probability.

In the working paper version (Cestone, Fumagalli, Kramarz, and Pica (2016)) we also document that diversification only boosts *horizontal* ILM activity – i.e. same-occupation ILM transitions – in line with the hypothesis that groups of affiliated firms rely on the ILM as a mutual insurance mechanism.

[56]Group diversification is computed by taking the opposite of an Herfindahl-Hirschman Index based on the employment shares of the group in the different macro/4-digit industries or geographical areas.

[57]Table A3 shows a negative correlation between the number of affiliated firms and the excess probability, in the presence of a group fixed effect. This is explained by the fact that in years when groups lose one or more units due to closures, ILM activity intensifies, hence larger excess probabilities are observed, a result we present in Table B1, Appendix B of Cestone, Fumagalli, Kramarz, and Pica (2016).

Table A2. Mean excess probability of within-group firm-to-firm transitions by year

	Panel A: Job transitions between any two occupations								**Panel B: Job transitions within same occupation**							
			Percentiles								Percentiles					
Year	Mean	St.Dev.	10	25	50	75	90	N	Mean	St.Dev.	10	25	50	75	90	N
	Unweighted firm-level aggregation								**Unweighted firm-level aggregation**							
2003	0.089	0.231	-0.001	0.000	0.000	0.010	0.333	37475	0.066	0.202	-0.001	0.000	0.000	0.000	0.199	34971
2004	0.093	0.237	-0.001	0.000	0.000	0.012	0.333	36691	0.069	0.209	-0.001	0.000	0.000	0.001	0.222	34103
2005	0.093	0.237	-0.001	0.000	0.000	0.012	0.333	38870	0.070	0.210	-0.001	0.000	0.000	0.000	0.211	36134
2006	0.093	0.237	-0.001	0.000	0.000	0.011	0.333	41868	0.070	0.210	-0.001	0.000	0.000	0.000	0.213	39069
2007	0.087	0.229	-0.001	0.000	0.000	0.007	0.333	44362	0.065	0.201	-0.001	0.000	0.000	0.000	0.177	41403
2008	0.084	0.226	-0.001	0.000	0.000	0.006	0.332	47356	0.065	0.202	-0.001	0.000	0.000	0.000	0.166	44542
2009	0.096	0.242	-0.001	0.000	0.000	0.012	0.364	40736	0.075	0.218	-0.001	0.000	0.000	0.001	0.250	38213
2010	0.095	0.244	-0.001	0.000	0.000	0.009	0.349	42045	0.073	0.217	-0.001	0.000	0.000	0.000	0.249	39329
	Weighted firm-level aggregation								**Weighted firm-level aggregation**							
2003	0.083	0.227	-0.001	0.000	0.000	0.010	0.250	37475	0.062	0.198	-0.001	0.000	0.000	0.001	0.150	34971
2004	0.087	0.233	-0.001	0.000	0.000	0.011	0.308	36691	0.065	0.205	-0.001	0.000	0.000	0.001	0.166	34103
2005	0.087	0.232	-0.001	0.000	0.000	0.011	0.324	38870	0.065	0.205	-0.001	0.000	0.000	0.001	0.166	36134
2006	0.086	0.232	-0.001	0.000	0.000	0.011	0.300	41868	0.065	0.204	-0.001	0.000	0.000	0.001	0.166	39069
2007	0.081	0.224	-0.001	0.000	0.000	0.008	0.250	44362	0.061	0.196	-0.001	0.000	0.000	0.000	0.143	41403
2008	0.078	0.221	-0.001	0.000	0.000	0.007	0.250	47356	0.061	0.197	-0.001	0.000	0.000	0.000	0.142	44542
2009	0.090	0.238	-0.001	0.000	0.000	0.013	0.333	40736	0.070	0.213	-0.001	0.000	0.000	0.001	0.199	38213
2010	0.090	0.240	-0.001	0.000	0.000	0.010	0.333	42045	0.068	0.212	-0.001	0.000	0.000	0.001	0.175	39329

Note: The left hand side (Panel A) considers firm-to-firm transitions between any two occupations, where we restrict the set c to be the set of all transitions occurring between occupation o and occupation z that originate from the same departments in France where firm j's group is active. In the right-hand side (Panel B), the set c includes only transitions occurring between occupation o and occupation z in which occupation o is equal to occupation z, restricting to transitions that originate from the same departments in France where firm j's group is active. The first column indicates the year in which workers transiting from one job to another were hired by the affiliated firm j. The upper parts of Panels A and B present simple averages. The bottom part of Panel A shows weighted averages where the weight associated to each $\gamma_{c,j}$ is the ratio of the number of transitions from occupation o to occupation z that originate from fim j's group to the total number of transitions (for all the occupation pairs associated with firm j) that originate from j's group. The weights reflect the importance of the transitions from occupation o to occupation z for the group firm j is affiliated with. The bottom part of Panel B shows weighted averages where the weight associated to each $\gamma_{c,j}$ is the ratio of the number of transitions from occupation o to occupation z, with $o = z$, that originate from fim j's group to the total number of transitions (for all the occupation pairs associated with firm j) that originate from j's group.

Table A3. ILM activity and group diversification

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Log) Firm size	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***	0.009***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
(Log) Rest of the group size	0.001	0.000	0.001	0.004*	0.001	0.001	0.002	0.004*
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
(Log) Number of affiliated firms	-0.084***	-0.085***	-0.085***	-0.088***	-0.085***	-0.087***	-0.087***	-0.0909***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
State Control	-0.025	-0.020	-0.024	-0.009	-0.024	-0.016	-0.025	-0.013
	(0.024)	(0.022)	(0.023)	(0.017)	(0.023)	(0.021)	(0.022)	(0.018)
Foreign control	-0.043	-0.038	-0.042	-0.029	-0.044	-0.039	-0.043	-0.035
	(0.026)	(0.026)	(0.026)	(0.021)	(0.026)	(0.023)	(0.025)	(0.021)
Diversification (Macrosectors)	-0.006	-0.009						
	(0.007)	(0.007)						
Diversification × Rest of the group size		0.012***						
		(0.003)						
Diversification (4 digit)			0.014*	0.030***				
			(0.006)	(0.006)				
Diversification (4d) × Rest of the group size				0.022***				
				(0.003)				
Diversification (Paris Area)					0.039***	0.022*		
					(0.008)	(0.009)		
Diversification × Rest of the group size						0.024***		
						(0.004)		
Diversification (Region)							0.043***	0.040***
							(0.007)	(0.007)
Diversification (Reg.) × Rest of the group size								0.027***
								(0.004)
N	289,689	289,689	289,689	289,689	289,689	289,689	289,689	289,689
Firm×group effects and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Dependent variable: Excess probability for firm j to hire a worker originating from the same group as j. *Firm size* is measured by (full time equivalent) total employment; *Rest of the group size* is measured by the (full time equivalent) total employment of all the other firms affiliated with the same group as firm j. *State Control* is an indicator equal to 1 if the head of the group is state-owned. *Foreign Control* is an indicator equal to 1 if the head of the group is located outside France. A group's *Diversification (macrosectors/4-digit sectors/Paris/Regions)* is computed as the opposite of the sum of the squares of all its affiliated firms' employment shares, where each share is the ratio of the total employment of affiliated firms active in a given macrosector (in a given 4-digit sector; in/outside the Paris Area; in a given region) to total group employment. Macrosectors are agriculture, service, finance, manufacturing, energy, automotive. The variables *Rest of the group size*, *Number of firms in the group*, *Diversification* are normalized to have zero mean. One star denotes significance at the 5% level, two stars denote significance at the 1% level, and three stars denote significance at the 0.1% level. Standard errors are clustered at the group level.

Table A4. Descriptive Statistics

	Mean	**St.dev.**	**Min**	**Max**	**N**
$\overline{\gamma}_{jt}$	0.091	0.23	-0.63	1	289,689
Firm size (empl.)	157.83	1468.45	0.005	217640	289,689
(Log) Firm size	3.593	1.481	-5.298	12.291	289,689
Rest of the group size (empl.)	10955	29375.43	0.001	349038	289,689
(Log) Rest of the group size	6.107	2.786	-6.908	12.763	289,689
Number of 4 digit sectors	11.52	18.57	1	92	289,689
Number of macrosectors	1.88	0.99	1	6	289,689
Number of regions	5.4	6.45	1	22	289,689
Diversification (macro sectors)	-0.87	0.18	-1	-0.26	289,689
Diversification (4-digit sectors)	-0.58	0.27	-1	-0.08	289,689
Diversification (Paris)	-0.85	0.19	-1	-0.5	289,689
Diversification (Regions)	-0.71	0.30	-1	-0.08	289,689
% of firms that close	0.015	0.12	0	1	289,689
# of firm closures in the rest of the group (in year t)	1.76	5.45	0	68	289,689
# of firm closures in the rest of the group (in year t-1)	1.98	5.75	0	68	289,689
% of firms affiliated with groups in which at least one (other) firm closes down (in year t)	0.28	0.45	0	1	289,689
% of firms affiliated with groups in which at least one (other) firm closed down (in year t-1)	0.32	0.46	0	1	289,689
# of plant closures in the group (in year t)	16.23	92.27	0	2149	289,689
# of plant closures in the group (in year t-1)	18.9	101.92	0	2149	289,689
% of firms affiliated with groups in which at least one (other) plant closes down (in yeat t)	0.45	0.50	0	1	289,689
% of firms affiliated with groups in which at least one (other) plant closed down (in yeat t-1)	0.50	0.50	0	1	289,689

Note: *Firm size* is measured as the total number of (full time equivalent) employees; *Rest of the group size* is measured as the total number of (full time equivalent) employees in firm j's group, except firm j. A group's *Diversification (macro sectors/4-digit sectors/Paris/Regions)* is computed as the opposite of the sum of the squares of all its affiliated firms' employment shares, where each share is the ratio of the total employment of affiliated firms active in a given macrosector (in a given 4-digit sector; in/outside the Paris Area; in a given region) to total group employment. Macrosectors are agriculture, service, finance, manufacturing, energy, automotive. We denote as firm/plant closure a situation in which a firm/plant sees its employment drop by more than 90% from one year to the other. We do not consider as closures events where more than 70% of the lost employment ends up in the same firm/plant. We denote as closure year a firm/plant's last year of activity, before at least 90% of the firm/plant's workforce is lost. For a given affiliated firm j, *# of firm closures in the rest of the group (in year t)* measures the number of firms in the rest of the group that close in year t, i.e. that are in their last year of activity in year t. *# of firm closures in the rest of the group (in year t-1)* measures the number of firms in the rest of the group that closed in year $t-1$, i.e. that were in their last year of activity in year $t-1$. The descriptive statistics displayed in this table are computed using *firm-level* data. Hence, large groups are over-represented and the average group characteristics are larger than those computed using data at the group level and mentioned in footnote 54.

A.4 Closures rates

Table A5. Firm closures

	Number of closing firms			Percentage of closing firms		
	All firms	< 10 employees	≥ 10 employees	All firms	< 10 employees	≥ 10 employees
2002	134,398	117,898	16,500	9.03	10.25	4.87
2003	130,538	114,079	16,459	8.68	9.78	4.88
2004	135,848	123,211	12,637	8.92	10.30	3.73
2005	123,244	109,912	13,332	8.13	9.38	3.88
2006	128,429	114,978	13,451	8.21	9.49	3.82
2007	136,002	121,576	14,426	8.54	9.91	3.95
2008	115,529	105,122	10,407	7.15	8.40	2.74
2009	158,014	139,456	18,558	9.63	10.99	5.01

Note: We denote as closure a drop in employment from one year to the next by 90% or more. In order to avoid denoting as a closure a situation in which a firm simply changes identifier, we remove all the cases in which more than 70% of the lost employment ends up in a single other firm.

A.5 Labor market regulation in France

In this section we briefly summarize the main pillars of employment protection regulation in France, regarding the termination of indefinite duration contracts. We refer to Abowd and Kramarz (2003) for more details on both indefinite and fixed duration contracts.

The termination of indefinite duration contracts under French Labor Law falls under different categories: dismissal for economic reasons (be it a single or a collective dismissal); dismissal for personal cause (be it for "serious reason" or "very serious misconduct"); early and normal retirement. With the exception of terminations for "very serious misconduct", in all other terminations the employer must (i) observe a mandatory advance notice period and (ii) pay a severance payment. The advance notice period (the delay between the formal notice letter announcing the termination and the end of the employment contract) varies between 1 and 3 months, depending on the worker's seniority. Severance payments must be paid to workers with at least two years seniority: for every year of seniority, the employer pays 1/10 of the wage if the worker is paid by the month. An additional payment is due for every year of service beyond 10. Employees who are fired for economic reasons also enjoy employment priority within the firm for 1 year after the termination date, and have 1 year to dispute the dismissal.

Dismissals can only be justified in case of a "genuine and serious cause". Valid economic reasons for termination include the destruction of the worker's job, the transformation of the job or the worker's refusal to sign a new contract when a modification of the labor contract is necessary. These events are usually due either to technological change within the firm or bad economic conditions. The employer must follow a strict procedure in notifying the dismissal and providing a justification for it. If the procedure is overlooked, or the dismissal deemed unfair by a court, the employee is entitled to additional compensation (normally at least 6 months salary). While a firm's closure represents a legitimate cause for dismissal, common procedural errors can still trigger additional compensation to employees in case of dismissals prompted by the firm's closure.

In sum, the complex termination procedure and the penalties involved in case of a successful dispute impose non negligible termination costs that add to the advance notice and severance payment. This is particularly true in the case of *large* collective terminations in firms with 50 or more employees. Indeed, the termination of less than 10 workers during a 30-day period must follow a procedure similar to individual terminations: the employer must consult the personnel delegate or the union representatives, notify the Ministry of Labor in writing, provide an exit interview to the employee and possibly a retraining program. However, for firms with 50 or more employees, the dismissal of at least 10 workers during a 30-day period requires a much more complex procedure, detailed by the 2 August 1989 law. Before engaging in the collective termination, these larger firms must formulate a "social plan" (recently renamed as "employment preservation plan") in close negotiation with staff and union representatives. This is mandatory also in case of collective terminations prompted by the firm's closure.

The employment preservation plan must try to limit the total number of terminations, and facilitate reemployment of the terminated workers (e.g., by retraining and redeploying them internally or within the firm's group if possible). The procedure required to formulate and negotiate the plan is fairly long, especially if it is disputed. It involves several meetings with staff and union representatives. During this period, the Ministry of Labor is kept informed about the process, and must verify that the procedure has been followed correctly. Along the process, the plan can be disputed by unions and staff representatives, for instance on the ground that not all dismissals are justified or not all reallocation options have been considered.

A.6 Large closures as positive shocks

Table A6. Effect of large firm closures on competitors' performance – Part I

Code	Sector	**Sales**	**Employment**	**Fixed Assets**	**Total Assets**
158H	Manufacture of sugar	2.2373*** (0.1121)	0.1247** (0.0641)	0.8866*** (0.0973)	1.7234*** (0.0950)
159S	Production of mineral water	0.2529*** (0.0763)	0.219*** (0.0573)	0.1773** (0.0695)	0.4395*** (0.0652)
159T	Production of soft drinks	0.8036*** (0.0765)	0.3133*** (0.0572)	0.3011*** (0.0696)	0.455*** (0.0659)
221E	Publishing of journals and periodicals	0.2976*** (0.0705)	0.1672** (0.0784)	0.0845 (0.1149)	0.4163*** (0.0817)
241E	Manufacture of other inorganic basic chemicals	0.2732** (0.1450)	0.3624*** (0.0867)	0.0841 (0.1785)	0.2643** (0.1190)
292D	Manufacture of lifting and handling equipment	0.3458*** (0.0382)	0.1203*** (0.0333)	0.1852*** (0.0421)	0.2665*** (0.0397)
295G	Manufacture of machinery for textile, apparel and leather production	0.1213** (0.0463)	0.1413*** (0.0356)	0.1135*** (0.0413)	0.0172 (0.0427)
314Z	Manufacture of accumulators, primary cells and primary batteries	0.3991** (0.1289)	0.3628*** (0.0841)	0.1303 (0.0888)	0.3601*** (0.0881)
452B	Construction of sundry buildings	0.2568*** (0.0667)	0.3657*** (0.0621)	0.2931*** (0.0681)	0.2557*** (0.0591)
513W	Non specialized wholesale of food	0.8191*** (0.0506)	0.6718*** (0.0429)	1.0424*** (0.0690)	0.6735*** (0.0511)
514N	Wholesale of pharmaceutical goods	0.2061*** (0.0761)	0.4194*** (0.0599)	0.6825*** (0.0940)	0.1433** (0.0631)
518L	Wholesale of electric equipment	0.3374*** (0.0730)	0.2548*** (0.0528)	0.1609** (0.0750)	0.6672*** (0.0592)
526B	Specialized retail sale via mail order	0.317*** (0.0743)	0.2065** (0.0787)	0.2187** (0.1166)	0.3587*** (0.0861)
526H	Vending machine sale	0.5171*** (0.0717)	0.1334** (0.0581)	0.5503*** (0.1044)	0.6267*** (0.0674)
631B	Non harbour cargo handling	0.9739** (0.2930)	0.4194** (0.2032)	1.3155** (0.5487)	0.9637** (0.4063)
743B	Technical analyses, testing and inspections	0.5515*** (0.1431)	0.5986*** (0.1444)	0.6417*** (0.1279)	0.6094*** (0.1957)

Note: Estimated coefficients of the triple interaction term ($Top10 \times PostClosure \times TreatedSector$) from the regressions on sales, employment, total assets and fixed assets (i.e., property plant and equipment). The included sectors are those for which the coefficient is positive and significant in both the sales and employment regressions. The remaining ones are in Table A7. All outcome variables are in logs. One star denotes significance at the 5% level, two stars denote significance at the 1% level, and three stars denote significance at the 0.1% level. Standard errors are clustered at the 4-digit sector level.

Table A7. Effect of large firm closures on competitors' performance – Part II

Code	Sector	Sales		Employment		Fixed Assets		Total Assets	
		Coeff.	St.Err.	Coeff.	St.Err.	Coeff.	St.Err.	Coeff.	St.Err.
	Panel A								
155C	Manufacture of cheese	0.0567	(0.1120)	0.056	(0.0653)	-0.0538	(0.0973)	-0.0885	(0.0948)
158A	Industrial manufacture of bread and fresh pastry	0.0979	(0.0762)	0.0184	(0.0572)	0.1365**	(0.0696)	0.1462**	(0.0653)
158P	Processing of tea and coffee	0.182	(0.1342)	-0.0227	(0.0951)	0.3542**	(0.1309)	0.4039***	(0.1351)
174C	Manufacture of other made-up textile articles	-0.0828	(0.0860)	0.0076	(0.0691)	-0.1659	(0.0992)	-0.101	(0.0626)
211C	Manufacture of paper and paperboard	0.4775	(0.2567)	0.0643	(0.1506)	0.2749	(0.3059)	0.415	(0.2286)
212E	Manufacture of household and sanitary goods and of toilet requisites	0.2567	(0.3281)	0.2485	(0.1699)	-0.1344	(0.2956)	0.3329	(0.2191)
222C	Printing n.e.c.	-0.0648	(0.1245)	-0.1083	(0.1394)	-0.0294	(0.1385)	-0.1544	(0.1018)
241J	Manufacture of fertilizers and nitrogen compounds	0.2246	(0.1708)	0.0677	(0.0800)	0.0539	(0.1530)	-0.0719	(0.1234)
251E	Manufacture of other rubber products	-0.1245	(0.1126)	-0.1283	(0.1078)	-0.2645**	(0.1045)	-0.1652**	(0.0769)
252C	Manufacture of plastic packing goods	-0.0712	(0.1114)	-0.2103	(0.1057)	-0.1239	(0.1036)	-0.1026	(0.0767)
252H	Manufacture of plastic-based technical parts	-0.0422	(0.1054)	-0.0152	(0.0968)	0.0148	(0.0793)	-0.0055	(0.1009)
271Y	Manufacture of basic iron and steel and of ferro-alloys	-0.3344	(0.3665)	-0.3019	(0.2671)	-0.4736	(0.4892)	-0.6421	(0.4019)
284B	Cutting, pressing	-0.3154	(0.2233)	-0.1033	(0.2154)	-0.3335	(0.2529)	-0.3579	(0.2532)
287G	Manufacture of fasteners and screw machine products	-0.0202	(0.0761)	-0.0299	(0.0585)	0.2717***	(0.0830)	-0.0394	(0.0784)
312A	Manufacture of low tension electricity distribution and control apparatus	-0.2312	(0.1588)	0.0022	(0.1029)	-0.2777	(0.1737)	-0.0323	(0.1285)
321C	Manufacture of electronic active components	0.121	(0.1953)	0.1131	(0.1553)	0.1836**	(0.0358)	0.4451	(0.2184)
332B	Manufacture of scientific instruments	0.0783	(0.1251)	0.0791	(0.1001)	-0.0199	(0.1377)	0.244	(0.1410)
333Z	Manufacture of industrial process control equipment	0.3769	(0.4855)	0.2413	(0.4318)	0.1533	(0.4911)	0.3922	(0.5689)
361C	Manufacture of other office and shop furniture	-0.0731	(0.1005)	0.1156	(0.1006)	-0.0469	(0.1334)	-0.0115	(0.0835)
503A	Wholesale of motor vehicle parts and accessories	-0.1897	(0.1397)	0.0043	(0.1005)	-0.1746	(0.2648)	-0.317	(0.1991)
524H	Retail sale of furniture	-0.1131	(0.0745)	0.0526	(0.0787)	-0.1463	(0.1165)	0.0388	(0.0861)
551A	Tourism hotels and motels with restaurant	-0.0594	(0.1271)	0.0069	(0.0691)	-0.1728	(0.0995)	0.0406	(0.0661)
552E	Other provision of tourist lodgings	-0.2419	(0.2629)	0.0171	(0.1911)	-0.2134	(0.2096)	-0.0791	(0.1732)
553B	Fast food restaurants	-0.2298	(0.2077)	-0.0248	(0.1311)	-0.0279	(0.1629)	-0.11	(0.1164)
602M	Interurban freight transports by road	-0.0489	(0.1773)	-0.3054	(0.185)	-0.0777	(0.2802)	-0.1931	(0.2364)
634B	Chartering	0.1338	(0.2922)	0.3158	(0.2025)	0.9454	(0.5502)	0.3389	(0.4055)
642C	Telecommunications, except radio and television transmission	-0.2472	(0.5263)	0.0374	(0.2398)	-0.3482	(0.3337)	-0.2823	(0.3509)
702A	Letting of dwellings	0.2723	(0.1662)	0.213	(0.1452)	0.4838	(0.2982)	0.2892**	(0.1412)
703C	Management of residential building on a fee or contract basis	0.1791	(0.2393)	0.1279	(0.2041)	0.091	(0.34)	-0.0779	(0.216)
723Z	Data processing	-0.0441	(0.2258)	0.1219	(0.1764)	0.0632	(0.2057)	-0.083	(0.2981)
745B	Temporary work	-0.0899	(0.12)	-0.1679	(0.1389)	-0.3882***	(0.1147)	-0.0843	(0.1707)
748B	Film processing	-0.4295	(0.2528)	-0.0335	(0.2390)	-0.1931	(0.2152)	-0.5176	(0.3689)
748D	Packaging activities	-0.0827	(0.2016)	0.0939	(0.1922)	0.1277	(0.1695)	0.1059	(0.2850)
	Panel B								
151E	Industrial production of meat products	-0.1239	(0.0907)	-0.1562***	(0.0544)	-0.1699**	(0.0794)	-0.0827	(0.0791)
158V	Manufacture of other food products n.e.c.	0.125	(0.0765)	-0.1083**	(0.0562)	0.1323**	(0.0661)	0.0044	(0.0646)
159J	Manufacture of cider and other fruit wines	-0.0005	(0.0770)	-0.207***	(0.0572)	-0.0242	(0.0697)	-0.0194	(0.0667)
177C	Manufacture of knitted and crocheted pullovers and similar articles	-0.1914**	(0.0693)	-0.2983***	(0.0459)	-0.2584***	(0.0859)	-0.4604***	(0.0525)
193Z	Manufacture of footwear	0.0465	(0.0470)	-0.1751***	(0.0081)	0.0972	(0.0447)	0.0058	(0.0491)
262C	Manufacture of ceramic sanitary fixtures	-0.2108**	(0.1016)	0.5602***	(0.2001)	-1.2667***	(0.1480)	0.732***	(0.0800)
273G	Wire drawing	-0.7209***	(0.1384)	-0.481***	(0.1054)	-0.076	(0.1905)	-0.3254**	(0.1407)
274C	Production of basic aluminium	-0.1579	(0.1741)	-0.4672***	(0.1300)	-0.4488**	(0.2304)	-0.4841**	(0.1608)
274D	First processing of aluminium	-0.4707***	(0.1388)	-0.1522	(0.1018)	-0.5858***	(0.1919)	-0.4055**	(0.1398)
275E	Casting of light metals	-0.4709***	(0.1307)	-0.203**	(0.0886)	-0.634***	(0.1381)	-0.2364**	(0.1075)
282D	Manufacture of central heating radiators and boilers	-0.2071**	(0.0747)	0.04	(0.0593)	-0.0837	(0.0839)	-0.1415**	(0.0769)
285D	Machining, except turning	-0.3001**	(0.1090)	-0.2024**	(0.0975)	-0.2093	(0.1272)	-0.2665**	(0.1135)
297C	Manufacture of non-electric domestic appliances	-0.2412***	(0.0632)	-0.4931***	(0.0526)	0.0298	(0.0629)	-0.3638***	(0.0526)
311B	Manufacture of high power electric motors, generators and transformers	-0.5346***	(0.0927)	-0.051	(0.0529)	-0.0374	(0.0731)	-0.5803***	(0.0694)
316A	Manufacture of electrical equipment for engines and vehicles n.e.c.	-0.5783***	(0.1686)	-0.876***	(0.1224)	-0.8024**	(0.2476)	-0.3809**	(0.1795)
316D	Manufacture of electric equipments n.e.c	-0.291**	(0.0928)	-0.0673	(0.0528)	0.3278***	(0.0733)	-0.0895	(0.0697)
322B	Manufacture of wired telecommunication equipment	0.0708	(0.1713)	-0.2625**	(0.0839)	-0.4345***	(0.0190)	-0.1622	(0.1865)
351B	Building of civilian ships	-0.1356	(0.1288)	-0.3016**	(0.1390)	-0.632***	(0.1319)	0.1637	(0.1135)
351E	Building and repairing of pleasure and sporting boats	-0.6868**	(0.3232)	-0.0656	(0.2613)	0.283	(0.3742)	0.0203	(0.3353)
361A	Manufacture of chairs and seats	-0.3415***	(0.0949)	-0.3873***	(0.1114)	-0.3353**	(0.1370)	-0.2785***	(0.0892)
402C	Distribution and trade of gaseous fuels through mains	-0.1741**	(0.0719)	-0.7448***	(0.0736)	0.4156**	(0.1277)	-0.6247**	(0.2069)
452C	Construction of civil engineering structures	-0.2342***	(0.0528)	0.1135**	(0.0463)	-0.0794	(0.0482)	-0.2134***	(0.0444)
452D	Underground works	0.1282**	(0.0531)	-0.1348***	(0.0464)	-0.301***	(0.0491)	-0.1686***	(0.0444)
511R	Agents specializing in the sale of particular products	-0.1839**	(0.0756)	0.1707***	(0.0597)	-0.2969***	(0.0964)	-0.3787***	(0.0644)
512A	Wholesale of grain, seeds and animal feeds	-0.2002**	(0.0954)	0.1315**	(0.0740)	-0.0365	(0.1151)	0.2076**	(0.0864)
521A	Retail sale of frozen products	-0.3019***	(0.0626)	-0.0868	(0.0656)	-0.0194	(0.0970)	-0.3047***	(0.0703)
524L	Retail sale of electrical household appliances and radio and television goods	-1.329***	(0.0563)	-1.6156***	(0.0567)	-1.4642***	(0.0567)	-1.6079***	(0.0482)
526G	Home sale	0.5699***	(0.0798)	-0.1062**	(0.0581)	-0.0692	(0.1179)	0.0769	(0.0714)
553A	Traditional style restaurants	-0.8844***	(0.1963)	-0.8128***	(0.1301)	-0.8072***	(0.1646)	-0.7193***	(0.1165)
555C	Collective catering on contract basis	-0.4964**	(0.1819)	-0.296***	(0.0785)	-0.4052**	(0.1298)	-0.1986**	(0.0895)
631D	Refrigerated storage and warehousing	-0.408**	(0.1364)	-0.5204***	(0.1078)	-0.4738	(0.2593)	-0.3923**	(0.1796)
633Z	Activities of travel agencies and tour operators	-0.3732	(0.2202)	-0.4932**	(0.1548)	-0.4787	(0.3994)	-0.4167	(0.3130)
741G	Business and management consultancy activities	-2.8802***	(0.2653)	-2.3639***	(0.2432)	-4.8498***	(0.2156)	-5.0473***	(0.3677)
748K	Related services to production	-1.5058***	(0.1512)	-1.7771***	(0.1508)	-2.9374***	(0.1247)	-2.0213***	(0.1920)
900G	Sanitation, remediation and similar activities	-0.144	(0.1125)	-0.2912**	(0.0799)	-0.7629***	(0.0336)	-0.2052	(0.1154)
	Panel C								
143Z	Mining of chemical and fertilizer minerals	0.1258	(0.0979)	0.1313**	(0.0681)	0.329	(0.2403)	-0.0478	(0.0935)
151F	Cooked meats production and trade	0.22***	(0.0764)	-0.0787	(0.0562)	0.0467	(0.0661)	0.004	(0.0641)
152Z	Processing and preserving of fish and fish products	0.242**	(0.1342)	-0.0409	(0.0951)	-0.1257	(0.1310)	-0.0761	(0.1352)
157C	Manufacture of prepared pet foods	0.0389	(0.0907)	0.1064**	(0.0548)	-0.3305***	(0.0798)	-0.1236	(0.0806)
202Z	Manufacture of veneer sheets, plywood, laminboard, and other panels and boards	0.6224**	(0.1862)	0.2908	(0.2051)	0.5575**	(0.2670)	0.1015	(0.2067)
241A	Manufacture of industrial gases	1.9225***	(0.1857)	0.115	(0.0904)	-0.1902	(0.1573)	1.542***	(0.1373)
244A	Manufacture of basic pharmaceutical products	-0.1494	(0.1453)	0.2146**	(0.0864)	0.6171***	(0.1769)	-0.1511	(0.1187)
287C	Manufacture of light metal packaging	-0.1113	(0.0764)	0.1103**	(0.0586)	-0.2248**	(0.0831)	-0.4511***	(0.0791)
361M	Manufacture of mattresses	0.5525**	(0.1925)	0.1852	(0.1653)	0.4356**	(0.2012)	0.3459**	(0.1623)
365Z	Manufacture of games and toys	0.5282***	(0.1206)	-0.1344	(0.1266)	0.0669	(0.1580)	-0.1034	(0.1055)
515C	Wholesale of metals and metal ores	0.1712**	(0.0754)	0.0838	(0.0598)	0.0112	(0.0932)	0.2622***	(0.0631)
518G	Wholesale of computers, computer peripheral equipment and software	0.2305**	(0.0948)	0.08	(0.0740)	0.3952***	(0.1146)	0.2939***	(0.0840)
602B	Road scheduled passenger land transport	0.3344**	(0.1505)	-0.2067	(0.15)	-0.1365	(0.2971)	0.0184	(0.2183)
631E	Non refrigerated storage and warehousing	0.3621**	(0.1351)	0.0562	(0.1106)	0.6717**	(0.2004)	0.3072	(0.1531)
711A	Short term renting of automobiles	0.6906	(0.545)	0.727**	(0.2702)	-0.1302	(0.5357)	0.3021	(0.4980)
713C	Renting of construction and civil engineering machinery and equipment	0.332	(0.413)	0.631***	(0.1898)	0.3129	(0.3595)	0.2874	(0.3235)
725Z	Maintenance and repair of office, accounting and computing machinery	0.7115**	(0.2189)	-0.0148	(0.1543)	0.7034**	(0.1743)	0.4174	(0.2911)
744B	Advertising agency, advertising consultant	0.1095	(0.1662)	0.4813**	(0.1624)	0.0836	(0.1412)	0.0727	(0.2475)

Note: Estimated coefficients of the triple interaction term ($Top10 \times PostClosure \times TreatedSector$) from the regressions on sales, employment, total assets and fixed assets (i.e., property plant and equipment). The included sectors are those for which the coefficient is: (*i*) not significant in both the sales and employment regression (panel A); (*ii*) negative or not significant in the sales and the employment regression (panel B); (*iii*) negative or not significant in either the sale or the employment regression (panel C). All outcome variables in logs. One star denotes significance at the 5% level, two stars denote significance at the 1% level, and three stars denote significance at the 0.1% level. Standard errors are clustered at the 4-digit sector level.

Table A8. Descriptives on large firm closures in the shocked sectors

Code	Sector	Number of closures	Average size of closing firm in normal times	Year of closure
158H	Manufacture of sugar	1	1689.5	2008
159S	Production of mineral water	1	4339.75	2004
159T	Production of soft drinks	1	620	2004
221E	Publishing of journals and periodicals	1	578.5	2004
241E	Manufacture of other inorganic chemicals	1	915.7	2006
292D	Manufacture of lifting and handling equipment	1	847.5	2004
295G	Manufacture of machinery for textile, apparel and leather production	1	830.75	2005
314Z	Manufacture of accumulators, primary cells and primary batteries	1	1244.5	2005
452B	Construction of sundry buildings	1	513.25	2007
513W	Non specialized wholesale of food	2	2471.9	2004
514N	Wholesale of pharmaceutical goods	3	999.1	2007
518L	Wholesale of electric equipment	5	1103.2	2006
526B	Specialized retail sale via mail order	1	767	2007
526H	Vending machine sale	1	1065.25	2005
631B	Non harbour cargo handling	1	713.25	2008
743B	Technical analyses, testing and inspections	1	1063.5	2005

IA Internet Appendix

IA.1 TFP estimation

Table IA.1. TFP: Labor and capital coefficients in the production function

Sector	Labor Coefficient	Capital Coefficient
Accommodation and food services	0.3186	0.1690
Administrative services	0.7085	0.0506
Arts, entertainment and recreation	0.4840	0.0774
Construction	0.4771	0.0847
Educational services	0.5466	0.0419
Healthcare and social assistance	0.2331	0.0201
ICT	0.7183	0.0582
Manufacturing	0.5420	0.0982
Mining, quarrying and oil and gas extraction	0.5015	0.0566
Other services	0.5485	0.0897
Professional, scientific and technical services	0.6747	0.0186
Real estate	0.5852	0.1083
Retail and wholesale trade	0.5340	0.0855
Transportation and warehousing	0.5441	0.1075
Utilities	0.3851	0.2275
Water production and distribution	0.4804	0.1625

Note: Labor and capital coefficients are estimated following Levinsohn and Petrin (2003) separately for each 1-digit sector (NAF 2008 classification) on the universe of French firms between 2002 and 2010. We deflate value added and materials using 2-digit sector prices and the gross capital stock using a 2-digit sector capital goods deflator. The empirical specification includes year indicators.

Table IA.2. Estimated TFP across sectors

Sector	Mean	Median	N
Accommodation and food services	3.3811	3.4205	1,009,928
Administrative services	3.8606	3.8805	221,507
Arts, entertainment and recreation	3.8149	3.8371	62,995
Construction	4.0717	4.0943	1,385,275
Educational services	3.9390	3.9696	95,362
Healthcare and social assistance	4.9364	4.9011	518,821
ICT	3.9940	4.0661	184,040
Manufacturing	3.9310	3.9080	730,105
Mining, quarrying and oil and gas extraction	5.2440	5.2614	3,101
Other services	3.3666	3.4194	472,083
Professional, scientific and technical services	4.4120	4.4710	622,463
Real estate	3.7624	3.8288	219,777
Retail and wholesale trade	3.8601	3.9246	2,116,558
Transportation and warehousing	3.9705	4.0094	263,143
Utilities	4.0681	4.2005	2,207
Water production and distribution	3.9865	4.0195	27,761

Note: TFP is estimated following Levinsohn and Petrin (2003) separately for each 1-digit sector (NAF 2008 classification) on the universe of French firms between 2002 and 2010. We deflate value added and materials using 2-digit sector prices and the gross capital stock using a 2-digit sector capital goods deflator. The empirical specification includes year indicators.

Table IA.3. Estimated TFP across sectors: stand-alone vs. group-affiliated firms

Sector	Stand-alone firms	BG-affiliated firms
Accommodation and food services	3.3419 (3.3982) [978,639]	4.6067 (4.6328) [31,289]]
Administrative services	3.7760 (3.8209) [195,140]	4.4867 (4.4407) [26,367]
Arts, entertainment and recreation	3.7278 (3.7747) [58,779]	5.0297 (5.0658) [4,216]
Construction	4.0377 (4.0756) [1,338,107]	5.0369 (5.0476) [47,168]
Educational services	3.9043 (3.9480) [91,805]	4.8340 (4.8836) [3,557]
Healthcare and social assistance	4.9179 (4.8928) [511,342]	6.2063 (6.1766) [7,479]
ICT	3.8715 (3.9680) [157,084]	4.7082 (4.7418) [26,956]
Manufacturing	3.8068 (3.8201) [634,690]	4.7573 (4.7800) [95,415]
Mining, quarrying and oil and gas extraction	4.9059 (4.8949) [1,780]	5.6995 (5.7519) [1,321]
Other services	3.3561 (3.4142) [466,132]	4.1942 (4.1483) [5,951]
Professional, scientific and technical services	4.3742 (4.4421) [578,319]	4.9070 (4.9050) [44,144]
Real estate	3.7045 (3.7954) [205,235]	4.4790 (4.5085) [14,542]
Retail and wholesale trade	3.7937 (3.8741) [1,942,897]	4.6031 (4.6445) [173,661]
Transportation and warehousing	3.8714 (3.9368) [231,731]	4.7013 (4.7272) [31,412]
Utilities	3.7417 (3.8070) [1,605]	4.9382 (4.9274) [602]
Water production and distribution	3.8085 (3.8872) [22,073]	4.6712 (4.6985) [5,728]

Note: TFP is estimated following Levinsohn and Petrin (2003) separately for each 1-digit sector (NAF 2008 classification) on the universe of French firms between 2002 and 2010. We deflate value added and materials using 2-digit sector prices and the gross capital stock using a 2-digit sector capital goods deflator. The empirical specification includes year indicators. Median values are reported in parenthesis, and the number of observations in squared brackets.