Corporate Hierarchies under Employee Representation

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ABSTRACT

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This paper analyzes whether workplace employee representation (ER) affects the design of firm hierarchies. We rationalize the role of ER within a knowledge-based model of hierarchies, where the firm's choice of hierarchical layers depends on the trade-off between communication and knowledge acquisition costs. Using a sample of more than 20000 private-sector workplaces in 32 countries, we document conditional correlations between ER and the depth of hierarchy that are consistent with our framework. The presence of ER is positively associated with the number of organizational layers, though the relationship is tempered by firm size. Additional instrumental variable estimates reinforce our main result. ER positively correlates with job training and skill development, suggesting that the effect of ER (if any) is to reduce knowledge costs. Moreover, ER is associated with enhanced internal communication via staff meetings. The analysis of managers' perceptions suggests the higher frequency of meetings in firms with ER does not lead to more delays in the implementation of organizational changes. Taken together, our findings suggest that ER increases the depth of firm hierarchy by facilitating the flow of information to top decision makers, possibly through skip-level reporting, and hence reducing communication costs.

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1 Introduction

The internal organization of firms is a topic of great interest to scholars in economics, industrial relations, management and organization science. It is now well understood the fact that the organization of firms has wide implications in terms of productivity, income distribution and resilience to negative macro shocks (Garicano and Rossi-Hansberg, 2015a; Aghion et al., 2020). A key attribute of organizational structure is the depth of managerial hierarchies, i.e. the number of organizational layers a firm rely on to solve production problems. There is an extensive literature analyzing a wide range of determinants of firm hierarchies, such as technology, competition, social capital and trade openness (Caroli and Van Reenen, 2001; Delmastro, 2002; Bresnahan et al., 2002; Acemoglu et al., 2007; Guadalupe and Wulf, 2010; Bloom et al., 2012). However, little is know about the interplay between corporate hierarchies and labor institutions, including industrial relations arrangements at the workplace.

This paper is aimed at analyzing if and how the depth of firm hierarchies is affected by the presence of workplace employee representation (ER), i.e. an institutional channel for employee voice through which workers exert an influence on work organization and employment-related issues as exists in many European countries (e.g. unions, works councils, consultative committees). Does the presence of ER affect the depth of the firm's organizational hierarchy? Does this effect depends on firm size? What are the channels through which this effect takes place?

We rationalize the role of ER within the framework of knowledge hierarchies, which stresses the cognitive role of hierarchies in processing and communicating information within firms (Garicano, 2000; Garicano and Wu, 2012). The firm is conceived as a collective group of workers who deal with problems and need to acquire the relevant knowledge to solve them. Whenever the match between problems and solutions is costly the firm is organized as a hierarchy, with those at the bottom dealing with routine problems and those at the top with more complex

exceptions. The optimal choice of layers depends on the trade-off between communication and knowledge acquisition costs. The former capture the costs of evaluating and passing problems through the hierarchy and are increasing in the number of layers. The latter reflect the costs of acquiring knowledge to deal with problems at each layer of the hierarchy and are larger in flatter organizations.

We model employee representatives as institutional bodies that impact on the cost structure of the firm. On the one hand, employee representatives have the rights to be informed or consulted on a given fraction of problems before they are passed to any layer above the shop-floor. This is the case, for instance, with problems whose solutions require decisions that may have a strong impact on the employment structure of the company, e.g. important investment decisions or substantial changes in the technology used in production. As a result, ER increases communication costs by delaying the process of problem evaluation. On the other hand, ER can perform "skip-level" reporting in organization that facilitates the flow of information to top decision makers. For example, an industrial council may provide a forum through which selected workers report directly to top managers on important issues related to production (Kaufman and Levine, 2000). In these cases, ER reduces communication costs by speeding up the passing of problems across layers of the organization. Depending on the relative size of these two effects, ER may induce the entrepreneur to select a higher or lower number of layers. In particular, as long as the reduction in communication costs due to skip-level reporting more than compensate the rise in costs due to delayed problem evaluation, ER will induce firms to select a higher number of layers. Such an effect, however, is expected to be weaker among large firms, due to organizational diseconomies of scale.

We investigate the empirical relevance of our theoretical framework by using unique establishment-level data from the third wave of the European Company Survey (2013), which covers more than 20000 private-sector workplaces located in 32 countries and provides harmonized information on the presence of ER bodies, firm hierarchies, and a wide range of man-

agement practices. Overall, the empirical analysis produces two main stylized facts that are consistent with our model: (1) the presence of ER is positively correlated with the depth of hierarchy (number of vertical layers); (2) the number of layers is increasing in establishment size but less so in establishment with ER. We account for the potential endogeneity of ER bodies by exploiting firm coverage by sectoral wage agreements as an exogenous factor that shifts the probability of organizing ER structures at the workplace level. Our instrumental variable (IV) estimates reinforce our main findings.

Finally, we explore the underlying mechanisms that may explain our main results. We document a positive correlation between ER and different measures of job training and skill development, what may reflect that the effect of ER (if any) is to reduce knowledge acquisition costs and facilitate skilling of frontline employees. The presence of ER also correlates with reported changes in the way establishments coordinate and allocate work to employees and the frequency of regular staff meetings, possibly enabling skip-level reporting and facilitating the flow of information to top decision makers. The analysis of managers' perceptions suggests the higher frequency of staff meetings in establishments with ER does not seem to come at a cost in terms of delayed implementation of organizational changes.[1] Taken together, these pieces of evidence suggest that the positive correlation between ER and the number of hierarchical layers may be driven by a reduction in communication costs rather by an increase in knowledge acquisition costs. In other terms, ER presence may relax the trade-off between information and communication costs.

Our paper is most closely related to three streams of literature. First, the paper relates to theoretical and empirical work that study the organization of firms, the allocation of authority and the structure of production hierarchies (Aghion and Tirole, 1997; Garicano, 2000; Delmastro, 2002; Colombo and Delmastro, 2004; Hart and Moore, 2005; Caliendo and Rossi-Hansberg, 2012;

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[1]There is evidence showing that staff meetings may also provide workers with a structured opportunity to exchange knowledge and information with their peers (Sandvik et al., 2020). Therefore, by facilitating horizontal knowledge flows meetings may also contribute to reduce information acquisition costs in establishments with ER.

Garicano and Wu, 2012; Caliendo et al., 2015). Empirical works focused on the knowledge-based functioning of hierarchies have mainly looked into the technological drivers of information and communication costs, such as resource planning software and intranet (Bloom et al., 2014). Given the fact that these technologies are widely accessible in advanced countries, residual (and yet significant) differences in the hierarchical organization of firms and their degree of decentralization remain puzzling. We argue that the way in which organizations administer the cognitive and communication burden associated with the accumulation and use of knowledge in production is critically influenced by their institutional embeddedness and patterns of governance of employment relationships (Aguilera and Jackson, 2003; Van Essen et al., 2013; Lam and Marsden, 2017). Few studies have analyzed the role of labor market institutions in explaining variation of management practices across firms and countries (Bloom and Van Reenen, 2010; Bloom et al., 2019). However, in the context of those studies labor institutions are predominantly conceptualized as distortions preventing the diffusion of "good" management practices. To our knowledge this paper is one of the first attempts to study the interplay between collective forms of employee voice and the depth of corporate hierarchies using a large sample of establishments.

Secondly, this paper is related to the empirical literature on firm flattening and decentralization. Several empirical works show that during the last decades firm hierarchies have indeed become flatter. Rajan and Wulf (2006), for instance, document that in major US corporations the number of managers reporting directly to the CEO has increased steadily in recent years, reducing the number of layers in senior management hierarchies. Acemoglu et al. (2007) and Caroli and Van Reenen (2001) find similar trends in French and UK data. The causes of this organizational change have been related to two main factors: the growing intensity of market competition that requires firms to speed up and shorten the process through which decisions are taken (Guadalupe and Wulf, 2010); and the diffusion of technologies that make information access and processing cheaper at the plant-level (Bloom et al., 2014). Some works have also investigated the implications of firm flattening for the shift of decision power within organiza-

tions (Wulf, 2012). So far, however, little research has been conducted on the effect of firm-level institutional bodies, in particular employee representatives, on decisions concerning the optimal number of organizational layers. Our paper contributes to this body of research, by pointing to ER as an institutional hurdle that may refrain firm flattening.

Finally, our work integrates the voluminous literature on ER, considered both in its unionized and non-unionized version (e.g. shop-floor committees, works councils, unions). From a theoretical point of view, previous contributions investigate the role of ER in relation with several aspects of firms' activity such as wage bargaining (Booth and Chatterji, 1995), work engagement and employee voice (Bryson, 2004; Kwon and Farndale, 2020). On this ground, a relatively rich empirical literature has developed studying the effects of employee representation on firm performance, focusing in particular on productivity (Addison et al., 2004; FitzRoy and Kraft, 2005), investment (Addison et al., 2007; Jäger et al., 2019), employment (Addison and Teixeira, 2006; Jirjahn, 2010), innovation (Kraft et al., 2011; Addison et al., 2017) and corporate market value (Gorton and Schmid, 2004). A relatively smaller literature has also investigated the effects of ER and more generally unions on non-wage aspects of labor, such as hours of work (Buchmueller et al., 2004), flexible-time arrangements (Burdin and Pérotin, 2019) and length of worker tenure (Bidwell, 2013). In this paper we study the effect of ER on the hierarchical organization of the firm by embedding the well-known information and communication role of ER (Freeman and Lazear, 1994) into the framework of knowledge hierarchies, bridging the gap between disparate bodies of literature in industrial relations, management and organization studies.

The remaining of the paper is organized as follows. In Section 2, we introduce our basic conceptual framework, of which the underpinnings are based on Garicano (2000). In Section 3, we describe the data and the key variables used in the empirical analysis, whose results are presented in Section 4. In Section 5, we discuss some possible alternative explanations of the empirical evidence. Section 6 concludes.

2 Conceptual framework

2.1 Knowledge, hierarchy and institutions

Economists are used to approach the study of firm organization through the lenses of agency theory and the related incentive problems (Alchian and Demsetz, 1972; Fama and Jensen, 1983; Williamson, 1985; Milgrom and Roberts, 1992). While important insights have been obtained from this approach, a shortcoming is that it overlooks the role of organizations in coordinating disparate knowledge. Management scholars have given this role greater centrality using a variety of approaches such as the evolutionary (Nelson and Winter, 1982) and capability-based (Richardson, 1972; Teece et al., 1997) views of the firm. Despite some conceptual differences, all these approaches indeed share a common emphasis on the relevance of localized, socially constructed and embedded knowledge in understanding firm organization (Foss, 2003).

Although knowledge-based theories represent fruitful ways to study firm organization, they suffer of three limitations. First, they do not pay sufficient attention to the role of hierarchies in organizing and processing information. Within organization theory, this role was emphasized by the Carnegie school (Simon, 1976; March and Simon, 1958). Simon (1981), in particular, argues that hierarchy is a general feature of complex systems emerging because of its evolutionary and problem-solving advantages. Hierarchies represent efficient mechanisms to coordinate production systems that consist of multiple specialized units, such as a firm. Over time, however, organizational research has downplayed the analysis of hierarchies especially with formal models, while shifting the focus towards higher order concepts such as routines and capabilities. This trend, as argued by Gavetti (2005), has had a negative impact on the development of the theory's microfoundation.

The second limitation of the knowledge-based approaches is that, even when they discuss organizational hierarchies, they take the latter as given. Grant (1996), for instance, debates the role of hierarchies in favouring the process of knowledge integration, but he is more concerned

with the shift of decision power within organizational layers than with the analysis of how the organizational structure is derived in the first place. Similar weaknesses characterize other contributions in the knowledge-based tradition (e.g. Teece et al., 1997).[2] It follows that such theories have little to say about the factors affecting the design of organizational hierarchies. Based on these premises, Garicano (2000) develops one of the first formal model in which the structure of organizational layers is derived within a knowledge-based approach to production. The latter represents a promising way of complementing organizational research with formal analysis of hierarchies (see also Garicano and Rossi-Hansberg, 2015b).

Finally, and this is a limit also in Garicano (2000), most knowledge-based theories of organization adopt a universalistic model of production, which abstracts away from the institutional environment in which firms are embedded. Despite extensive research, both theoretical and empirical, shows that institutions matter for firm organization – e.g. they affect the adoption of corporate governance models (e.g. Aguilera et al., 2008) as well as management practices (e.g. Bloom and Van Reenen, 2010; Bloom et al., 2019), similar issues have been seldom taken up by organizational research. Bloom et al. (2014) exploit Garicano's framework to study how changes in the costs associated with the acquisition and transmission of information affect organizational design but their analysis is limited to the role of technology. However, likewise technology, institutions may also affect the process of knowledge integration especially if their definition is stretched to include, not only formal and informal "rules of the game" (North, 1990), but also common resources (Hall and Thelen, 2009) and organizational bodies that foster cooperation among agents (Deeg and Jackson, 2007). For instance, the existence of labor institutions that support employee voice may affect the cost of knowledge acquisition and transmission, which may in turn impact on organizational design. Similarly, the degree of protection foreseen by employment contracts may create different incentives for workers to accumulate firm-specific knowledge, which may also affect the desirable level of hierarchical depth. Overall, a more

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[2]The same limitation in the analysis of firm hierarchy characterizes most incentive-based approaches derived from agency theory (e.g., Qian, 1994; Calvo and Wellisz, 1978).

explicit consideration of institutional embeddedness would improve our understanding of the extent to which the structure of organizational hierarchies change across time and space.

On this ground, the next section presents a formal model that make a first step in filling such gaps. The model is framed within a knowledge-based approach to production and it gives explicit account to the process through which firm hierarchies are derived. It embeds organizational design within a set of labor institutions related to workplace ER. The model, however, is general and simple enough to allow for future extensions that consider other types of institutions as well.

2.2 A simple model

To begin with, we follow Garicano (2000) and consider an organization without ER. The organization is composed by an entrepreneur and a number W of workers, who are organized in a hierarchical structure of L layers, with $L \geq 1$. Each layer l has a size s_l, in terms of the number of workers at layer l. The organization faces a flows of production problems over time. Problems may be of a different nature, from very standard (only requiring small adjustments at the shop floor) to very complex (involving, for example, the need to modify production schedules, to update some technologies used in the production line, or to enlarge or reduce an establishment's size). Problems of a different type arise with a different likelihood, with the more complex ones arising less likely. Let $F(n)$ be the probability density function of a problem n. Normalize this density so that problems are ordered from most to least common and assume that the density of problems $F(n)$ is nonincreasing. The number of problems that the organization receives in each time period t is $N_t > 1$. In t, the organization is concerned about solving all the N_t problems, with the average solved problem having value $v(N)$. Assume that $v(N)$ is continuous and twice differentiable, with $v'(N) < 0$ and $v''(N) > 0$, and that $\lim_{N \to \infty} v(N) = 0$. This means that the average value of a solved problem decreases with the number of problems solved (i.e. there are diseconomies of scale in problem solving). Various justifications may be provided for this

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assumption. One is based on the transaction costs economics argument that some organizational costs (not explicitly modeled here) increase with firm size because of contracts incompleteness, disagreements among employees, conflicts of interests and possibly hold-up (e.g., Williamson, 1967). Another is the possibility that problems are ordered from most to least valuable and that the firm starts dealing with the former; so, when problems are added to the firm's workload, the value of the average problem goes down. Finally, one may consider increasing opportunity costs for each unit of time spent in production by the firm that make the marginal problem less valuable than the preceding ones. Assume also that, in each time period t, one worker can solve one problem. Hence, under the assumption that the organization needs to solve all the N_t problems, we will have that $N_t = W_t$. To keep notation simple, hereafter we use N to denote both the number of problems and of workers; moreover, we omit the subscript t, but continue to consider all the variables as referred to a given time period t.

Workers are identical in all the relevant characteristics, but the knowledge they acquire to solve problems. Suppose that each problem can be solved by applying a problem-specific knowledge and that the per-problem cost of knowledge is k_n, with $k_n = k \quad \forall n$ for simplicity. Unit cost k captures the cost of understanding the problem and designing and implementing a solution strategy. It includes both cognitive costs and the time spent on problem solving as well as the costs of external information acquisition, if required. Problems may be of a same type (thereby having a same frequency) or different. Refer to the number of problem types the organization is concerned with as the "total problem variety". The "depth" of the knowledge of the worker, i.e. how many different problems he is able to solve (or the problem variety he is able to address), is denoted by d_i, with i denoting a generic worker. Workers of a same layer have the same depth of knowledge, so that $d_i = d_l \quad \forall i \in l$. Assume that knowledge is not overlapping across layers (i.e., workers at different layers are able to solve different problems), but workers of a same layer may be able to solve more than one problem.[3] The costs of making a worker

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[3]We make the assumption of no-overlapping knowledge in order to avoid confusion in the text, but it is irrelevant for the comparative statics in the propositions here.

at a layer l acquiring knowledge is $d_l^{1-e}k$, with e (normalized between 0 and 1) being the effort that the worker may exert to facilitate the development of problem-specific skills (e.g. through off-the-job training or by exchanging relevant information with colleagues). Assume that effort is not contractible and that its cost is infinitely small.

The most standard production problems are solved at the shop floor layer, while more complex and rarer issues require the involvement of workers at some higher layer in the hierarchy. Specifically, when workers of layer l do not know how to solve a problem, they pass the problem to workers of a higher layer $l+1$, and this process continues until the workers of a higher layer are able to solve the problem. The process of a worker passing a problem across two layers cost $c_l = c \quad \forall l$, with $c < k$.[4] The cost c is incurred by who receives the problem and is identical for those who know the solution and those who not. Alternatively, all the workers at any layer are aware of the problems arisen in t, but for a problem being solved the workers of the relevant layer need to collect some information from the layers below in the hierarchy, with the cost of transferring information across layers being c for each problem-layer pair.

The net output per-worker is

$$y = v(N) - \underbrace{\sum_{l=1}^{L} s_l d_l^{1-e} \frac{k}{N}}_{\substack{\text{Knowledge} \\ \text{costs}}} - \underbrace{\left((L-1) \sum_{l=1}^{L} s_l - \sum_{l=1}^{L-1} s_l (L-l) \right) \frac{c}{N}}_{\substack{\text{Communication} \\ \text{costs}}} \tag{1}$$

where the communication costs component reflects the sum of the costs of each unsolved problem moving across layers until it is solved.[5] Clearly, as both communication costs and knowledge costs enter Equation (1) negatively, the net output per-worker is reduced when they increase. However, as in Garicano (2000), while an increase in communication costs pushes a profit maximizing firm to reduce L in order to minimize over the cost of transmitting information across layers, an increase in knowledge acquisition costs induces an increase in L, because in doing so

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[4]The assumption that $c < k$ is used because it seems more reasonable from an empirical point of view. Also, this assumption rules out the unrealistic situation of the most cost efficient organizational structure being that with only one layer, with all the workers able to solve any type of problem.

[5]A simple formal example to grasp the intuition of how we obtained the communication costs component of Equation (1) can be provided upon request.

the firm minimizes redundancies in knowledge formation.

Next, consider an organization where an ER body is established. The ER body has the right to be informed or consulted on an exogenously given fraction p (with $0 \leq p \leq 1$) of the problems that are unsolved at the shop floor, which amount to $N - s_1$. Information and consultation take place thorough meetings, that have both a positive and a negative effect on the ease of communication within the firm. First, meetings allow ER to make skip-level reporting, i.e. to collect information about a fraction of unsolved problems and to supply them directly at the layer where they can be solved. In doing so, meetings with ER allow the firm to save some costs of communication across layers, because workers at different layers are not required anymore to communicate directly to each other about $p(N - s_1)$ problems. Second, meetings require ER itself to discuss about a fraction p of problems with the workers and this slows communication down. The unit cost of delay (which includes the cost of transmitting a problem to ER, discussing it in a meeting and transmitting it back to the correct layer) is z. At the layers higher than the shop floor, the fraction of problems $1 - p$ can be addressed by workers without involving the ER body, and therefore imply communication costs as when ER is absent. If ER bodies are not established, then $p = 0$. To keep things simple, assume without loss of generality that an ER does not reduce the workload of workers at any layer, regardless of whether it is composed by one or more workers of lower or higher layers. Figure 1 shows a graphical representation of within-firm communication both with and without ER.

[insert Figure 1 about here]

ER may also influence knowledge acquisition costs (this is not crucial for our argument). Assume that (both with and without ER) workers are paid

$$w = \overline{w} + \tau y \tag{2}$$

where $\overline{w}$ is an exogenously given (fixed) component and $\tau = \tau(p)$ is the share of the unit net output that goes to workers. The share $\tau(p)$ is monotonically increasing in p, i.e. τ rises with

the share p of problems the ER body is consulted about, which proxies the bargaining strength of workers (this is a standard result of industrial bargaining models; see Freeman and Lazear, 1994), with $\tau(0) = 0$. Therefore, if $p = 0$ (or the ER is absent), workers are paid only a fixed wage $w = \overline{w}$. On the other side, the payoff of the entrepreneur is

$$\pi = (1 - \tau)y - \overline{w} \tag{3}$$

The workers can raise their payoff, by increasing y as a result of improved effort. Hence, when p increases, thereby increasing the worker share $\tau(p)$ of total rent, the workers will also improve effort to benefit from a larger payoff. That is, effort e also depends on p. Given that both e and p range from 0 to 1, assume that $e(p) = p$ for simplicity.

Now, the net output per-worker is

$$y = v(N) - \underbrace{\sum_{l=1}^{L} s_l d_l^{1-p} \frac{k}{N}}_{\substack{\text{Knowledge} \\ \text{costs}}} - \underbrace{\left[\left((L-1) \sum_{l=1}^{L} s_l - \sum_{l=1}^{L-1} s_l(L-l) \right) \frac{c}{N}(1-p) + (p(N-s_1)z) \frac{1}{N} \right]}_{\substack{\text{Communication} \\ \text{costs}}} \tag{4}$$

To improve clarity, exploiting that $\sum_{l=1}^{L} s_l = N$ and that $e = 0$ when $p = 0$, the net output per-worker with and without ER can be simplified as

$$y = \begin{cases} v(N) - \sum_{l=1}^{L} \frac{s_l d_l}{N} k - \left((L-1) - \frac{\sum_{l=1}^{L-1} s_l(L-l)}{N} \right) c, & \text{w/out ER} \\[4mm] v(N) - \sum_{l=1}^{L} \frac{s_l d_l^{1-p}}{N} k - \left((L-1) - \frac{\sum_{l=1}^{L-1} s_l(L-l)}{N} \right) c(1-p) - \frac{p(N-s_1)z}{N}, & \text{w ER} \end{cases} \tag{5}$$

The problem of the entrepreneur is to decide the number of layers L so as to maximize (5). Each time period t can be thought of as composed by three sub-periods. In t_0, the firm observes N and the types of the problems it is required to deal with, sets the number of workers and decides the number of layers L, k and c being given. In t_1, an ER body can be established at the firm (this is an exogenous event). If the ER body is established, in t_2 the firm can change the number of layers. Looking at Equation (5), we can advance some testable predictions.

Prediction 1: *When an ER is present, a profit maximizing firm may optimally choose to have a higher number of layers than a firm without ER.* It is so when the communication costs component in Equation (5) is reduced enough by the introduction of ER, i.e. when the reduction in the communication costs component is larger than the reduction in the knowledge acquisition costs component.

Prediction 2: *The positive effect of ER on hierarchical depth decreases with firm size and eventually becomes negative, i.e. ER induces the firm to select a higher number of layers, but less so in larger firms.* Due to diseconomies of scale, the average value of a solved problem is lower for larger firms. Hence, larger organizations (i.e. larger firms) are less able to accommodate the layer-increasing effect of ER.

3 Data and variables

3.1 The European Company Survey: overview

We test the basic predictions of the model using establishment-level data from the third wave of the European Company Survey (ECS 2013). ECS data cover a representative sample of non-agricultural establishments employing at least 10 employees and located in 32 countries (27 EU Member States and Croatia, Former Yugoslav Republic of Macedonia, Iceland, Montenegro and Turkey). A crucial advantage of this survey is that it provides harmonized cross-country information on employee representation, management practices and organizational design at the workplace level. The survey is conducted in two steps. The first step involves a telephone interview with a manager, who is asked about establishment characteristics, organizational practices (e.g. compensation policies, working-time arrangements, etc), and industrial relations, including the existence of employee representation structures. The second stage comprises an interview with an employee representative in those establishments in which an employee representation structure is present. As information obtained in the second stage is conditional on having an employee representation structure, our analysis is exclusively based on the information gathered

in the management questionnaire.

A. Measure of shop-floor employee representation. We focus on institutionalized forms of employee representation, either through trade unions or works councils. Employee representation is a dummy variable identifying establishments with a trade union, works council or any other country-specific official structure of employee representation (e.g. joint consultative committees). This definition excludes health and safety representatives and ad-hoc forms of representation.

B. Measure of depth of hierarchy. To characterize the hierarchical structure of establishments, we rely on the current number of hierarchical levels for each establishment, as reported by the managers. We also have access to information on whether the number of layers has decreased, increased or remained constant since 2010, that we use to validate the data. In particular, in Figure 2a and Figure 2b, we show that both these measures correlate in the expected way with average country-level scores on "Willingness to Delegate Authority" based on Executive Opinion Surveys and collected as part of the Global Competitiveness Index (World Economic Forum).

[insert Figure 2 about here]

C. Other control variables. Finally, managers report information on the use of information systems, outsourcing of production activities, changes in technology, firm organization and ownership, frequency of meetings between employees and managers, training activities, workforce composition (gender, age, education, fraction of part-time, permanent employees), average tasks' complexity, plant size, subsidiary/headquarter status and a wide range of management practices and manager's characteristics (gender, position, tenure). This rich set of information allows to test for specific mechanisms and control for conventional technological drivers of hierarchical structures previously studied in the literature.

Variables description and descriptive statistics are reported in Table 1. On average, establishments have three layers, which compares well with previous studies using self-reported

indicators.[6]

<center>*[insert Table 1 about here]*</center>

In Figure 3, we report changes in employment between 2010-2013 depending on whether the establishment decreased, increased or kept unchanged the number of layers over the same period. Roughly 70% of establishments that experienced delayering also reduced employment. By contrast, 63% of workplaces that increased the number of layers experienced employment growth. This suggests our measure of layers' reorganization is economically meaningful in the sense that it correlates with different patterns of firm growth.

<center>*[insert Figure 3 about here]*</center>

In Figure 4, we plot the histogram of the numbers of hierarchical layers for establishments with and without ER. The distribution appears to be skewed to the right for establishments in which ER is present, indicating deeper firm hierarchies in those establishments. This pattern holds for all industries; moreover, a similar distribution is observed across countries belonging to different industrial relations regimes (Figure 5).[7] This suggests employee voice explains some of the variation in hierarchical depth independently of other labor institutions, reinforcing the case for unbundling institutions and investigating this specific arrangement separately.

<center>*[insert Figures 4 and 5 about here]*</center>

4   Results

4.1   ER and hierarchical depth

We begin by considering the following baseline regression model:

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[6]Using a French sample of manufacturing firms, the "Changements Organisationnels et Informatisation" (COI), Acemoglu et al. (2007) report a mean value of 3.2 layers of management.

[7]We group countries according to the classification of industrial relations regimes proposed by Visser (2009).

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$$Y_i = \beta_0 + \beta_1 \, ER_i + \beta_2 \, \text{Medium firm}_i + \beta_3 \, \text{Large firm}_i +$$
$$\beta_4 \, ER_i \times \text{Medium firm}_i + \beta_5 \, ER_i \times \text{Large firm}_i + \mathbf{b}\mathbf{X}_i + \varepsilon_i \qquad (6)$$

where Y_i is the natural logarithm of the number of layers in 2013; ER_i is a dummy variable for the presence of ER at the establishment level; Medium firm$_i$ and Large firm$_i$ are dummies for medium (50-249 employees) and large firms (250+ employees), the small firm category (10-49 employees) being the benchmark; $\mathbf{X}_i$ is the vector of controls (it also includes country and industry fixed effects); ε_i are the residuals. While the industry dummies capture differences in ER prevalence due to sector-specific industrial relations structures, the country dummies absorb cross-country heterogeneity in labor institutions, including those regulating ER formation and functioning, and culture (e.g. trust) that may also affect the structure of corporate hierarchies.

Table 2 reports the results of a series of OLS estimates. In column 1, we estimate a parsimonious model in which we only include a dummy variable that takes value one for establishments in which there is a ER structure in place, three dummy variables to control for establishment size (small firms being the benchmark category) and interaction terms to capture the interplay between ER and plant size. Estimates reported in column 1 also control for industry and country fixed effects. The presence of ER is positively associated with the number of layers. As expected, larger establishments tend to have more layers (this is consistent with previous research; see, e.g. Delmastro, 2002; Colombo and Delmastro, 2004). Interestingly, the interaction between ER and size is significantly negative, suggesting that the impact of ER on firm hierarchies tend to vanish as firm size increases.

[insert Table 2 about here]

In columns 2-5, we sequentially add more controls to see the robustness of the results. In column 2, estimates control for establishment-level differences in workforce composition (gender, age, skills, fraction of part-time and permanent contracts) and share of workers performing com-

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plex tasks, reported change in productivity and employment since 2010, and dummy variables identifying multi-site firms, subsidiary sites, recent changes in ownership and organizational changes. In column 3, we also account for differences in the prevalence of outsourcing of production activities that may also affect the hierarchical structure of firms. In column 4, we additionally control for the use of information systems oriented to minimize supplies or work-in-process (e.g. just-in-time, lean production systems). Finally, in column 5, we add a series of "noise controls" on respondents' characteristics (gender, position and job tenure of the manager) in order to increase the precision of our estimates and reduce concerns about measurement error in the organizational variables. None of the described modifications alters the basic finding. Marginal effects computed for our preferred specification reported in column 5 indicate that the presence of ER is associated with a 5% increase in the number of layers. [8]

This result is compatible with our Prediction 1, as it suggests that on average the reduction in communication costs associated with the presence of ER is sufficiently large to offset any reduction in knowledge acquisition costs. This would also indicate that the net effect of ER on communication costs is negative, i.e. the skip-level reporting effect dominates the cost of delayed decisions resulting from the operation of employee representation (e.g. information and consultation process). The fact that the effect of ER is heterogeneous across establishment size categories suggests the trade off between communication costs and information acquisition costs may be size-contingent. This is consistent with the idea that firms of a different size deal with problems with different average value, thereby inducing ER to exert differential effects on the depth of hierarchy depending on firm size (our Prediction 2).[9]

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[8]Results are robust to a different operationalization of the dependent variable (number of hierarchical layers). We recoded the dependent variable into seven categories, with the first 6 categories corresponding with the reported number of layers and the last category including all establishments where the number of layers was seven or more. Estimates from an Ordered Probit Model using this alternative specification yields similar results.

[9]The positive relationship between ER and number of hierarchical layers could be an artifact of measurement issues. Counting the number of layers in a consistent way may be difficult even for experienced managers with detailed organizational knowledge. The presence of ER may increase the salience of hierarchical levels. Layers could be more formalized, more visible, serving as points of evaluation for promotions and guides for compensation policies. In organizations with ER, where promotion and evaluation policies are more likely to be negotiated and debated with high visibility, a manager may be more sensitized to those levels. While reporting issues are potentially important, the argument is difficult to reconcile with the fact that the depth of hierarchy is lower in large establishments with ER compared to large establishments without ER.

4.2 Endogeneity

Tables 2 presents conditional correlations that are broadly consistent with the theory. In particular, our model suggests that in equilibrium the number of hierarchical layers should covary in systematic ways with the presence of ER and that the direction of such relationship is mediated by firm size. This is what we observe in the data. Nevertheless, we are concerned about the potential endogeneity bias of our estimates. For example, there may be an unobservable variable that is correlated with the organizational outcome and our measure of ER. To deal with this we consider an instrumental variable (IV) strategy for ER. We ground the identification of a viable instrument on the analysis of the institutional determinants of unionization.

According to standard cost-benefit analysis of union determination (e.g., Berkowitz, 1954; Hirsch and Addison, 1986; Pencavel, 1971), ER can be modeled as though it were an asset available to utility-maximizing workers that provides a flow of services. In this framework, the costs and benefits of unionization (as well as the propensity and the opportunity to organize) are affected by institutional variables such as the centralization of collective bargaining (Schnabel, 2003). Sectoral or regional coverage of collective agreements influences, in particular, the collective action costs needed to establish ER and the benefits that the workers can obtain from it. For instance, when employment conditions are determined by a collective agreement, workers have incentive to be active proponents of these conditions through union action. Setting up an employee representation structure at the workplace level may also require expert knowledge and operational support which is more likely to be available when there are higher level union confederations involved in collective bargaining (Devicienti et al., 2018). Depending on the labor legislation, it is also possible that sectoral collective agreements cannot be extended to workers if it is absent at the firm an ER body that acts as a signatory party of the agreement.

Previous empirical research has showed that the coverage by centralized collective agreements is an important determinant of the degree to which unions can successfully pursue an individual service or insurance strategy. In line with this, Scheuer (2011) finds that coverage

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by a collective agreement actually triples the likelihood of union membership. Moreover, comparative legal analysis clarifies that extension of collective agreements to third parties at the sectoral or regional level is mostly subject to regulatory institutions and labor laws, that are clearly exogenous in our study (Adams et al., 2016).

Following these arguments we use information on whether the firm is covered by a collective wage agreement negotiated at the sectoral or regional level, i.e. a feature of institutional environment in which the establishments operate, as an exogenous factor that shifts the probability of establishing an ER at the establishment level. Specifically, we build a dummy variable (Sectoral bargaining$_i$) coded 1 if the firm is covered by a sectoral wage agreement and 0 otherwise, and use it as an instrument for ER in Equation (6). Also the interaction terms capturing ER effects at different firm size classes are instrumented. The results are collected in Table 3. Consistent with our priors, the first-stage results show that coverage by sectoral or regional agreements is a strong predictor of ER presence at the firm level. Moreover, when entered in the depth of hierarchy regression, the coefficients of both the instrumented ER variable and interaction terms have sign and significance coherent with our baseline regressions. We find again that ER positively correlates with the number of hierarchical layers and that the positive firm size-layers relationship is tempered by the presence of ER.[10] Reassuringly, usual IV diagnostic tests for instrument relevance and exogeneity are passed.[11]

[insert Table 3 about here]

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[10]The magnitude of the effect is larger than in the baseline OLS estimates. This could be due to measurement error in our indicator of ER presence. Moreover, OLS estimates could also be downward biased if an omitted determinant of the number of layers is negatively correlated with ER presence. For example, managers acting on their preference for power (Fehr et al., 2013; Pikulina and Tergiman, 2020) may favor a more hierarchical organizational design and obstruct the introduction of shared governance mechanisms, such as works councils (Smith, 1991). Finally, there could be reverse causality: it may be more difficult to organize ER in establishments organized in a more hierarchical way (e.g. less group solidarity and heterogeneous interests between workers employed at different layers).

[11]We obtain similar results by instrumenting ER with any form of higher-level wage bargaining. i.e. sectoral and national-level wage agreements. We obtain qualitatively similar IV estimates when the dependent variable is recoded as explained in footnote 10.

4.3   Mechanisms

There is a positive association between ER and the number of hierarchical layers. In this Section, we investigate several potential mechanisms that may account for our basic finding, by analyzing the relationship between training activities, coordination of work and staff meetings on the one side and ER on the other.

First, we use training as a proxy of firm-specific activities related to the acquisition and accumulation of noncodifiable knowledge (Garicano and Wu, 2012). The survey contains extensive information on training activities at the workplace level, including the fraction of employees entitled to paid time off for training and information on the purpose of training activities. Results are reported in Columns 1-2 of Table 4.[12] The presence of ER positively correlates with our measures of training. Interestingly, ER is positively associated with the extent of training activities oriented not only to develop workers' skills at the current jobs but also with those aimed at enabling workers to take different job positions and rotate tasks with colleagues. This suggests that employees in ER-establishments are able to deal with and solve a wider variety of production problems. Hence, the effect of ER (if any) would be to reduce knowledge acquisition costs.

[insert Table 4 about here]

In the context of our model, this "skilling" effect of ER should contribute to push down the number of hierarchical layers. Therefore, our finding that ER is associated with a higher number of vertical layers should be driven by an even stronger reduction in communication costs in establishments under employee representation. In columns 3-5 of Table 4, we show that the presence of ER at the establishment level is associated with reported changes in coordination and allocation of work to employees and meetings between managers and employees. It is worth noting that the positive correlation between ER and the frequency of staff meetings is an

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[12]The fraction of employees involved in training activities is a categorical variable: None at all, less than 20%, 20%-39%, 40%-59%, 60%-79%, 80%-99%, All employees. For this reason, Column 1 of Table 4 reports estimates from Ordered Probit Models.

empirical fact that conflates both delay effects and skip-level reporting. Interestingly, according to estimates reported in column 6 of Table 4, managers in establishments with ER are not more likely than their counterparts in establishments without ER to agree with the statement that "employee involvement causes delays in the implementation of decisions". Our interpretation in light of the theoretical model is that arguably skip-level reporting dominates so the net effect of ER on communication costs is negative.

5   Alternative explanations

We analyse the effect of employee representation on the depth of corporate hierarchies through the lens of a model of knowledge-based hierarchies. However, our results may be consistent with alternative models. While we do not neglect the importance of alternative theoretical explanations, most of them suggest the effect of ER on hierarchical depth should be increasing in firm size, a pattern that we do not verify in our data.

For instance, models of hierarchy and delegation put significant emphasis on issues related to incentive design in environments characterized by contractual incompleteness (Aghion and Tirole, 1997; Dessein, 2002; Mookherjee, 2013). For instance, Dessein (2002) develops a model in which the principal must decide whether to fully delegate a task to a better informed agent or to keep authority on what to do after having consulted him. Although there is not explicit reference to hierarchical depth, the choice to delegate would induce an empowerment of the agent's knowledge and thus correspond to a flatter organization in our framework. On the contrary, authority brings with it disempowerment of the agent's knowledge and thus lead to a more hierarchical setup. The main result of the model is that delegation dominates authority as long as the agent's reporting bias, which is a proxy of the conflicting interest between him and the principal, is sufficiently small. When applied to our framework, the main prediction of the model would be that the effect of ER on the organization of corporate hierarchies depends on its effect of the reporting bias. If ER increases the reporting bias (i.e. it makes the interests of

the principal and the agent more divergent), then we should expect an increase in hierarchical depth. In contrast, if ER reduces the reporting bias (i.e it makes the interests of the principal and the agent more convergent), then the hierarchical depth should reduce. The fact that we do not find ER to increase hierarchical depth more in large firms, where the conflict between ER-representatives and firm owners is (if anything) higher,[13] provides little support for this explanation.[14]

An alternative line of reasoning rests on the literature that conceives the design of organizations as functional to resolve bargaining issues between workers and entrepreneur. Dow (1989), for instance, argues that workers employed to operate plants that present some degree of firm specificity may be able to capture quasi-rent by threatening to suppress knowledge acquired in the course of production activities. Difficulties in arranging ex ante payments that can completely offset the ex-post leakage of quasi-rent, make it attractive for the entrepreneur to create an information system that limits ex post worker bargaining power. Such system can take many forms such as: a hierarchical organization of tasks and information channels, a gradual "deskilling" of shop-floor workers (see also Braverman, 1974; Noble, 1977) as well as a greater propensity to invest in assets that are less relation-specific (Williamson, 1985). In relation to our work such an approach would imply that the depth of corporate hierarchies is mainly driven by the extent to which workers are able to capture ex-post quasi rents. As long as ER strengthen worker's ability to do so, because for instance it solves collective action problems among workers, the theory would predict a positive correlation between ER and number of organizational layers, which is consistent with our results. However, once again, it is plausible to assume that

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[13]A wide corporate governance literature (e.g. Mayer, 1997) finds that conflicts of interests between owners and employees tend to be milder in smaller firms, because in these firms ownership is more concentrated (this improves reputational mechanisms and within-firm long-term relationships) and owners are less diversified (this makes owners' interests in the firm longer and arguably closer to those of the employees).

[14]According to incentive-based explanations, one should expect different effects of ER on the number of layers depending on the interest congruence between workers and owners-managers. We analyse the correlation between ER and the number of layers for establishments with and without profit sharing schemes. The extent of conflict of interest between ER and management may be lower where pay is contingent on the performance of the enterprise, limiting the scope for rent-seeking activities (Freeman and Lazear, 1994). Interestingly, we find that ER is associated with more hierarchical layers in both establishments with and without profit sharing. These additional estimates are available upon request.

the size of such quasi-rent is greater in larger organizations, which are involved in more complex productions. As a consequence the positive effect of ER on hierarchical depth should increase with firm size, which is not what we find in the data.

A third group of works link the decision to delegate authority within organizations to the characteristics of the technology available both inside and outside the firm. Acemoglu et al. (2007), for example, argue that principal's choice to delegate authority to an agent depend on the knowledge he has about the technology used in production: as the available public information about it reduces, the trade-off shifts in favor of delegation. The reason is that in such cases the principal benefits the most from gaining access to the local knowledge available to the agent. The main predictions of the model are thus that delegation, i.e. low hierarchical depth, should be more likely in firms that operate closer to technological frontier (because they are dealing with new technologies about which the public information is limited) and in more heterogeneous environment (because principals can learn less from other firms operating within the same market). Bloom et al. (2014), using a theoretical framework very similar to ours, suggest that firm-level investments in different types of technologies can have differential impacts on the decentralization of decision-making. In particular, while information technology (via a reduction in knowledge acquisition costs) is a decentralizing force, communication technology (via a reduction in communication costs) foster centralization. With respect to our analysis these contributions can be relevant as long as the establishment of ER is correlated with some of the above mentioned technological or firm-specific characteristics. For instance, ER structures may be more frequently organised in technologically mature and less competitive industries (where workers can share on noncompetitive rents) in which decentralization would be less common. This selection pattern could be driving the positive correlation between ER and the number of layers. However, the fact that our result holds even after controlling for industry fixed effects and the use of information systems at the workplace level suggests that the underlying theoretical argument remains valid.

Fourth, the differential negative effect of ER on the depth of hierarchy in large firms may be driven by the relationship between size, ER and complexity. Models based upon information processing (see, Radner, 1992; Bolton and Dewatripont, 1994) predict that the larger the number of items that need to be processed by an organization, the deeper the management hierarchy that minimizes total planning and implementation time. In particular, items complexity generates overload of information within the firm, thereby increasing the principal's marginal disutility of getting informed and so his/her incentives to delegate decision-making power to plant managers who enjoy an information advantage; that is, complexity requires a more stratified hierarchy. Hence, in these models, since larger firms deal with greater complexity, firm size should be observed to correlate with the depth of the organization positively. In the context of our framework, this positive correlation may be comparatively reduced where ER is present, if ER bodies reduce the complexity of the items the firm deals with (i.e. what we call the total problem variety). This may be due to risk aversion of the workers, who may prefer focusing on less uncertain activities in traditional productions, where problems are well-known and less diversified. Thus, where workers have a voice over strategic decisions and investments, as when ER is present, they may push the firm towards environments with lower complexity. As a result, the number of layers should positively correlate with firm size, but less so where ER is established. While this possible interpretation shares with ours the empirical prediction of deeper hierarchies in larger firms (which in fact finds verification in our estimates), it also requires that ER has an independent negative effect on the number of layers: this is something that instead we do not observe in the data. Also, the argument that ER reduces complexity does not fit well with the positive correlation between ER and training that we detected in our analysis.

Fifth, there is a variety of work in industrial relations that ties ER to the growth of formalization and bureaucratization, because it increases the need for professional staff in the firm to deal with ER itself. This literature highlights that institutions of employee representation are traditionally hierarchical and bureaucratic and that they encourage the firms where they

operate to adopt the same structures (Voss and Sherman, 2000). According to this view, a positive relationship between ER and hierarchical depth may not be driven by an attempt to gain from efficient organizational design, but instead by the institutionalization of the organizational structure that follows from ER pressures as well as commonly accepted norms about the right way to manage. In sum, our results may simply reflect differences in bureaucratization, not controlled for in our regressions. Yet, this alternative explanation fails to account for the negative correlation between hierarchical depth and ER in large firms, shown in Table 2. A long line of research suggests that large firms have a more fine-grained division of labor and more structured organizational hierarchies (e.g., Grusky, 1961; Blau and Schoenherr, 1971) and organizational size is often considered in the empirical literature as a key measure of how bureaucratic a firm is (Sørensen, 2007). Hence, had the bureaucratization mechanism driven our findings, the positive correlation between ER and hierarchical depth should have been higher, and not lower, in large firms, because their structure is more prone to excessive bureaucratization. This is not what we observe in the data.

Finally, there is also the possibility that corporate hierarchy emerges not as a result of conflicting interest between workers and owners, but as a consequence of colluding activities between workers and managers. The idea is that in presence of an imperfectly incentivized corporate system managers and workers may collude to further decisions that leave shareholders worse off. Together, they may try to transform cash flow into fixed assets rather than dividends, and engage in so-called empire-building (as in the agency conflict mechanism in Jensen and Meckling, 1976). As long as ER makes such type of collusion easier, and under the assumption that hierarchical depth correlate positively with empire-building behaviour, we should expect firms with ER to be more hierarchical. However, this effect should hold independently of firm size, or eventually be larger in larger firms where management's prestige associated with empire-building is higher. Again, this is not supported by our results.

6 Conclusions

Our study sheds light on the interplay between labor institutions and the internal organization of firms. Using establishment level data from 32 countries, we analyzed the effect of shop-floor employee representation on the depth of corporate hierarchies. We framed our empirical analysis on a model of knowledge-based hierarchies in which the optimal number of layers depends on the trade-off between communication costs and knowledge acquisition costs.

We found that ER is positively associated with the number of organizational layers. In the absence of cleaner sources of exogenous variation in employee representation rights, we exploited features of the institutional environment and instrumented ER using firm coverage by sectoral or national wage agreements. Ordinary Least Squares and Instrumental Variables estimates yielded consistent estimates. This positive association between ER and the number of layers seems to be driven by a reduction in communication costs, suggesting that skip-level reporting may dominate the delay costs inherent to the information and consultation procedures involving managers and employee representatives. Phrased differently, ER may allow for a more efficient information transmission, by improving the match between unsolved issues and managers without such issues being required to move bottom-up through all the intermediate layers. Clearly, for this information improving effect to be effective, ER needs to be directly involved in the business decision making as an integral part of the corporate structure, and not to be relegated in a passive role where it is only informed without any substantive role. This is something that we did not elaborated in the paper, yet it is implicitly assumed in our conceptual framework.

Our results have important implications for the design of firm organizations and labor market institutions. The positive relationship between ER and hierarchical depth offers an alternative explanation for the growing evidence showing that firms are becoming flatter over time (Acemoglu et al., 2007; Caroli and Van Reenen, 2001). The previous literature explains such trend either as a result of rising market competition, which requires faster decision-making

(Guadalupe and Wulf, 2010), or as the consequence of the spread of information and communication technologies, which reduces communication costs (Bloom et al., 2014). Our work suggests that a third possible explanation is deunionization, i.e. the shrinking proportion of workers covered by unions that has characterized the labor market of most advanced countries during the last decades (Farber et al., 2018; Ebbinghaus and Visser, 1999). By reducing the share of firms with unionized forms of ER, and under the assumption that the latter have been only partially replaced by non-union types of ER, deunionization may have created incentives for many firms to design flatter organizations.

Our findings suggest that alongside well-known effects of ER on workers' bargaining power and wage composition, such bodies affect also the internal organization of corporate hierarchies. In particular, thanks to the improved information flows that follows the establishment of ER (i.e. skip-level reporting), firms with ER are induced to select a higher number of organizational layers compared to firms without ER. This insight contributes to extend the view of employee representatives beyond the approach that sees them mainly as tools to protect workers' interests. ER bodies impacts on the distribution of information and knowledge within hierarchies and managers need to take this effect into account while designing their organizations. Our results suggest that institutionalized forms of employee voice may enable firms to economize scarce cognitive resources through deeper hierarchies without retarding the accumulation of new shop-floor capabilities.

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Figures and Tables

Figure 1: ER and within-firm communication.
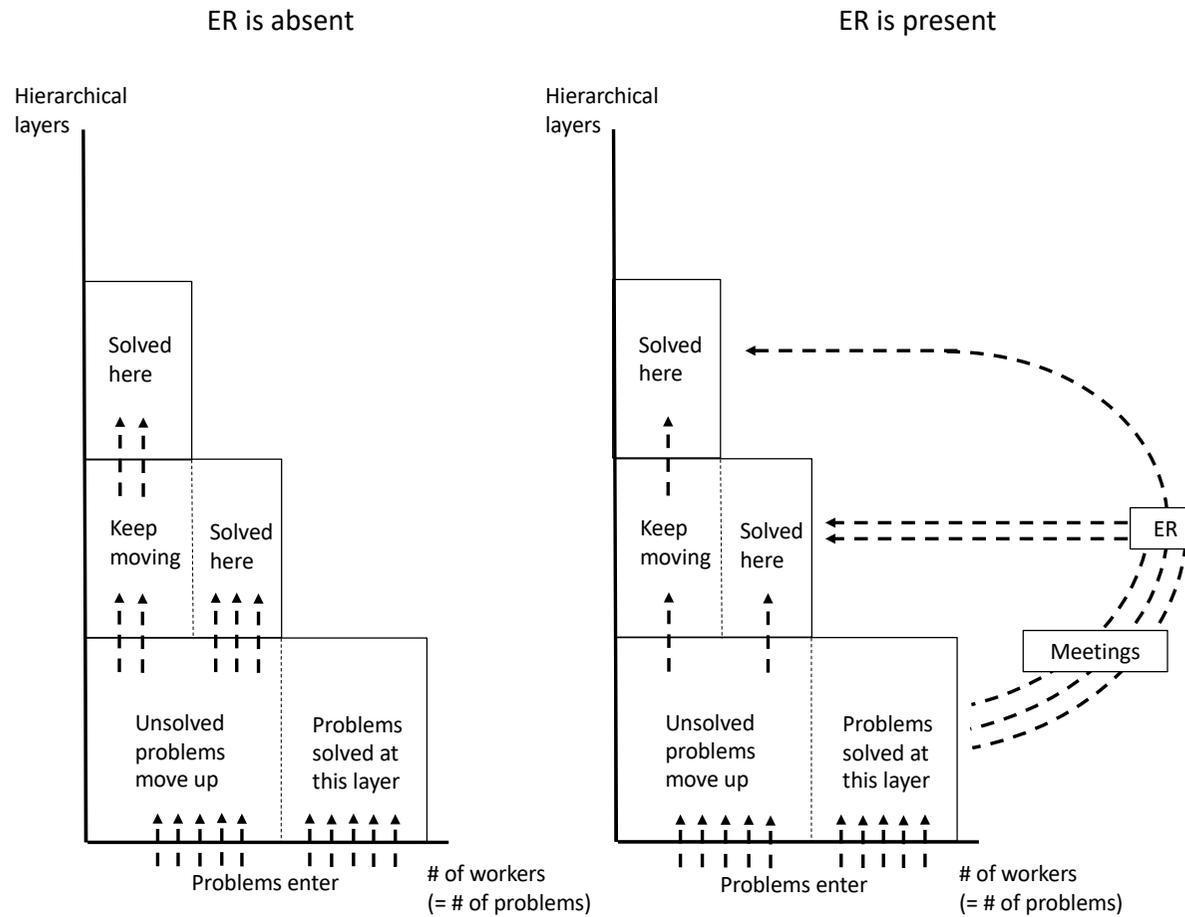
Figure 2: Numbers of layers (delayering) and willingness to delegate authority: correlation between ECS and GCR-WEF 2007-2013.

a. Num. of layers
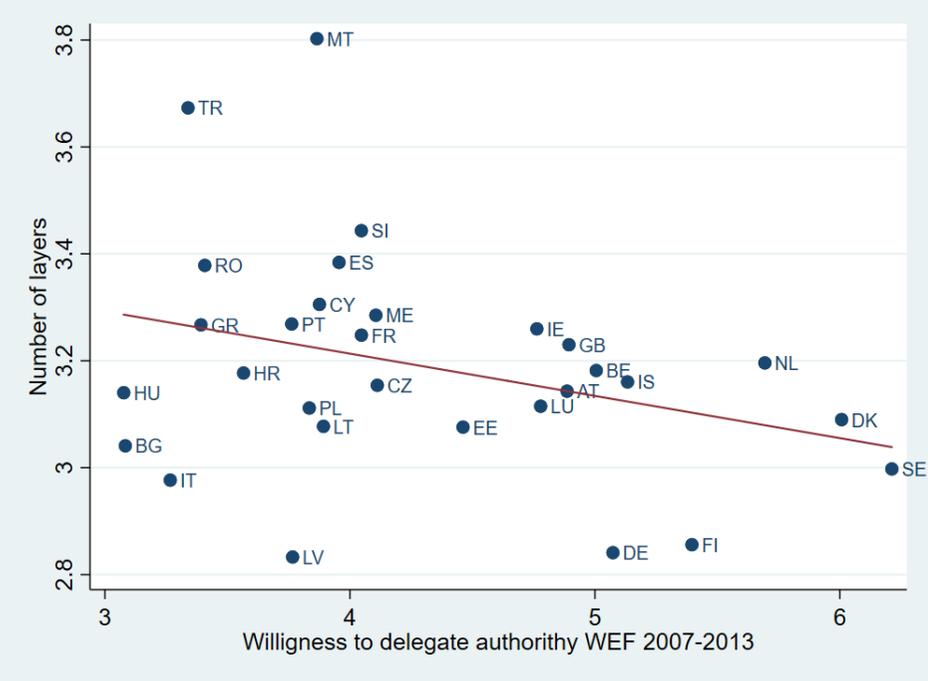
b. Delayering
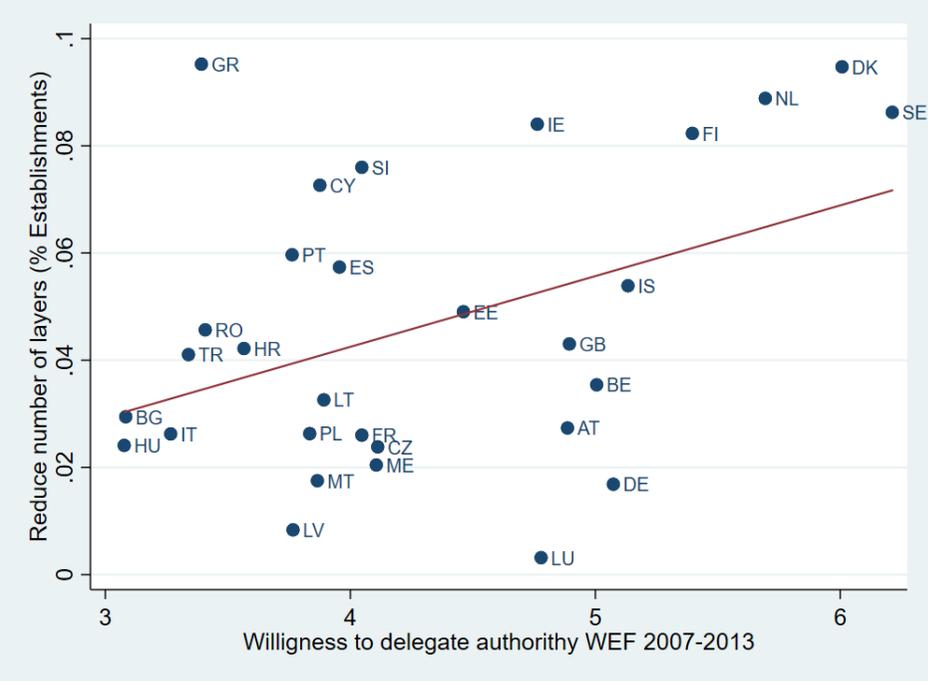
Notes: This figure displays the correlation between the average number of layers per establishment in ECS 2013 and average country-level scores on "Willingness to Delegate Authority" in the Global Competitiveness Index (World Economic Forum). GCI country-level scores are based on the following question: In your country, how do you assess the willingness to delegate authority to subordinates? [1 = not willing at all-senior management takes all important decisions; 7 = very willing-authority is mostly delegated to business unit heads and other lower-level managers]

Figure 3: Changes in employment and layers: period 2010-2013.
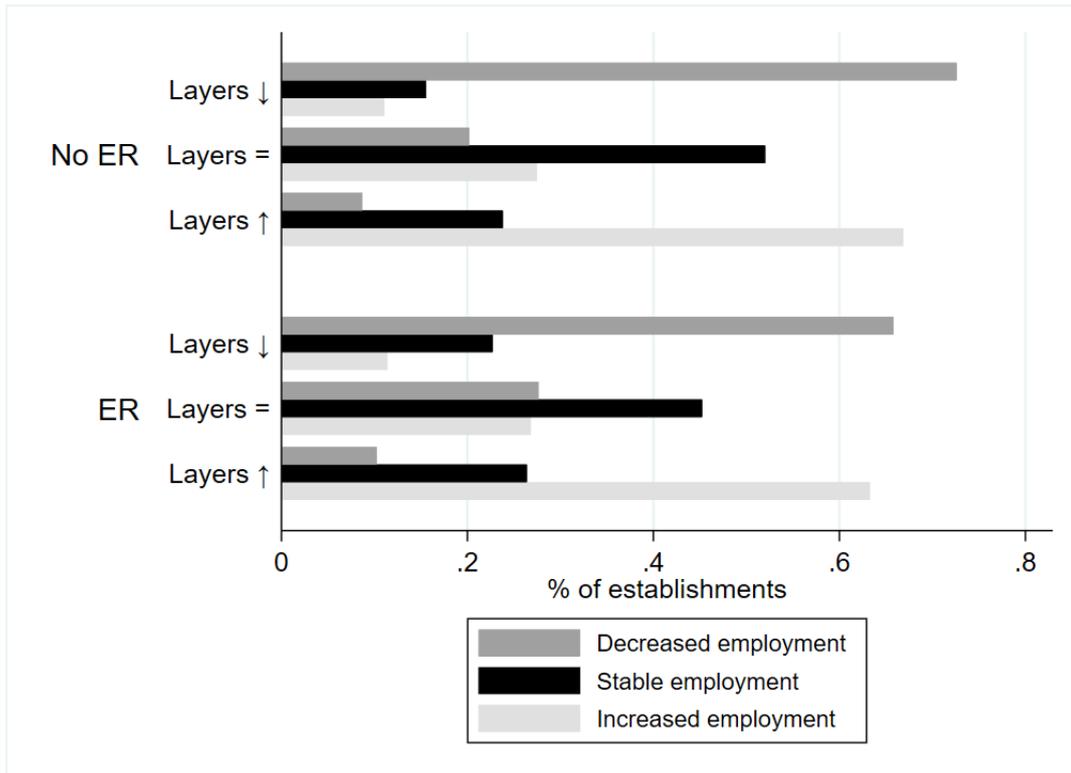
Notes: Pooled data from the European Company Survey 2013. Sample restricted to private-sector establishments.

Figure 4: Histogram of number of hierarchical layers.
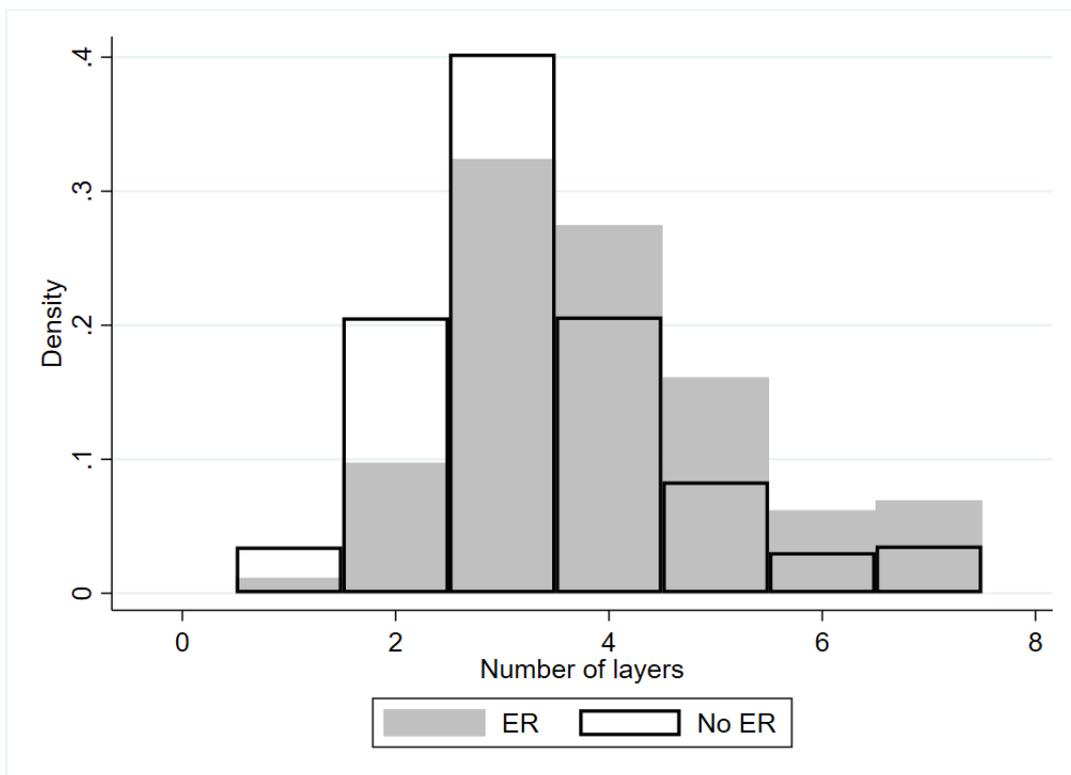
Notes: Pooled data from the European Company Survey 2013. Sample restricted to private-sector establishments.

Figure 5: Histogram of number of hierarchical layers by groups of countries with different industrial relations regimes and by industry.
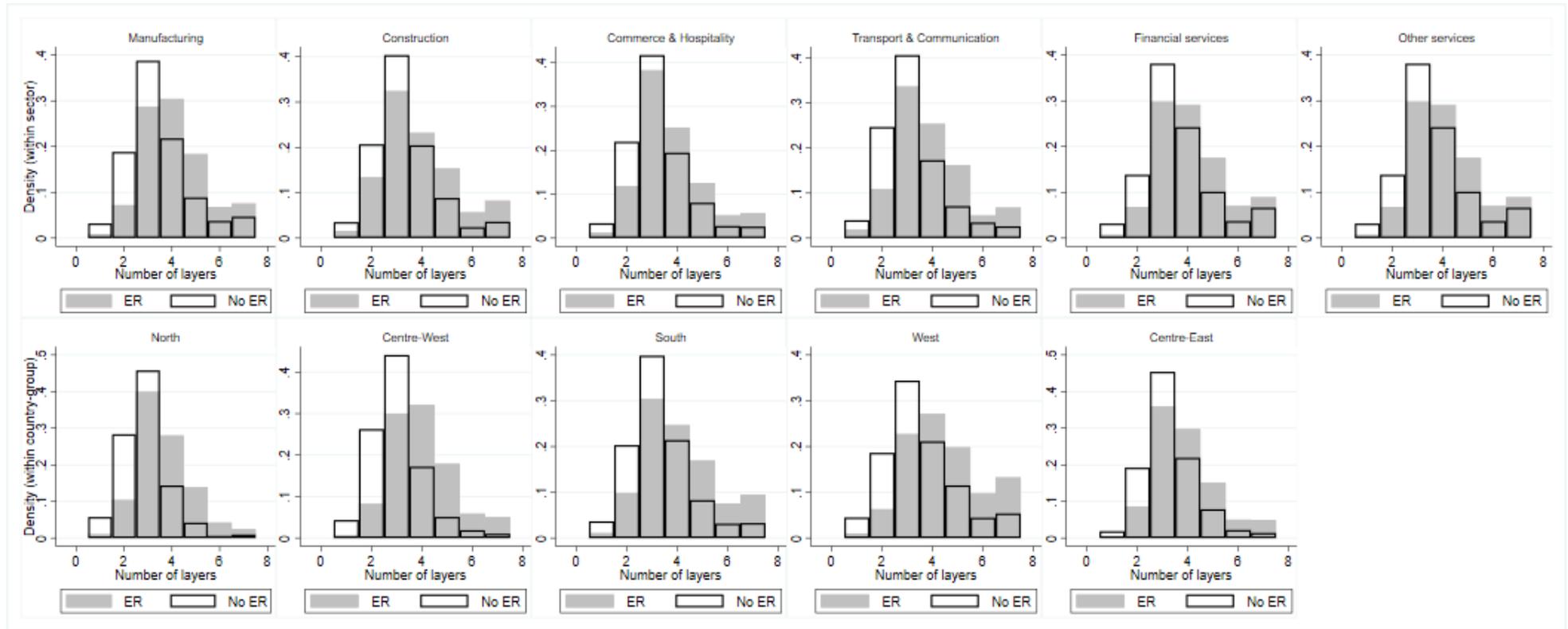
Notes: Pooled data from the European Company Survey 2013. Sample restricted to private-sector establishments. As for the industrial relations regimes, countries were classified according to the classification proposed by Visser (2009): North (Denmark, Finland, Sweden); Centre-West (Belgium, Germany, Luxembourg, Netherlands, Austria, Slovenia); South (Greece, Spain, France, Italy, Portugal); West (Ireland, Malta Cyprus, UK); Centre-East (Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Slovakia).

Table 1: Main variables' description and descriptive statistics.

Variable	Description as in the ECS questionnaire	Mean	Std.Dev.
ER	An official employee representation currently exists in the establishment (yes/no)	0.323	0.468
Depth of hierarchy	Number of hierarchical layers (logs) in the establishment, including the highest and the lowest level	1.082	0.402
Ownership change	In the last three years, a change in ownership affected the establishment substantially (yes/no)	0.084	0.278
Organizational change	In the last three years, this establishment introduced an organizational change (yes/no)	0 .311	0.463
Paid time off for training	% of employees received paid time-off from their normal duties to undertake training in the past 12 months	2.939	2.066
Change coordination	In the last three years, the establishment made changes in ways to coordinate and allocate work to employees (yes/no)	0.335	0.472
Meetings to all	Regular staff meetings open to all employees are used to involve employees in how work is organised (yes/no)	0.609	0.488
Meetings managers	Regular meetings between employees and immediate manager are used to involve employees in how work is organised (yes/no)	0.858	0.349
Multi-site	The establishment is one of a number of establishments at different locations belonging to the same company (yes/no)	0.212	0.409
Information systems	Information systems are used to minimize supplies or work-in-process (just-in-time or lean production systems or working according to a zero buffer principle) (yes/no)	0.475	0.499
Outsourcing	The establishment partly or entirely outsources production of goods and services to a third party that is not owned by the establishment or the company it belongs (yes/no)	0.265	0.441
Subsidiary site	The establishment is a subsidiary site (yes/no)	0.069	0.254
Employee delays	Involving employees leads to unnecessary delays in the implementation of changes (yes/no)	0.259	0.438

Notes: Variables are dummies unless otherwise specified. Pooled data from the European Company Survey 2013. Sample restricted to private-sector establishments. Means are weighted by ECS sampling weights.

Table 2: Depth of hierarchy.

	(1)	(2)	(3)	(4)	(5)
ER	0.091***	0.077***	0.075***	0.070***	0.066***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Medium firm	0.289***	0.266***	0.268***	0.261***	0.239***
	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
Large firm	0.543***	0.516***	0.510***	0.501***	0.467***
	(0.015)	(0.017)	(0.017)	(0.017)	(0.018)
ER $\times$ Medium firm	-0.022**	-0.023**	-0.026**	-0.020*	-0.017
	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)
ER $\times$ Large firm	-0.085***	-0.107***	-0.101***	-0.100***	-0.093***
	(0.018)	(0.020)	(0.020)	(0.020)	(0.020)
Observations	23,973	20,739	20,129	19,461	19,037
R-squared	0.253	0.277	0.279	0.280	0.286
Country + industry dummies	Yes	Yes	Yes	Yes	Yes
Establishment-level controls	No	Yes	Yes	Yes	Yes
Outsourcing	No	No	Yes	Yes	Yes
Information Systems	No	No	No	Yes	Yes
Manager's controls	No	No	No	No	Yes

Notes: Estimation by ordinary least squares with robust standard errors in parentheses. The dependent variable is the number of layers (in logs). Establishment-level controls: workforce composition (gender, age, education, fraction of part-time, permanent employees), firm size, multi-plant, change in employment, productivity, organizational structure and ownership in the last three years, subsidiary site, share of workers involved in complex tasks. Estimates reported in column 3 control for outsourcing of production activities. In Column 4, we add controls for the use of information systems. In Column 5, we add controls for manager's characteristics (gender, position, tenure). The small firm category (10-49 employees) is the benchmark category for size dummies. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 3: Depth of hierarchy. IV results.

	(1)	(2)	(3)	(4)	(5)
ER	0.336***	0.348***	0.339***	0.329***	0.329***
	(0.066)	(0.077)	(0.079)	(0.083)	(0.085)
Medium firm	0.302***	0.290***	0.292***	0.292***	0.267***
	(0.031)	(0.036)	(0.036)	(0.037)	(0.038)
Large firm	0.524***	0.522***	0.527***	0.509***	0.475***
	(0.059)	(0.064)	(0.065)	(0.065)	(0.066)
ER × Medium firm	-0.150***	-0.174***	-0.174***	-0.175***	-0.164**
	(0.058)	(0.066)	(0.067)	(0.068)	(0.069)
ER × Large firm	-0.195**	-0.256***	-0.260***	-0.242***	-0.231***
	(0.078)	(0.086)	(0.088)	(0.088)	(0.089)
Observations	23,973	20,739	20,129	19,461	19,037
R-squared	0.216	0.231	0.235	0.238	0.242
Country + industry dummies	Yes	Yes	Yes	Yes	Yes
Establishment-level controls	No	Yes	Yes	Yes	Yes
Outsourcing	No	No	Yes	Yes	Yes
Information Systems	No	No	No	Yes	Yes
Manager's controls	No	No	No	No	Yes

Notes: Estimation by 2-stage least squares with robust standard errors in parentheses. The dependent variable is the number of layers (in logs). The instrumental variable is a dummy coded 1 if the wages are determined at the sectoral level through collective bargaining agreements. Establishment-level controls are the same as those in Table 2. Estimates reported in column 3 control for outsourcing of production activities. In Column 4, we add controls for the use of information systems. In Column 5, we add controls for manager's characteristics (gender, position, tenure). The small firm category (10-49 employees) is the benchmark category for size dummies. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Mechanisms: training, coordination and meetings.

	(1) Paid time off for training	(2) Skill development	(3) Change in ways to coord. and allocate work	(4) Meetings open to all staff	(5) Meetings between employees and immediate manager	(6) Employee involvement causes delays
ER	0.151***	0.012**	0.024***	0.038***	0.019***	0.012
	(0.019)	(0.005)	(0.008)	(0.008)	(0.006)	(0.008)
Medium firm	0.135***	0.038***	-0.016**	-0.044***	0.015***	0.006
	(0.019)	(0.005)	(0.008)	(0.008)	(0.006)	(0.008)
Large firm	0.233***	0.060***	-0.061***	-0.034***	0.032***	-0.028***
	(0.025)	(0.006)	(0.011)	(0.012)	(0.007)	(0.011)
Observations	19,084	17,144	19,145	19,194	19,196	18,809
R-squared		0.056	0.175	0.076	0.066	0.048
Country + industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Establishment-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Outsourcing	Yes	Yes	Yes	Yes	Yes	Yes
Information Systems	Yes	Yes	Yes	Yes	Yes	Yes
Manager's controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: In column 1, we report estimates from Ordered Probit Models with robust standard errors in parentheses. The dependent variables (see definition in footnote 8) are the fraction of workers engaged in on-the-job training and the fraction of workers entitled to paid time off for training, respectively). In Columns 2-6, we report estimates from Linear Probability Models with robust standard errors. Establishment-level controls are the same as those in Table 2. Estimates also control for outsourcing of production activities, use of information systems and manager's characteristics (gender, position, tenure).*** $p<0.01$, ** $p<0.05$, * $p<0.1$.