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DEPARTAMENT D'ECONOMIA

Edita:

Adreçar comentaris al Departament d'Economia / CREIP

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Determinants of Decentralization within the Firm: Some Empirical Evidence from Spanish Small and Medium- Sized Enterprises[*]

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December 2012

Abstract

This paper examines empirically the determinants of decentralization of decision-making in the firm for small and medium-sized enterprises (SMEs) that tend to be highly centralized. By decentralization of decisions we mean the delegation of decision rights from the owner or manager to the plant supervisor or even to floor workers. Our findings show that the allocation of authority to basic workers or a team of workers depends on firm characteristics such as firm size, the use of internal networks or the number of workplaces, and workers characteristics, in particular, the composition of the laborforce in terms of education and seniority and whether or not workers receive pay incentives. External factors such as the intensity of competition and the firm's export intensity are also important determinants of the allocation of authority.

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1 Introduction

The decentralization of decisions within the firm is an important issue because the allocation of decision rights and other organizational aspects of the firm are related to several indicators of firm performance.[1] While most empirical studies on decentralization have considered large firms, in this paper we focus on small and medium-sized enterprises (SMEs), which is an important contribution of the paper.

SMEs play an important role in Spanish economy; as of 2011, 99.88% of Spanish firms were SMEs[2] and they employed about 60% of the total workforce. In the Spanish region we look at in this paper, Catalonia, SMEs represent 99.86% of total businesses and contribute to 51.3% of the region Gross Value Added. Besides their economic importance in countries like Spain, SMEs have certain particularities that clearly make them different in their characteristics and organization from larger firms. One such aspect is the ownership structure; many of them are family business (that is, the majority of the voting securities are held by a single family) which has clear implications for the hierarchical organization and the allocation of decision rights within the firm. Moreover, given their reduced size they naturally tend to have fewer hierarchical layers and the information from bottom workers (and customers) to supervisors and managers can flow more easily than in larger firms. A priori, all these factors would make us expect higher levels of centralization of decisions among SMEs. Thus in the case of small and medium size firms, it is less clear what factors, if any, lead to the delegation of decision rights within the firm.

As known, decentralization entails the delegation of authority to decide from the owner or manager (the principal) to a worker (the agent) who potentially possesses more information about the specific matters of the firm. However, the interests of the principal and the agent might not be aligned, so the agent can use his informational advantage to make choices that are not in the best interest of the principal. This is the so-called principal-agent problem.[3]

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[1]For instance, Caroli and Van Reenen (2001) find a positive effect of organizational changes (including the decentralization of authority) on firm productivity. Similarly, Cooke (1994) and Boning et al. (2007) stress the relationship between the firm's organizational design and productivity, whereas Ichniowski (1990) and Osterman (2006) highlight the relationship with financial results and wages, respectively.

[2]Source: Directorio Central de Empresas (DIRCE), 2011.

[3]Henceforth, in order to simplify the terminology used by other authors we refer to the principal and the

A rich stream of theoretical papers has reflected the existing trade-off between the benefits and the costs of decentralization. There are mainly two sets of models analyzing this topic. The first one focuses on information processing,[4] while the second stresses the incentives to decentralize decisions. Briefly, the information processing models analyze the issue of coordination of imperfectly informed agents and ignore the problem of conflicting objectives among agents. These papers also highlight the fact that hierarchical organizations that centralize the decision-making tend to have organization failures due to information transmission leaks (Keren and Levhari, 1979, 1983, 1989) and delays in transmitting information from the top to the bottom of the hierarchy (Radner, 1993; Van Zandt, 1999). As for the incentives motive, papers like Aghion and Tirole (1997), Laffont and Martimort (1998) and Poitevin (2000) emphasize the information advantage that the agent has over the principal with respect to certain decisions so the communication of information is strategic and depends on the authority relationship.[5]

More related to our work, some efforts have been made in recent years to empirically test the theories concerning delegation of authority.[6] For instance, using a survey of Italian manufacturing firms, Colombo and Delmastro (2004) investigate the relationship between the allocation of decision-making authority and internal aspects of firm's organizational structure. Using Acemoglu et al. (2007) study decentralization on a dataset on British and French firms and emphasize an establishment's distance to the technological frontier, as well as firm age and the heterogeneity in which the firm operates as determinants of decentralization.

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agent, where in our case the principal can be the manager or the owner and the agent is a basic worker or a team of workers.

[4]These include Keren and Levhari (1979, 1983, 1989), Sah and Stiglitz (1986), Geanakoplos and Milgrom (1991), Radner and Van Zandt (1992), Radner (1993), Bolton and Dewatripont (1994), Aghion and Tirole (1997), Garicano (2000), Rajan and Zingales (2001), Dessein (2002), Hart and Moore (2005) and Alonso et al. (2008).

[5]Aghion and Tirole (1997) and Laffont and Martimort (1998) are reviewed in more detail in the following Section. Poitevin (2000) develops a theory of decentralization of decision-making within organizations based on private information and incentives, and finds that renegotiation, collusion, and limits on communication are three sufficient conditions for decentralization to be optimal.

[6]Importantly, the focus of this work is empirical, and so we just use the theoretical papers as guidance on potential factors that can affect the delegation of decision-making power.

Bloom et al. (2007) find that product-market competition and trust are associated with decentralization while the religious preferences of a region can be associated with centralization. Similarly, Guadalupe and Wulf (2010) find that product market competition has an effect on the number of layers between division managers and the Chief Executive Officers (CEO). Wait and Meagher (2008) model the allocation of decision making rights between a principal and an agent when there are multiple decisions to be made and empirically find that delegation is more likely the more competitive the product market is and also in the case of exporting firms.

The objective of this paper is to test some of the theoretical and empirical findings on decentralization of decision rights for the case of small and medium-sized enterprises. To that aim, we use a survey that provides detailed information on the allocation of a number of decision rights, as well as firm and worker characteristics, for a sample of over 300 manufacturing SMEs in the Spanish region of Catalonia.

The paper is organized as follows. Section 2 presents the empirical and theoretical literature about the determinants of decentralization. Section 3 describes the dataset. In Section 4 the econometric model is specified and main results are presented. Finally, Section 5 concludes.

2 Determinants of Decentralization: A Literature Review.

As said above the principal-agent problem lies at the heart of the decentralization problem. Aghion and Tirole (1997) show that the optimal transfer of decision authority to the agent depends positively on the information advantage he enjoys with respect to the principal and the extent of the private benefits he can extract from exercising decision-making power. If the agent's private benefits are large, delegation may increase both his initiative to acquire information and his participation in the contractual relationship. Similarly, Laffont and Martimort (1998) argue that decentralization emerges whenever limits of communication and collusive behavior among agents are taken into account. In other words, the trade-off between the superior knowledge of the agent and the agency costs of managerial delegation

determines the optimal degree of decentralization. Therefore the determinants governing the decision to delegate authority depend on the costs and benefits that it implies. Among the *benefits of decentralization* we have the following: *i*) it reduces the costs of information transfer and communication, because the information is processed at the level at which it is used (Caroli and Van Reenen, 2001); *ii*) it increases the agent's initiative and participation (Aghion and Tirole, 1997) and so it may increase productivity through increased involvement of lower level staff and rising job satisfaction (Caroli and Van Reenen, 2001); *iii*) it allows full exploitation of agent's competencies as it fosters task specialization (Bolton and Dewatripont, 1994; Geanakoplos and Milgrom, 1991); *iv*) it increases the response of firms to market changes (Thoenig and Thesmar, 1999); *v*) it reduces delays because it allows tasks to be performed concurrently (Van Zandt, 1998).[7]

On the other hand, decentralization entails some *costs*: *i*) as is natural in a context of asymmetric information, there is a control cost; that is, agents are tempted to hide valuable information in order to achieve their own objectives that generally are not congruent with those of their superior (Aghion and Tirole, 1997; Poitevin, 2000; Wait and Meagher, 2008; Christie et al., 2003); *ii*) there tends to be duplication of information between hierarchical levels (Greenan and Guellec, 1994; Caroli and Van Reenen, 2001); *iii*) it might increase the risk of errors because specialized monitoring disappears and there are less direct controls over the production process; *iv*) it may reduce the efficiency of workers because decentralization implies a greater responsibility for workers and thus might lead to increased stress; *v*) as decentralization leads to skill upgrading, it might also lead to increased wage inequality (Aghion et al., 1999).

Some of the above mentioned determinants of decentralization are internal to the firm (for example, the ease with which information flows between hierarchical levels) while others are external factors (market conditions or uncertain demand). We use this classification as guidance to our empirical work, and try to identify the determinants affecting decentralization in practice.

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[7]Sah and Stiglitz (1986, 1988) also show that centralized organizations select a relatively lower number of projects than decentralized structures.

2.1 Internal factors

Among the factors internal to the firm that affect the allocation of the decision rights, the theoretical and empirical literature have emphasized the following: firm size and the firm organizational structure, the use of communication technologies, firm human capital, firm age and the use of pay incentives.

Firm size is a factor that might difficult the flow of information within the firm and makes local knowledge important (Colombo and Delmastro, 2004). In effect, a larger firm size might lead to information overload within the firm, which increases the principal's marginal disutility of getting informed and presses him to delegate decision-making power to the agent who is closer to the firm's operations.

In a similar fashion, the *firm organizational structure* in several plants requires greater coordination among them, which encourages the centralization of decision making.[8] However, the physical distance between the agent and the principal is also greater if the plant belongs to a multi-unit firm, and this can have two effects on the allocation of decision making. First, a greater physical distance reinforces the informational advantage on local issues enjoyed by the agent and makes communication with the principal more difficult, which favors decentralization. Second, it becomes harder for the principal to monitor the decisions taken by the agent which, in the absence of effective incentive systems, would lead to greater centralization.

As for the *communication technologies* used by the firm, they might either centralize or decentralize the decision-making process since, on the one hand, the decentralization disadvantage of losing control is reduced as advanced communication technologies allow the principal to monitor the agent and to be informed and, on the other hand, they can also reduce the disadvantages of centralization by speeding up the transmission of information from the top to the bottom of the hierarchy.[9] Therefore, the effect of communication technologies is ambiguous.

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[8]However, the use of yardstick competition may increase the ability of the company's headquarters to decentralize decision-making (Colombo and Delmastro, 2004).

[9]Keren and Levhari (1979, 1983), Radner (1993) and Aghion and Tirole (1997), consider that the use of advanced communication technologies reinforces the trend towards centralization of decision making.

The firm *human capital* is another important factor because decentralization requires higher levels of human capital from individual workers who need to deal with increased responsibility and uncertainty. Other arguments supporting this idea are the fact that skilled workers are more autonomous and less likely to make mistakes (Scott, 1981), they are better at communicating, which reduces the risk of duplicating information (Zammuto and O'Connor, 1992) and they are more able to analyze new pieces of knowledge so that the benefits of local information processing are enhanced when the labor force is more skilled (Caroli et al., 2001).[10] We go one step further and consider not only the firm average human capital but also the dispersion of skills of the labor force. In effect, although neglected by the literature on the allocation of decision rights, some studies analyzing firm productivity have paid attention to the composition of the labor force (see for example, Iranzo et al. (2008), Ilmakunnas and Maliranta (2005) or Hellerstein et al. (1999)) and found that it does matter.

Firm age is generally included as a control variable without a clear theoretical prediction behind with Acemoglu et al. (2007), for instance, finding that, on average; younger firms tend to be more decentralized than older firms.[11]

The *nature of the decision* is also important. Aghion and Tirole (1997) show that the need to delegate authority is higher for decisions that involve large private benefits for the agent while the decisions about projects that involve a large pay-off to the principal tend to be centralized. For instance, decisions such as hiring staff, that affects the agent's power and personal relationships with subordinates, are more likely to be delegated whereas decisions that require greater coordination should be retained with the agent's superior.

Finally, given the principal-agent problem it is necessary to also take into consideration the use of *incentives*. Colombo and Delmastro (2004) argue that the degree of decentralization is influenced by the ability of the principal to design efficient incentive schemes so that she can observe the behavior of the agent.

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[10] Thesmar and Thoenig (2000) model the relationship between skills, technological and organizational change, and find that a more highly skilled labor force leads to faster technological change and hence to changes in work organization aimed at reducing the cost of implementing the new technology.

[11] According to their data about 45% of the firms under the age of five years are decentralized, compared to 30% for the older firms.

2.2 External factors

Among the factors external to the firm, we consider the need to quick decision making, product market competition and the heterogeneity of the firm's environment.

Quick decision making is needed to reduce 'time to market' and ensure quick response to market conditions Colombo and Delmastro (2004). Keren and Levhari (1989), Radner (1993) and Aghion and Tirole (1997) consider that the urgency of decision should also favor delegation of authority to the agent because the decision-making process is slower when the principal exerts more control and in hierarchical organizations characterized by high degrees of task specialization that require greater coordination (Thoenig and Thesmar (1999) and Caroli and Van Reenen (2001)). By contrast, when organizations adopt decentralized structures, responsibility is often delegated to teams of workers that do multitask (Lindbeck and Snower, 1996), which requires less coordination and enables quick responses to market changes.

The *product market competition* also affects the degree of delegation. Guadalupe and Wulf (2010) argue that competition increases the need for timely decisions that make better use of local knowledge and they find that leads to flatter firms. However, Bloom et al. (2007) point that "there are counterarguments: more firms means more public knowledge so there is less need to delegate to privately knowledgeable managers. Very strong competition may reduce profit margins close to zero, thus blunting managerial effort if remuneration has a firm performance related element. Consequently, the effect of competition on decentralization is an empirical issue". Another factor related to market competition is whether the firm exports or not, because an establishment selling in a foreign market will be under higher competitive pressures to adopt the most productive work system and this may lead to more flexible work organization (Osterman, 1994). Empirically, Marin and Verdier (2003) find that greater international competition leads to the delegation of authority from the CEO to the managers and Wait and Meagher (2008) find that workplaces that export are more likely to decentralize decision-making rights.

As for the *heterogeneity of the firm's environment* this will tend to favor decentralization because the principal will find it more difficult to learn what is best for his firm from the

experiences of other firms in the industry.[12] Indeed, Acemoglu et al. (2007) find that firms in more heterogeneous environments are more likely to choose decentralization.

Table 2 lists the proxies used for each of the factors considered in this section that we include in our empirical analysis, as well as their expected signs according to the literature.

3   Data Description

The data comes from a unique survey on small and medium firms, that is, firms with less than 250 employees, conducted during 2005 and 2006 in the Spanish region of Catalonia.[13] The survey contains a rich set of questions and information that is not typically available in standard firm-level datasets.[14] In total, it contains information for a cross-section of about 500 firms covering the main manufacturing and service sectors representative of the Catalan economy. For homogeneity and ease of comparability, though, we focus on manufacturing SMEs, that is, 318 firms.[15] Workers in each firm from three different hierarchical levels (core employees, supervisors and managers) were sampled randomly. On average, about half of the workforce in a firm was interviewed, and we also have information on those workers.

Table 1 provides descriptive statistics of the firm and worker characteristics, as well as on the main external factors, of the final sample we use for our main regression models.[16] Notice

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[12] For example, "choosing the right way to use a new technology is much harder if the 'right' way to do it differs radically between different firms" (Bloom et al., 2007, p. 5)

[13] The survey is called "*Enquesta Empresarial de Desenvolupament de Producte i Necessitats de Cualificacions Transversals*" and was run by Petita i Mitjana Empresa de Catalunya (PIMEC).

[14] The survey design bears similarities with the British Workplace Employment Relations Survey (WERS), upon which it was based, containing additional questions not included in the WERS.

[15] They belong to the following two-digit NACE-code sectors: Food products and beverages (15), Chemicals (24), Rubber and plastic products (25), Fabricated metal products, except machinery and equipment (28), Machinery and mechanical equipment (29), Electrical machinery and instruments (31), Radio, television and communication equipment (32), Medical, precision and optical instruments, watches and clocks (33), Motor vehicles, trailers and semi-trailers (34), Furniture; manufacturing not elsewhere classified (36).

[16] As in Colombo and Delmastro (2004), we stack the firm-level data according to the eleven firm decisions we have information on, and create a pseudo-panel. As we have 318 firms and eleven decisions for each firm, we have a total of 3,498 firm-decision pairs. There are fewer observations in the cases of those variables for which the information for some firms is missing.

that as these are small and medium-sized enterprises, the average number of employees is rather small, 28. A high percentage of the firms (82%) are family business, about 67% of them use internal networks, on average they have 2 work centers and the average firm age is 30 years.

As for the workers characteristics, most of them are male; they have on average 10 years of schooling; basic workers and supervisors have spent on average 9 and 12 years respectively working in the current firm. Finally, regarding incentive payments, as there are many workers whose salary does not include a variable component, on average the percentage of the salary that depends on firm performance is rather small: 0.53% and 1% of the wages of basic workers and supervisors respectively.

Table 1: Descriptive statistics

Variable	Obs.	Mean	Std. Dev.
Firm characteristics			
Firm Size (in logs)	2332	3.039	0.717
Firm age (in logs)	3267	3.183	0.662
Number of workcenters	3212	2.575	6.259
Family firm (dummy var)	3454	0.822	0.383
Internal Networks (dummy var)	3025	0.669	0.471
Worker characteristics			
Gender	3498	2.664	14.5
Foreign (dummy var)	3454	0.068	0.185
Years of schooling	3498	10.073	2.099
Seniority of Basic workers (years)	3289	9.036	5.843
Seniority of Supervisors (years)	2574	12.297	8.175
Incentives (% of salary depending on firm performance):			
- Supervisors	3355	0.533	2.203
- Basic workers	2673	0.989	3.732
External Factors			
Intensity of competition	3421	2.132	0.694
Export intensity	3322	0.337	0.778

3.1 Measuring Decentralization

The dataset contains information on who in the firm decides on a number of issues. In particular, the following firm decisions are considered: i) daily tasks planning, ii) weekly tasks planning, iii) results control, iv) customer relations, v) quality control, vi) supply purchases, vii) machinery and equipment maintenance, $viii$) workers' needs, ix) hiring, x)

process technology choice and xi) training. The possible answers to these decisions are categorical ranging from 1 to 5, depending on who makes the decision. Decisions can be made by the firm's owner (value 1), manager (value 2), supervisor (value 3), a group of workers (value 4) or basic workers (value 5). Thus, according to our definition of decentralization a value of 5 corresponds to the greatest degree of delegation or decentralization and a value of 1 to the greatest degree of centralization (the owner makes the decision), while a value of 3 would constitute partial delegation.

It is worthwhile pointing out that the degree of centralization of decisions for these small and medium sized firms is quite high. Most of the decisions in most firms are taken by the owner or the manager –only 3.6% and 2.9% of the firm-decisions are being made by core/basic employees and by a group of workers respectively, with partial delegation over the supervisor accounting for 23.2% of the firm-decisions. Thus, in order to avoid econometric problems of thin cells for low levels of centralization, we group some of the answers to the decision questions and consider 2 possible models depending on how the dependent variable is defined:

1) A model of *Centralization* (if the decision is taken by firm's owner or manager), *Partial Delegation* (if the decision is made by a supervisor) and *Decentralization* (if the decision is made by either a group of workers or core employees). Figure 1 (b) shows the distribution of the allocation of decision rights in this case, with 70.3% of the observations indicating Centralization, 23.2% representing Partial Delegation and 6.5% Decentralization.

2) A model of just *Centralization* (if the decision is taken by firm's owner or manager) and *Decentralization* (if the decision is made by a supervisor, a group of workers or core employees). As Figure 1 (a) shows, 29.7% of the observations corresponds to Decentralization now and 70.3% to Centralization.

As we will see in the Empirical Section, in the first case we estimate an ordered probit model wheres in the second case we estimate a simple probit model.

(a)	(b)
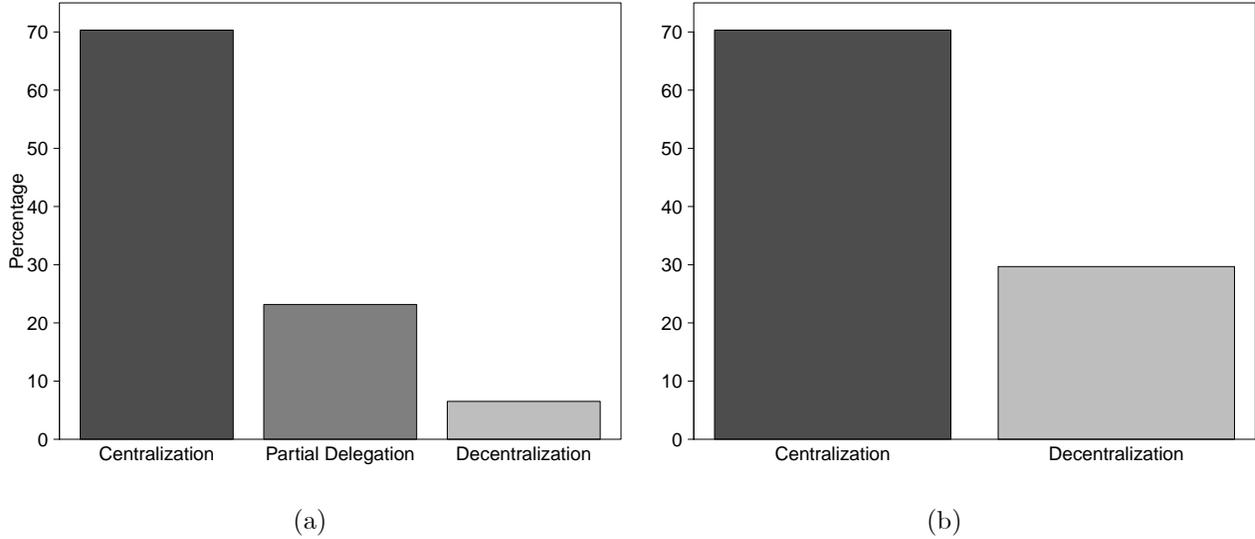
Figure 1: Allocation of Decision Rights within the firm (Who makes decision....?)

3.2 Measuring the Determinants of Decentralization

The proxies for the internal and external factors of the firm described in Section 2 are briefllisted in Table 2 with their expected impact on decentralization. We also discuss them briefly next.

3.2.1 Internal factors

Firm size is measured as the logarithm of the number of employees in the firm and, based on our discussion above, we would expect it to have a positive impact on decentralization.

As a proxy for information communication technologies we use *Internal Networks* which is a dummy variable that takes value one if the firm uses internal networks and zero otherwise. As explained in Section 2 the expected sign is ambiguous.

The organizational structure of the firm is captured by *Workcenters*, the number of work-centers that the firm has and its expected sign is also uncertain.

We measure the human capital as the average *years of schooling* of the workers in the firm and their experience (*seniority)* in the firm. We expect these variables to have a positive impact on the delegation of authority. Importantly, we also consider the dispersion of workers skills, in particular, the standard deviation of years of schooling of workers within

the firm. There is no theory oon whether a more or less homogeneous labor force facilitates the delegation of authority from top to bottom workers and so a priori there is no expected sign on this variable.

The use of incentive schemes to motivate employees is proxied by *Supervisor incentives* and *Basic worker incentives* which are respectively the percentage of their wages that depend on firm performance. Based on the theory, we would expect a positive effect of these variables on decentralization.

We also include a dummy variable for *family firms* that is mostly neglected in previous studies focusing on large firms. However, given the importance of family firms in the sample (the majority of the firms), this represents a natural factor influencing the allocation of decision rights within the firm.[17]

Finally, we control for the effect of each particular decision by including decision-specific dummies.[18]

3.2.2 External factors

As proxies for product-market competition we use the variables *Intensity of competition* and *Export intensity of the firm.* The former is based on the answers to the question: "Considering the market in which the company operates (national, international), how many competing firms there are?" Possible answers range from 1 ("few competitors)" to 3 ("many competitors"). So, a high value of this variable corresponds to a very competitive environment. The *Export intensity of the firm* was constructed from the information on the firms market share in domestic and international markets. In particular, we took the ratio between the share

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[17]For instance, (Colombo and Delmastro, 2004) argue that owner-managers (about 89% of the observations in our sample) may be unwilling to delegate authority due to personal preferences for autocratic decision-making. There is no particular theory on this issue though.

[18]We estimated different specifications of the model. In some of them, we grouped the decisions into different categories according to their correlations and so we included decision-group dummies instead of individual decision dummies. In particular, we grouped the 11 decisions into the following categories: *Task planning* (daily or weekly task decisions), *Labor* (workers needs, hiring and training), *Production* (results control, quality control, supply purchases, machinery and equipment maintenance and process technology choice) and *Clients*.

of sales in foreign markets versus the share of sales in the domestic market. Although the expected sign for product-market competition is somewhat ambiguous, previous empirical studies have confirmed a positive sign of export intensity on decentralization, and not a clear one on intensity of competition.

For lack of information, it was not possible to measure quick decision making and heterogeneity of the firm's environment.

We complete the list of explanatory variables with some additional controls for the workforce (such as gender and the percentage of foreigners in the firm) as well as other variables correlated with the tendency to delegate authority and that might then help us control for some of the remaining unobserved heterogeneity. One type of such variables can be the use of certain Human Resource Practices that go hand in hand with the delegation of decisions from top to bottom workers. Thus, we use as such control a dummy variable for whether the firm uses *Problems Solution Teams*.

4   Empirical Model and Results

As explained, we use the answers to the 11 firm decisions listed in subsection subsection 3.1 as our measure of decentralization or delegation of authority within the firm. Two types of models are estimated:

1. Discrete choice models (ordered probit and simple probit) on the stacked data of firm-decision observations and

2. Linear OLS models at the firm-level with a (continuous) decentralization index as dependent variable.

We explain each type of model and present the estimation results next.

Table 2: Explanatory Variables Description and Expected sign on Decentralization

	Variables	Description	Expected Sign on Decentralization
Internal Factors	**Company Features**		
	Firm Size	Logarithm of number of employees in the firm.	+
	Internal Networks	Dummy variable that takes the value 1 when the firm use internal networks; 0 otherwise.	?
	Workcenters	Number of work centers of the firm.	?
	Firm age	Logarithm of firm age	−
	Family firm	1 if it is a family-owned firm; 0 otherwise.	−
	Workers' characteristic		
	Years of schooling	Mean of years of schooling of workers	+
	Seniority of Basic workers	Mean of seniority of supervisors (years)	+
	Seniority of Supervisor	Mean of seniority of basic workers (years)	+
	Seniority difference	Difference in seniority of supervisor and seniority of basic workers	?
	Supervisor incentives	Mean of Percentage of supervisors earnings which corresponds to company incentives	+
	Basic workers incentives	Mean of Percentage of basic workers earnings which corresponds to company incentives	+
External Factors	Intensity of competition	Index that measures the intensity of competition	?
	Export intensity	Ratio sales foreign market/sales domestic market	+

4.1 Discrete Choice Models

The choice of allocation of authority reflects the maximization of the firm's profits. Let D_{ij}^* denote the "optimal" allocation of authority over decision i for firm j, which is given by:

$$D_{ij}^* = \gamma X_j + v_i + \varepsilon_{ij}, \quad (i = 1, \ldots, 11; j = 1, \ldots, 318) \tag{1}$$

where X_j is the vector of firm internal and external factors governing decentralization, as well as other firm and worker controls, v_i is a decision-specific fixed effect and ε_{ij} is a random disturbance term.

We do not observe D_{ij}^* but just a latent variable, D_{ij}, which in the case of the ordered probit model takes values from 1 to 3 and whose relation with the optimal allocation of authority is as follows:

$$
\begin{array}{ll}
D_{ij} = 1 \; (Centralization) & \text{if } D_{ij}^* \leq \mu_1 \\
D_{ij} = 2 \; (Partial\ Delegation) & \text{if } \mu_1 < D_{ij}^* \leq \mu_2 \\
D_{ij} = 3 \; (Decentralization) & \text{if } D_{ij}^* > \mu_2
\end{array}
$$

Or in the case of a simple probit model:

$$
\begin{array}{ll}
D_{ij} = 0 \; (Centralization) & \text{if } D_{ij}^* \leq \mu_0 \\
D_{ij} = 1 \; (Decentralization) & \text{if } D_{ij}^* > \mu_0
\end{array}
$$

with μ_k being, in either case, the thresholds that separate the different discrete categories of delegation of authority.

Table 3 reports the marginal effects of the baseline ordered probit estimation (Equation 1).[19] Since we are interested in the decentralization of decision rights, we will focus on the marginal effects of this outcome and on Model II which includes controls for decision-specific fixed effects. Decentralization is negatively (and significantly) associated to the use of intra-firm communication technologies (*Internal Networks*). This would mean that the use of an intranet and other communication technologies makes it easier for the owner or manager to have access to all the relevant firm information as to make herself the decisions without having to delegate on workers or either supervisors (partial delegation). By contrast, decentralization is positively, and significantly, correlated to being a family firm. This is somewhat surprising as, if anything, the opposite was to be expected, namely that firms

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[19]See Table 6 in the Appendix section for table containing the estimated coefficients.

whose control is in the hands of a dominant, family group would tend to be more centralized. One possible explanation for this relatively puzzling result is that in family firms, especially in the small ones, family members tend to also be involved as workers, and not only running the firm, and so they would tend to make decisions as well. It is worthwhile to point out that, among firm characteristics, firm size does not result significant –and as we will see, it will not be significant in any of the other models. This constitutes an important difference with previous empirical studies considering larger firms that generally find quite a robust positive effect of firm size on decentralization. The fact that we do not find it here makes us think that there might be a minimum firm size beyond which the costs of information transfer and communication entailed by centralization are too high and so it is optimal for firms to decentralize decisions. However, in our dataset of SMEs, firm size might be too "small" as to capture that effect.

As for the workers characteristics, both measures of human capital, average years of schooling and seniority, appear to be positively correlated to decentralization, although only the coefficient on seniority of basic workers is statistically different from zero. The other relevant, and statistically significant, result is the negative correlation between the dispersion of workers schooling and decentralization, what means that the delegation of decisions from top to bottom workers is more likely the more homogeneous, in terms of skills or education, is the workforce. Decentralization is also positively associated to pay incentives to both basic workers and supervisors, although the coefficient fails to be statistically significant. This could be because incentives do not matter or, most likely, it could mask an identification problem because few workers in these firms receive pay incentives and even for those who do receive them, the percentage of their wages depending on firm performance is rather small.[20] As for the additional control on workers characteristics included in the regressions, it is worthy to note the negative and significant coefficient on the dummy variable of being foreigner. That is, firms with a higher percentage of foreign workers tend to decentralize (even partially delegate) less.

Finally, the external factors considered here have signs that are in line with those obtained in previous empirical studies: the firm export intensity is positively and significantly

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[20]In other words, there is not much variability in these variables which tend to cluster around 0.

correlated with decentralization while the effect of the intensity of competition (which is based on the manager's subjective perception) would be inconclusive as the sign fails to be statistically significant.

By and large, we obtain the same qualitative results with our baseline probit model that defines decentralization as the allocation of decision rights to any hierarchical level below that of manager. The estimation results are presented in Table 4. Clearly, we confirm the negative correlation between decentralization and the use of internal communication technologies and the dispersion of workers education, and the positive correlation between decentralization and seniority of basic workers and also export intensity. In this case, we also obtain a negative and significant (at the 10% significance level) effect of intensity of competition on the probablity to decentralize which is not completely incongruent with the previous literature.[21]

As robustness checks, in the Appendix section we report the results of the ordered probit estimation and for the simple probit model for each group of decisions. That is, we estimate the models separately for *task planning decisions*, for *labor decisions* and for *production decisions* –see Tables 7 through 11 in the Appendix. As expected, the factors affecting the decentralization of decisions differ from each group of decision. For *task planning decisions* we do not find a significant effect on decentralization of any of the explanatory variables, although partial delegation of authority is positively and significantly correlated to internal firm aspects such as the number of *workcenters, Seniority of Basic workers* and *Supervisor incentives*. By contrast, the *Intensity of competition* and the *dispersion of years of schooling* favor centralization. For *labor decisions*, decentralization depends negatively on the *dispersion of years of schooling* and positively on the *export intensity* of the firm. Finally, as far as *production decisions* are concerned, decentralization is negatively correlated with the use of *internal networks* and positively with *seniority difference*, the *export intensity* of the firm and being a *family firm.* Overall, these results provide support to the view that, having a different importance to the principal (owner or manager) and to agent (supervisors, basic workers or a group of workers), the different types of decisions are allocated differently over

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[21]Guadalupe and Wulf (2010), for instance, find the opposite effect (ie, a positive effect of competition intensity on decentralization). However, as Bloom et al. (2007) note the effect of competition on delegation is utimately an empirical issue.

Table 3: Results of the baseline Ordered Probit Model: Marginal Effects

	Model I			Model II		
Variables	Centralization $P[Dec=1]$	Partial Deleg. $P[Dec=2]$	Decentralization $P[Dec=3]$	Centralization $P[Dec=1]$	Partial Deleg. $P[Dec=2]$	Decentralization $P[Dec=3]$
Firm Size	0.017	-0.011	-0.005	0.020	-0.014	-0.006
	(0.022)	(0.015)	(0.007)	(0.022)	(0.016)	(0.006)
Internal Networks	0.100**	-0.066***	-0.034**	0.107***	-0.073***	-0.033**
	(0.037)	(0.023)	(0.014)	(0.037)	(0.025)	(0.013)
Workcenters	-0.001	0.001	0.000	-0.002	0.001	0.000
	(0.002)	(0.001)	(0.000)	(0.002)	(0.001)	(0.000)
Firm age	-0.010	0.007	0.003	-0.008	0.006	0.002
	(0.025)	(0.017)	(0.008)	(0.025)	(0.018)	(0.007)
Years of schooling	-0.007	0.005	0.002	-0.008	0.006	0.002
	(0.008)	(0.006)	(0.003)	(0.008)	(0.006)	(0.002)
Years of schooling (St. Dev.)	0.073***	-0.050***	-0.023***	0.075***	-0.054***	-0.022***
	(0.018)	(0.013)	(0.006)	(0.019)	(0.014)	(0.006)
Seniority of Basic workers	-0.006**	0.004**	0.002**	-0.007**	0.005**	0.002**
	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.001)
Seniority of Supervisor	0.000	-0.000	-0.000	0.000	-0.000	-0.000
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Seniority difference	-0.000	0.000	0.000	0.000	-0.000	-0.000
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)
Basic worker incentives	-0.001	0.001	0.000	-0.003	0.002	0.001
	(0.009)	(0.006)	(0.003)	(0.009)	(0.006)	(0.003)
Supervisor incentives	-0.005	0.003	0.001	-0.005	0.003	0.001
	(0.004)	(0.003)	(0.001)	(0.004)	(0.003)	(0.001)
Intensity of competition	0.027	-0.018	-0.008	0.027	-0.019	-0.008
	(0.022)	(0.015)	(0.007)	(0.022)	(0.016)	(0.006)
Export intensity	-0.082***	0.056***	0.026***	-0.085***	0.061***	0.024***
	(0.017)	(0.012)	(0.006)	(0.017)	(0.012)	(0.005)
Family firm	-0.059	0.042	0.018*	-0.060*	0.044	0.016*
	(0.036)	(0.026)	(0.010)	(0.036)	(0.027)	(0.009)
Gender	0.006	-0.004	-0.002	0.007	-0.005	-0.002
	(0.039)	(0.027)	(0.012)	(0.039)	(0.028)	(0.011)
Foreign	0.139*	-0.095*	-0.044*	0.135*	-0.096*	-0.039*
	(0.072)	(0.049)	(0.024)	(0.073)	(0.052)	(0.022)
PST	-0.131***	0.086***	0.045***	-0.133***	0.091***	0.042***
	(0.032)	(0.021)	(0.012)	(0.031)	(0.021)	(0.011)
Provinces dummies	YES	YES	YES	YES	YES	YES
Sector dummies	YES	YES	YES	YES	YES	YES
Decision Group Dummies	NO	NO	NO	YES	YES	YES

Notes: Categorical Dependent Variable: Centralization, Partial Delegation and Decentralization. *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Robust standard errors in parentheses.

Table 4: Results of the baseline Probit Model

Variables	Model I		Model II	
	Coef.	Marginal Effects	Coef.	Marginal Effects
Firm Size	-0.077	-0.027	-0.090	-0.031
	(0.064)	(0.023)	(0.065)	(0.022)
Internal Networks	-0.211**	-0.076**	-0.233**	-0.082**
	(0.104)	(0.038)	(0.108)	(0.039)
Workcenters	0.007	0.003	0.008	0.003
	(0.005)	(0.002)	(0.005)	(0.002)
Firm age	0.043	0.015	0.040	0.014
	(0.079)	(0.028)	(0.080)	(0.028)
Years of schooling	0.015	0.005	0.017	0.006
	(0.024)	(0.008)	(0.025)	(0.009)
Years of schooling (St. Dev.)	-0.222***	-0.078***	-0.236***	-0.082***
	(0.056)	(0.019)	(0.058)	(0.020)
Seniority of Basic workers	0.020**	0.007**	0.022***	0.008***
	(0.008)	(0.003)	(0.008)	(0.003)
Seniority of Supervisor	-0.006	-0.002	-0.006	-0.002
	(0.006)	(0.002)	(0.006)	(0.002)
Seniority difference	0.003	0.001	0.002	0.001
	(0.007)	(0.003)	(0.007)	(0.002)
Basic worker incentives	-0.012	-0.004	-0.009	-0.003
	(0.026)	(0.009)	(0.026)	(0.009)
Supervisor incentives	0.014	0.005	0.015	0.005
	(0.012)	(0.004)	(0.012)	(0.004)
Intensity of competition	-0.102*	-0.036*	-0.108*	-0.037*
	(0.061)	(0.021)	(0.063)	(0.022)
Export intensity	0.255***	0.090***	0.277***	0.096***
	(0.063)	(0.022)	(0.064)	(0.022)
Family firm	0.168	0.058	0.178	0.059
	(0.114)	(0.038)	(0.116)	(0.037)
Gender	0.011	0.004	0.011	0.004
	(0.114)	(0.040)	(0.118)	(0.041)
Foreign	-0.259	-0.091	-0.260	-0.090
	(0.235)	(0.083)	(0.245)	(0.085)
PST	0.392***	0.142***	0.415***	0.148***
	(0.093)	(0.034)	(0.095)	(0.034)
Constant	-0.107		-0.894*	
	(0.420)		(0.459)	
Provinces dummies	YES	YES	YES	YES
Sector dummies	YES	YES	YES	YES
Decision Group Dummies	NO	NO	YES	YES
Sample size	1243	1243	1243	1243
Log Likelihood	-733.65	-733.65	-693.08	-693.08
Pseudo-R^2	0.05	0.05	0.11	0.11

Notes: Dependent Variable: Decentralization. *** Significant at 1%, ** Significant at 5 %, * Significant at 10 %. Robust

standard errors in parentheses.

hierarchical levels.

4.2   Linear OLS Models

Alternatively to the estimation of discrete choice models on the stacked data of firm-decision

pairs, we construct different (continuous) indeces of decentralization at the firm-level and

estimate simple linear OLS models. In particular, we compute a synthetic index of decentralization based on all the decisions and indeces for 3 different sub-groups of decisions that, using factor analysis, we find are somewhat more correlated amont them. We label these sub-groups of decisions as follows: task planning decisions (which include daily and weekly tasks planning decisions), labor decisions (decisions on workers' needs, hiring and training) and production decisions (results control, quality control, supply purchases, machinery and equipment maintenance and process technology choice).

Table 5 presents the OLS estimation results for the different decentralization indeces. Once again, we confirm the robustness of some of our previous results as well as the fact that the impact of the different explanatory variables differ by the type of decisions to be made. Firms with more homogeneous workforces in terms of education tend to decentralize more –the coefficient on the dispersion of years of schooling is negative throughout all the models and it is also highly significant with the only exception of the group of production decisions. Decentralization is also higher (and this effect is generally statistically significant) for all decisions and for all groups of decisions among those firms that export more. As for the rest of variables, among the firm characteristics, the use of internal networks presents, except for task planning decisions, a negative coefficient although this is only significant in the case of labor decisions. Interestingly enough, being a family firm is now negatively correlated to decentralization for some type of decisions (task planning and labor decisions) and, in any case, is no longer significant. As for the other workers characteristics, seniority (of basic workers) is still associated to higher levels of decentralization, but only statistically significantly in the case of task planning decisions and for the overall decentralization index, whereas the effect of pay incentives is still not significantly different from zero. Finally, firms facing more intense competition tend to centralize decisions more, although this correlation is only significant in the case of task planning decisions.

5   Conclusions

This paper represents an effort to empirically identify the factors affecting the delegation of authority in the case of small and medium sized enterprises. Since most of the studies on

Table 5: Estimation Results (OLS)

Variables	All decisions (1)	Only Task planning decisions (2)	Only Labor decisions (3)	Only Production decisions (4)
Firm Size	0.037	0.126	0.035	0.024
	(0.080)	(0.113)	(0.099)	(0.084)
Internal Networks	-0.185	0.108	-0.269*	-0.239
	(0.133)	(0.184)	(0.157)	(0.158)
Workcenters	0.004	0.018	0.005	-0.001
	(0.006)	(0.011)	(0.008)	(0.006)
Firm age	-0.014	0.018	-0.014	0.006
	(0.094)	(0.137)	(0.115)	(0.114)
Years of schooling	0.021	0.046	-0.011	0.022
	(0.031)	(0.039)	(0.039)	(0.036)
Years of schooling (St. Dev.)	-0.158**	-0.272***	-0.190**	-0.094
	(0.068)	(0.102)	(0.090)	(0.079)
Seniority of Basic workers	0.017*	0.028**	0.019	0.008
	(0.010)	(0.013)	(0.012)	(0.012)
Seniority of Supervisor	-0.003	-0.010	-0.008	0.001
	(0.007)	(0.010)	(0.008)	(0.007)
Seniority difference	-0.002	-0.008	-0.011	0.009
	(0.009)	(0.010)	(0.011)	(0.010)
Basic worker incentives	0.033	0.035	0.037	0.019
	(0.022)	(0.028)	(0.029)	(0.025)
Supervisor incentives	0.001	0.013	-0.014	0.011
	(0.013)	(0.016)	(0.018)	(0.015)
Intensity of competition	-0.089	-0.285**	-0.045	-0.030
	(0.084)	(0.111)	(0.111)	(0.086)
Export intensity	0.206***	0.094	0.274***	0.219***
	(0.058)	(0.075)	(0.068)	(0.075)
Family firm	0.013	-0.063	-0.058	0.092
	(0.122)	(0.179)	(0.145)	(0.148)
Gender	-0.013	0.028	0.029	-0.035
	(0.148)	(0.280)	(0.156)	(0.136)
Foreign	-0.234	-0.456	0.236	-0.516
	(0.277)	(0.441)	(0.336)	(0.321)
PST	0.309**	0.297*	0.323**	0.326**
	(0.124)	(0.165)	(0.155)	(0.138)
Constant	0.152	0.135	0.547	-0.187
	(0.568)	(0.752)	(0.719)	(0.616)
Provinces dummies	YES	YES	YES	YES
Sector dummies	YES	YES	YES	YES
Sample size	114	114	114	114
R2 Adj.	0.08	0.23	0.07	0.02
F-stat	2.35	4.45	2.33	2.19
Log Likelihood	-70.98	-108.31	-93.73	-84.97

Notes: *** Significant at 1%, ** Significant at 5 %, * Significant at 10 %. Robust standard errors in parentheses.

decentralization have looked at large companies and it is difficult to obtain data for SMEs, this is an important contribution of the paper, even if the data available does not allow testing all the existing theories on delegation.

We considered eleven strategic decisions relevant to a firm's activity and tested the predic-

tions of economic theory for a sample of 318 Catalonian manufacturing firms. The empirical results are easily summarized. First, in general, our results show that internal aspects of the firms such as the use of internal networks, the number of workplaces, the dispersion of workers educational levels, the seniority of basic workers and supervisors incentives affect the degree of decentralization or delegation. Second, externals aspects that affects the allocation of authority are the intensity of competition and the export intensity of the firm. Nevertheless, all those factors depend on the type of decision.

It is also important to note that we find some differences with respect to previous empirical works considering larger firms. For instance, for our sample of small and medium-sized firms, firm size is usually not significant whereas this tends to be a pretty robust result in other studies, and when it is (in the case of labor decisions) it favors centralization. Contrary to what the previous literature suggested, we also find that family-owned firms tend to decentralize more, especially in the case of production decisions.

Finally, it is fair to point out a possible limitation of this empirical study which is that a number of the explanatory variables fail to be significant, which casts doubt on whether they genuinely do not affect the allocation of decision-making rights in small and medium sized enterprises or whether this is rather an identification problem due to the low variability of some of these variables in our dataset.

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Appendix

Table 6: Results of Ordered Probit Model (Coefficients)

Variables	Model I Coef.	Model II Coef.
Firm Size	-0.047	-0.057
	(0.063)	(0.064)
Internal Networks	-0.278***	-0.299***
	(0.099)	(0.102)
Workcenters	0.004	0.004
	(0.004)	(0.005)
Firm age	0.027	0.024
	(0.072)	(0.072)
Years of schooling	0.020	0.023
	(0.023)	(0.023)
Years of schooling (St. Dev.)	-0.208***	-0.217***
	(0.052)	(0.054)
Seniority of Basic workers	0.018**	0.019**
	(0.008)	(0.008)
Seniority of Supervisor	-0.001	-0.000
	(0.005)	(0.005)
Seniority difference	0.000	-0.001
	(0.006)	(0.006)
Basic worker incentives	0.004	0.008
	(0.025)	(0.025)
Supervisor incentives	0.013	0.013
	(0.011)	(0.010)
Intensity of competition	-0.075	-0.078
	(0.061)	(0.063)
Export intensity	0.234***	0.246***
	(0.049)	(0.049)
Family firm	0.174	0.179
	(0.110)	(0.113)
Gender	-0.018	-0.019
	(0.112)	(0.114)
Foreign	-0.394*	-0.390*
	(0.205)	(0.212)
PST	0.362***	0.372***
	(0.086)	(0.087)
μ_1	0.198	0.898*
	(0.415)	(0.463)
μ_2	1.295***	2.031***
	(0.415)	(0.467)
Provinces dummies	YES	YES
Sector dummies	YES	YES
Decision Group Dummies	NO	YES
Sample size	1243	1243
Log Likelihood	-931.63	-899.10
Pseudo-R^2	0.04	0.08

Note: *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Robust standard errors in parentheses.

Table 7: Results of Ordered Probit Model for each group of decisions

Variables	Only Task planning decisions (Coef.)	Only Labor decisions (Coef.)	Only Production decisions (Coef.)
Firm Size	0.147	-0.210	-0.016
	(0.164)	(0.149)	(0.090)
Internal Networks	0.134	-0.299	-0.369**
	(0.230)	(0.210)	(0.144)
Workcenters	0.027*	0.009	-0.005
	(0.014)	(0.008)	(0.007)
Firm age	0.206	0.127	-0.024
	(0.173)	(0.137)	(0.104)
Years of schooling	0.033	-0.013	0.016
	(0.055)	(0.044)	(0.034)
Years of schooling (St. Dev.)	-0.442***	-0.324***	-0.115
	(0.126)	(0.116)	(0.075)
Seniority of Basic workers	0.038**	0.012	0.009
	(0.017)	(0.016)	(0.011)
Seniority of Supervisor	-0.010	-0.000	0.001
	(0.012)	(0.013)	(0.007)
Seniority difference	-0.009	-0.020	0.014
	(0.015)	(0.014)	(0.009)
Basic worker incentives	0.056	-0.010	-0.016
	(0.060)	(0.048)	(0.036)
Supervisor incentives	0.037	-0.012	0.023
	(0.023)	(0.023)	(0.016)
Intensity of competition	-0.355**	-0.039	0.010
	(0.155)	(0.140)	(0.086)
Export intensity	0.098	0.375***	0.254***
	(0.133)	(0.115)	(0.059)
Family firm	-0.035	0.101	0.308*
	(0.253)	(0.240)	(0.159)
Gender	0.243	0.057	-0.072
	(0.292)	(0.210)	(0.174)
Foreign	-0.557	0.329	-0.829***
	(0.579)	(0.373)	(0.302)
PST	0.339	0.281	0.450***
	(0.209)	(0.185)	(0.123)
μ_1	0.166	-0.262	0.430
	(0.990)	(0.890)	(0.598)
μ_2	2.599***	0.772	1.416**
	(0.957)	(0.882)	(0.598)
Provinces dummies	YES	YES	YES
Sector dummies	YES	YES	YES
Sample size	226.00	335.00	568.00
Log Likelihood	-145.03	-187.77	-468.78
Pseudo-R2	0.16	0.09	0.05

Note: *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Robust standard errors in parentheses.

Table 8: Results of Ordered Probit Model: Task planning decisions

	Marginal Effects		
Group of decision=*Task planning*			
Variables	**Centralization**	**Partial Delegation**	**Decentralization**
	$P[Dec=1]$	$P[Dec=2]$	$P[Dec=3]$
Firm Size	-0.058	0.056	0.002
	(0.065)	(0.062)	(0.003)
Internal Networks	-0.053	0.051	0.002
	(0.090)	(0.087)	(0.003)
Workcenters	-0.011*	0.010*	0.000
	(0.006)	(0.005)	(0.000)
Firm age	-0.082	0.078	0.003
	(0.068)	(0.066)	(0.003)
Years of schooling	-0.013	0.012	0.001
	(0.022)	(0.021)	(0.001)
Years of schooling (St. Dev.)	0.175***	-0.168***	-0.007
	(0.050)	(0.049)	(0.004)
Seniority of Basic workers	-0.015**	0.014**	0.001
	(0.007)	(0.007)	(0.000)
Seniority of Supervisor	0.004	-0.004	-0.000
	(0.005)	(0.005)	(0.000)
Seniority difference	0.004	-0.003	-0.000
	(0.006)	(0.006)	(0.000)
Basic worker incentives	-0.022	0.021	0.001
	(0.024)	(0.023)	(0.001)
Supervisor incentives	-0.015	0.014	0.001
	(0.009)	(0.009)	(0.000)
Intensity of competition	0.141**	-0.135**	-0.006
	(0.061)	(0.060)	(0.003)
Export intensity	-0.039	0.037	0.002
	(0.053)	(0.051)	(0.002)
Family firm	0.014	-0.013	-0.001
	(0.100)	(0.096)	(0.004)
Gender	-0.097	0.093	0.004
	(0.116)	(0.111)	(0.005)
Foreign	0.221	-0.212	-0.009
	(0.229)	(0.221)	(0.011)
PST	-0.135	0.128	0.006
	(0.082)	(0.079)	(0.005)

Notes: Categorical Dependent Variable: Centralization, Partial Delegation and Decentralization. This table reports the marginal effects for each possible outcome of our dependent variable. *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Robust standard errors in parentheses. The estimates include provinces and sector fixed effects.

Table 9: Results of Ordered Probit Model: Labor decisions

Group of decision=*Labor*	Marginal Effects		
Variables	Centralization	Partial Deleg.	Decentralization
	$P[Dec=1]$	$P[Dec=2]$	$P[Dec=3]$
Firm Size	0.056	-0.043	-0.013
	(0.040)	(0.031)	(0.009)
Internal Networks	0.085	-0.063	-0.021
	(0.063)	(0.045)	(0.019)
Workcenters	-0.002	0.002	0.001
	(0.002)	(0.002)	(0.001)
Firm age	-0.034	0.026	0.008
	(0.037)	(0.028)	(0.009)
Years of schooling	0.003	-0.003	-0.001
	(0.012)	(0.009)	(0.003)
Years of schooling (St. Dev.)	0.087***	-0.066***	-0.020**
	(0.031)	(0.024)	(0.008)
Seniority of Basic workers	-0.003	0.003	0.001
	(0.004)	(0.003)	(0.001)
Seniority of Supervisor	0.000	-0.000	-0.000
	(0.003)	(0.003)	(0.001)
Seniority difference	0.005	-0.004	-0.001
	(0.004)	(0.003)	(0.001)
Basic worker incentives	0.003	-0.002	-0.001
	(0.013)	(0.010)	(0.003)
Supervisor incentives	0.003	-0.002	-0.001
	(0.006)	(0.005)	(0.001)
Intensity of competition	0.010	-0.008	-0.002
	(0.037)	(0.029)	(0.009)
Export intensity	-0.100***	0.077***	0.023***
	(0.031)	(0.025)	(0.009)
Family firm	-0.026	0.020	0.006
	(0.061)	(0.047)	(0.013)
Gender	-0.015	0.012	0.004
	(0.056)	(0.043)	(0.013)
Foreign	-0.088	0.068	0.021
	(0.100)	(0.077)	(0.024)
PST	-0.079	0.059	0.019
	(0.053)	(0.040)	(0.014)

Notes: Categorical Dependent Variable: Centralization, Partial Delegation and Decentralization. This table reports the marginal effects for each possible outcome of our dependent variable. *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Robust standard errors in parentheses. The estimates include provinces fixed effects.

Table 10: Results of Ordered Probit Model: Production decisions

	Marginal Effects		
Group of decision=*Production*			
Variables	**Centralization**	**Partial Deleg.**	**Decentralization**
	$P[Dec=1]$	$P[Dec=2]$	$P[Dec=3]$
Firm Size	0.006	-0.003	-0.003
	(0.034)	(0.019)	(0.014)
Internal Networks	0.141**	-0.075***	-0.066**
	(0.056)	(0.028)	(0.029)
Workcenters	0.002	-0.001	-0.001
	(0.002)	(0.001)	(0.001)
Firm age	0.009	-0.005	-0.004
	(0.039)	(0.022)	(0.016)
Years of schooling	-0.006	0.004	0.003
	(0.013)	(0.007)	(0.005)
Years of schooling (St. Dev.)	0.043	-0.025	-0.018
	(0.028)	(0.016)	(0.012)
Seniority of Basic workers	-0.003	0.002	0.001
	(0.004)	(0.002)	(0.002)
Seniority of Supervisor	-0.000	0.000	0.000
	(0.003)	(0.002)	(0.001)
Seniority difference	-0.005	0.003	0.002
	(0.003)	(0.002)	(0.001)
Basic worker incentives	0.006	-0.003	-0.003
	(0.013)	(0.008)	(0.006)
Supervisor incentives	-0.009	0.005	0.004
	(0.006)	(0.003)	(0.003)
Intensity of competition	-0.004	0.002	0.002
	(0.032)	(0.018)	(0.014)
Export intensity	-0.095***	0.054***	0.040***
	(0.022)	(0.013)	(0.010)
Family firm	-0.110**	0.067*	0.043**
	(0.054)	(0.035)	(0.020)
Gender	0.027	-0.015	-0.011
	(0.065)	(0.037)	(0.028)
Foreign	0.309***	-0.177***	-0.132***
	(0.112)	(0.065)	(0.051)
PST	-0.171***	0.091***	0.080***
	(0.047)	(0.024)	(0.025)

Notes: Categorical Dependent Variable: Centralization, Partial Delegation and Decentralization. This table reports the marginal effects for each possible outcome of our dependent variable. *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Robust standard errors in parentheses. The estimates include provinces fixed effects.

Table 11: Results of Probit Model for each group of decisions

Variables	Only Task planning decisions (I)		Only Labor decisions (II)		Only Production decisions (III)	
	Coef.	Marginal Effects	Coef.	Marginal Effects	Coef.	Marginal Effects
Firm Size	0.096	0.038	-0.232*	-0.062*	-0.066	-0.024
	(0.149)	(0.059)	(0.139)	(0.037)	(0.093)	(0.035)
Internal Networks	0.200	0.079	-0.191	-0.053	-0.315**	-0.120**
	(0.238)	(0.093)	(0.221)	(0.064)	(0.152)	(0.059)
Workcenters	0.028	0.011	0.013	0.003	-0.003	-0.001
	(0.017)	(0.007)	(0.010)	(0.003)	(0.008)	(0.003)
Firm age	0.211	0.084	0.096	0.026	0.024	0.009
	(0.182)	(0.072)	(0.152)	(0.041)	(0.116)	(0.043)
Years of schooling	0.021	0.008	-0.006	-0.002	0.000	0.000
	(0.057)	(0.022)	(0.047)	(0.013)	(0.036)	(0.013)
Years of schooling (St. Dev.)	-0.425***	-0.168***	-0.293**	-0.078**	-0.155*	-0.058*
	(0.127)	(0.050)	(0.122)	(0.032)	(0.081)	(0.030)
Seniority of Basic workers	0.046**	0.018**	0.012	0.003	0.012	0.004
	(0.019)	(0.007)	(0.017)	(0.005)	(0.012)	(0.004)
Seniority of Supervisor	-0.011	-0.004	-0.002	-0.001	-0.009	-0.004
	(0.014)	(0.006)	(0.014)	(0.004)	(0.009)	(0.003)
Seniority difference	-0.007	-0.003	-0.016	-0.004	0.021**	0.008**
	(0.018)	(0.007)	(0.015)	(0.004)	(0.011)	(0.004)
Basic worker incentives	0.012	0.005	-0.013	-0.004	-0.031	-0.012
	(0.068)	(0.027)	(0.054)	(0.014)	(0.038)	(0.014)
Supervisor incentives	0.043	0.017	-0.004	-0.001	0.026	0.010
	(0.032)	(0.013)	(0.027)	(0.007)	(0.019)	(0.007)
Intensity of competition	-0.407***	-0.161***	-0.047	-0.012	-0.005	-0.002
	(0.145)	(0.057)	(0.130)	(0.035)	(0.088)	(0.033)
Export intensity	0.071	0.028	0.372***	0.100***	0.353***	0.132***
	(0.153)	(0.061)	(0.123)	(0.033)	(0.092)	(0.034)
Family firm	-0.126	-0.050	0.119	0.031	0.301*	0.107*
	(0.270)	(0.108)	(0.239)	(0.060)	(0.166)	(0.056)
Gender	0.147	0.058	0.107	0.029	-0.036	-0.014
	(0.269)	(0.107)	(0.237)	(0.063)	(0.170)	(0.063)
Foreign	-0.376	-0.149	0.390	0.104	-0.635*	-0.236*
	(0.573)	(0.227)	(0.458)	(0.122)	(0.345)	(0.129)
PST	0.462**	0.182**	0.320	0.090	0.465***	0.177***
	(0.218)	(0.085)	(0.196)	(0.057)	(0.136)	(0.052)
Constant	0.104		0.117		-0.182	
	(0.957)		(0.858)		(0.614)	
Provinces dummies	YES	YES	YES	YES	YES	YES
Sector dummies	YES	YES	YES	YES	YES	YES
Sample size	226	226	335	335	568	568
Log Likelihood	-129.73	-129.73	-153.39	-153.39	-347.27	-347.27
Pseudo-R²	0.17	0.17	0.11	0.11	0.07	0.07

Notes: Dependent Variable: Decentralization. *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Robust standard errors in parentheses.