Use Your Skills: The Allocation of Decision Rights and Firm Performance*

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Abstract

This paper investigates the relationship between the allocation of decision-making rights and firm performance. The previous literature has assumed that underlying latent regressors are a good estimate of a firm's optimal choice, but has been unable to make a direct connection between the decision-making process and tangible outcomes. Our results suggest that younger firms perform relatively worse than older firms, but younger firms that decentralize decision-making rights perform better than their centralized counterparts. Similarly, organizational productivity is shown to be increasing in a firm's endowment of human capital. However, skilled labor is significantly more productive when decision rights are decentralized to skilled managers, particularly when manager's incentives are aligned with those of the firm.

Key words: decentralization, centralization, skilled labor, complementarity, decision making.
JEL classifications: D23, L23, L29.

1 Introduction

Recent advances in organizational economics are taking researchers deeper inside the "black box" of the firm. This paper focuses on three key empirical relationships in organizations. First, we contend that decentralized decision making is associated with other modern management techniques and certain organizational characteristics. Second, we hypothesize that more skilled agent will be better placed to understand the environment, decide between possible changes and to successful implement the change. As a consequence, use of skilled labor (and more to the point, managers) will be associated with decentralization of decision making. Third, effective decision structures should be linked to better performance such as higher levels of profitability and productivity.

This paper draws on a growing empirical literature examining decision making in firms. Acemoglu et al (2007) and Christie et al (2003) examine the profit center versus cost-center choice of a firm. Colombo and Delmastro (2004) investigate delegation of several decisions using a latent-variable approach for manufacturing firms in Italy. Similarly, for manufacturing firms Bloom et al (2007) create an index of delegation and worker autonomy. Meagher and Wait (2009) looked at the delegation decisions about innovation and major organizational changes or restructuring. Our unique data set allows us to take a complementary approach to these previous studies, focussing on decentralization, skills and congruence of interests. First, the data allows us to focus on decentralization rather than delegation per se, extending the analysis in Wait and Wright (2010). While the two aspects of decision making are undoubtedly related, decentralization is distinct from delegation, and it warrants study on its own. Second, our data allows us, unlike these previous studies to have a direct measure of performance; we are able to relate the decentralization of a firm to profit and value added.

Third, we also draw on the literature on the potential complementarity of skilled labor and organizational change, innovation and the use of new (computer) technology. Previous empirical studies in organizational design, such as Bresnahan et al (2002) and Caroli and Van Reenen (2001) provide empirical evidence suggesting skilled labor contributes to productivity and is an important feature in determining certain organizational changes. Caroli and Van Reenen (2001) argue that a firm's endowment of skilled labor impacts the benefits

and costs of decentralization. First, skilled workers are more able in analyzing and processing information which contributes to the benefits of decentralized information processing. Furthermore, more autonomous decision makers are less likely to make errors when they are sufficiently skilled, reducing monitoring costs. Empirical findings suggest that the introduction of decentralized decision-making protocols in skill-intensive firms leads to higher productivity when compared to firms with a low skill intensity.

As in Bresnahan et al (2002), one of the key purposes of this paper is to investigate the complementarity between different organizational design characteristics and performance. Following the organizational production function of Athey and Stern (1998), complementary assets require that increases in one variable increase the returns to increase another variable.[1] In terms of our empirical estimates, complementarity will increase the probability of observing one practice will be increasing in the presence of the other practice. Investigation of these complementary organizational design is worthy in its own right, helping identify the key practices that are correlated (Bresnahan et al 2002). The joint decision to implement certain management techniques does raise issues of endogeneity, and we explicitly do not claim our empirical estimates imply causality. However, our empirical strategy carefully identifies instruments for our decentralization variable. This approach is somewhat less arbitrary than some of the previous literature that primarily attempted to mitigate these problems has focused primarily on lagged values of organizational change.

2   Data Set

In this paper we use a cross-industry survey of Australian businesses with less than two hundred employees. The data set we use is the Business Longitudinal Survey (BLS95-98) that covers approximately 9550 businesses and has information relating to the relative performance of Australian organizations over eleven unique industry divisions. The advantage of this data set is that it properly identifies those characteristics that are relevant to the arrangement of decision-making units and also provides objective performance measures that will assist our empirical analysis of the relationship between decentralization and firm performance. However, given limited availability of data, we will focus on the 1995 cross section.

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[1]Formally, two variables x_i and x_j exhibit complementarity if $f : X \to \mathbb{R}$ if the following inequality holds $f(x_i^H, x_j^H) - f(x_i^H, x_j^L) > f(x_i^L, x_j^H) - f(x_i^L, x_j^L)$, where $x_i^H > x_i^L, \forall i \in X, x_j^H > x_j^L, \forall j \in X$. This is equivalent to $f : X \to \mathbb{R}$ satisfying increasing differences in (x_i, x_j) or if $f(\mathbf{x})$ that $\frac{\partial f(\mathbf{x})}{\partial x_i \partial x_j} > 0$.

The data set used in this paper was designed to provide information on the growth and performance of Australian businesses and identifies selected economic and structural characteristics of those firms. We focus on the relationship between several performance measures and the interaction between organizational change variables (decentralization) and a firm's internal characteristics. In the spirit of the skill-biased organizational change literature we test the hypothesis that there is complementarity between decentralized decision making and a subset of organization characteristics.[2]

2.1 Dependent variables

Our dependent variable *Decentralization* identifies firms that have one individual solely responsible for a business's major decisions (centralization, coded 0) or, alternatively, if the firm does not have a unique decision maker (decentralization, coded 1). As noted earlier, in contrast to previous studies, we do not conflate the delegation and decentralization choice. Moreover, our dependent variable is also a direct measure of decision-making power in that we identify whether there is a unique decision maker over a set of major decisions, rather than relying on a composite measure of decision making or a general indication of the degree of worker autonomy.

Our second dependent variable relates to value-added. In this study we use the convention of estimating organizational production functions of the form,

$$\ln(S_i - M_i) = f(\mathbf{O}_i, \mathbf{x}_i) \tag{1}$$

where S_i is sales and M_i represents material costs, such that the dependent variable is the natural logarithm of value added. We propose that this is an appropriate proxy for firm performance as it can be interpreted as an accurate measure of total productivity and how efficiently a firm utilizes its endowment of resources. Under this specification, our dependant variable is a function of both its structural organizational design elements $\mathbf{O}_i$ and other exogenous characteristics of the firm $\mathbf{x}_i$. Of most interest is evidence suggesting complementarity in the production function $f(\mathbf{O}_i, \mathbf{x}_i)$ and, in particular, how skilled labor interacts with decentralized decision making.

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[2]See, among others, Caroli and Van Reenen (2001), Bresnahan *et al.* (2002) and Colombo *et al.* (2007).

In this production function framework, similar to that of Bresnahan *et al.* (2002), delegation to skilled agents should have supermodular effects on productivity and we should observe synergistic gains from simultaneous increases in organizational complements above those obtained from changing the magnitudes of each variable in isolation.

2.2   Independent variables

First, we include the variable *Skilled Labor* which is coded as the natural logarithm of the total number of managerial employees with a tertiary education. We argue that skill-intensive management contributes to better decision making and should increase productivity as those individuals are more able in attending new technologies, making appropriate organizational choices and are more informed about a firm's external product-market environment. Skilled labor perform better at their tasks and thus those firms have a comparative advantage in labor inputs which should equate to a higher level of overall firm performance.

We include the variable *Decentralization × Skilled Labor* to test for complementarity between a firm's choice to decentralize decision-making authority and its endowment of human capital. Previous literature has argued that skill-intensive organizations benefit more from decentralization than an unskilled-intensive firm. This equates to increasing differences in our organizational-design production function framework and we should observe a positive correlation between productivity and the interaction between decentralization and skilled labor. That is, when these organizational variables are clustered we should observe higher marginal increases in productivity than when those variables are considered in isolation. These variables are generated using the predicted values of decentralization to minimize the potential for endogeneity (details in the next section).

We include variables on the owner's *Age* separated into five distinct cohorts: less than 2 years of ownership, 2-5 years of ownership, 5 to 10, 10 to 20, and over 20 years of ownership. Acemoglu et al. (2007) also argue that older firms are more likely to be centralized because the experience of senior management affords the opportunity to observe and accumulate public signals concerning performance and technology.

To address the possible interaction between the owner's tenure and the decentralization of decision making we also include a series of dummy variables interacting the predicted level of decentralization and the *Age*

dummies. This allows us to examine the relationship between value-added and decentralization when the owner has been at the firm for a different length of time.

Several other explanatory variables are included both as controls for our analysis and to permit comparison with previous studies.

Size and structure.— We include variables pertaining to the size and structure of the firm. Following Acemoglu et al. (2007), the variable *Lnsize* is coded as the natural logarithm of the total number of employees. Similarly, we include the natural logarithm of the firm's capital stock, labeled as ln *Capital*. Previous studies suggest that delegation is more likely in larger firms (see Colombo & Delmastro (2004) and Meagher & Wait 2009); we predict the same to be true of decentralization, because centralization is less feasible in larger firms, who must face a greater number and range of decisions. The variable *Contract Out* specifies whether the firm contracted out activities previously undertaken within the boundaries of the firm. We predict that if peripheral tasks are contracted out, the narrower set of decisions facing the firm will allow for greater centralization. *Locations* is a dummy variable indicating whether the business operates over multiple locations (1) or not (0). Colombo & Delmastro (2004), and Meagher & Wait (2009) found that centralization is more likely when a firm has more than one plant undertaking similar activities, consistent with the idea of economies of scale in decision making.

Flat measures the number of managerial employees as a percentage of the total number of employees. Colombo & Delmastro (2004) present evidence suggesting that firms with flatter hierarchial structures are more likely to be centralized. Acemoglu et al. (2008) also make the point that an increase in managerial employees lends itself to greater autonomy and a higher degree of decentralized decision making. Finally, *Business Plan* indicates whether the firm has a formal strategic plan (1 if so, 0 otherwise). Explicitly documenting its strategy in this manner suggests that central management may have made the major decisions, and is communicating this plan and the broad parameters of implementation to lower-level employees. We predict that the adoption of a formal business plan will be associated with higher levels of centralization.

Informational systems and requirements.— We also include variables relating the informational systems and requirements of the business. The dummy variable *Comparison* indicates whether a firm made any formal comparisons with other firms in their industry (1 if yes, 0 if not). The ability to benchmark enhances

a principal's access to relevant information, potentially aiding centralization. Given that formal comparisons are only feasible if firms are sufficiently similar, this result complements the findings of Acemoglu et al. (2007), that industry heterogeneity contributes to delegation.

Further, the variable *Network* indicates whether the firm has a networked administrative computer system (1) or not (0). We make no prediction relating to this control variable: Bloom et al. (2009) found that the adoption of intranet communication technology was associated with centralization; on the other hand, Colombo and Delmastro (2004) found that delegation is more frequent in firms that have networked computer systems, since systems allow for better monitoring of subordinate behavior.

Finally, a firm may have different informational requirements or greater competitive pressures when it competes in an export market. We include a dummy variable *Export* to indicate participation in the export market. This could possibly lead to a different choice of decision-making structure.

Table 1 lists the variables of interest and their summary statistics for the estimation sample. Table 2 provides details of the key explanatory variables and their expected relationship with *Decentralization*.

3   Instrumental variable model and estimation results

Econometric theory has long suggested that the presence of endogeneity in a vector of regressors $\mathbf{x}_i$ can potentially result in biased and inconsistent estimates. Recent empirical literature on organizational design has attempted to avoid this problem as it is generally accepted that organizational-design choices are necessarily endogenous within the framework of estimating organizational-design production functions. An important contribution by Athey and Stern (1998) has provided economists with the appropriate tools to identify the structural parameters of such production functions. Since we suspect possible endogeneity in our decentralization regressor we will include appropriate instruments for this organizational-design choice and estimate a set of two-stage regression models using instrumental variables.

In order to empirically test our major prediction we develop an econometric framework to provide robust evidence supporting our hypothesis that the marginal returns to decentralization are increasing in a firm's endowment of human capital. Since we suspect endogeneity in our decentralization dummy $d_i \in \{0, 1\}$ we

will first estimate a reduced-form probit regression for decentralization and use this estimate in a second stage organizational-design production function equation.[3]

To proceed we require at least one instrument that is correlated with decentralized decision-making but has no relationship with the performance of an organization. In our econometric model we use the variables *Business Plan* and *Decisions* as instruments for decentralization. The validity of these instruments are discussed in subsequent sections but, it is worth noting why we included these specific instruments. We contend that both these variables effect the performance of an organization indirectly via the choice to decentralize decision-making authority.

First, *Business Plan* is negatively and significantly related to the probability of decentralization.[4] Firms that formally document general strategies defined by a principal should generally be more centralized as subordinates have to abide by general plans documented by a principal. By restricting strategies via formal documentation a firm reduces the scope of autonomous decision making by lower levels of management. Second, we find that family businesses, by where family members are non-working but contribute to the decision making process, are more likely to decentralize decision-making authority. Firms that are considered a family business because family members are non-working decision makers should be characterized by more decentralized decision making as decisions will generally not be made by a sole decision maker but external parties will contribute and be responsible for the decision-making process.

We test the validity of our instruments by a Sargan test via over identifying restrictions. However, intuitively our instruments should effect performance indirectly by their effects on the choice to decentralize.[5] First, the variable *Business Plan* has no significant effect on productivity in our second stage organizational-design production function. We argue that the documentation of a formal business plan does not directly effect firm performance as it exists solely as a contingent document. However, a business plan directly effects the choice to centralize decision-making rights which in turn makes a firm more or less profitable given its organizational characteristics. Second, the variable *Decisions* has no significant effect on the performance of a firm. Non-working members of an organization do not put any strain on wages and do not directly contribute

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[3]Here the variable d_i is equal to zero if the responding firm has one individual that is responsible for the major decisions of the firm and equal to one otherwise.

[4]Results of the first stage probit regression are provided in the Appendix.

[5]An instrument z should indirectly effect a function f via the choice variable x when f is an implicit function of z such that $f(x(z))$ and not $f(x, z)$.

to productivity as they are external non-working parties. However, firms that exhibit this characteristic are more likely to decentralize decision-making authority which directly effects the relative performance of the firm as it contributes to the effectiveness of decision making and the implementation of tasks.

Assuming our instruments are valid we estimate a first stage reduced form maximum likelihood probit in the form of a latent regression index function model,

$$d_i^* = \beta' \mathbf{x}_i + \varepsilon_i \tag{2}$$

where ε_i is an error term normally distributed. The probit can then be estimated as

$$Pr(d_i = 1) = \Phi(\beta' \mathbf{x}_i) \tag{3}$$

and

$$Pr(d_i = 0) = 1 - \Phi(\beta' \mathbf{x}_i), \tag{4}$$

where $\Phi(.)$ is the standard cumulative normal.

Using the predicted estimate $\widehat{d}_i$ from this first stage probit regression we then wish to estimate the following equation via OLS.

$$f(\mathbf{O}_i, \mathbf{x}_i) = \alpha' \widehat{d}_i + \beta' \mathbf{x}_i + \xi' \widehat{d}_i . \mathbf{x}_i + \varepsilon_i$$

Under this model specification we wish to estimate the parameters ξ to measure the expected complementarity between the degree of autonomous decision making $\widehat{d}_i \in [0, 1]$ and a firm's other exogenous characteristics. Appealing to our formal definition of complementarity, our empirical result will be consistent with our theoretical prediction if the following inequality holds for those $x_i \in \mathbf{x}_i$ where,

$$\frac{\partial f(\mathbf{O}_i, \mathbf{x}_i)}{\partial \widehat{D}_i \partial x_i} = \xi > 0$$

Thus, the purpose of the following sections is to develop an empirical strategy by where we can properly identify the sign of the parameter ξ.

3.1 Empirical results

Table 3 illustrates the first-stage probit results of the probability of decentralization. Table 4 present our two-stage IV regression for *Value Added*; in these results we include interactions between decentralization and skilled labor among a class of other exogenous regression. Table 5 presents further IV results for *Value Added*, which include the interaction terms for the *Age* dummies and the predicted value of *Decentralization*. Both models are estimated via OLS using the estimate from a first stage reduced-form probit regression.[6] A Sargan test implies that we cannot reject the null hypothesis that our instruments are valid.

First, focusing on the first-stage probit estimates, we find decentralization of decision making associated with larger organization, when less of the equity in the firm is held by its director and when there is a greater number of skilled managers. This last result conforms with our intuition that decentralization of key decisions will require managers have the requisite skills to make those decisions. Also notable is that decentralization is more likely in firm's with an owner with a shorter tenure (indicated by the coefficients for the *Age* dummies.

Second, now turning our attention to the *Value added* estimate results in Table 4, we note that the coefficient on *Decentralizationhat* is negative.[7] However, the coefficient on *DecentralizationhatXSkill* is positive and significant. The coefficient on *Skilled Labor* is also positive and significant. This is supportive of the notion that decentralization of decision making and having skilled managers are complementary aspects of organizational design.

Now consider the estimation results in Table 5. As before, the coefficient on the interaction term *De-centralizationhatXSkill* is positive and significant. These estimates also include dummies for owner tenure and owner tenure interacted with the predicted value of decentralization. The results suggest something interesting: firms with owners that have a shorter tenure (relative to the default of a tenure longer than

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[6]We use the technique recommended by Wooldridge (2001). Simply replacing the decentralization estimate in the second stage regression will provide incorrect standard errors. The first stage probit regression is provided in the Appendix.

[7]It is important to note that the production functions in Table 1 include controls for industry specific variation in productivity. The conventional factors of our production function (ln *Labor* and ln *Capital*) take their expected signs and report coefficients consistent with Cobb-Douglas elasticities of both labor and capital inputs.

20 years) have a lower expected value added, however, 'young' owners that decentralize have a higher value added. This is consistent with the idea of Acemoglu et al (2007) that managers decentralize when they do not have the requisite information to make decisions; in this case the benefits of decentralizing to other with the information is larger. Thus, younger firms that are decentralized should perform better than those firms that rely on a sole decision maker who has very little information regarding productive capacity in the early stages of ownership. When a principal becomes sufficiently informed via a history of public signals, decentralization becomes relatively more costly as loss of control can assume the form of deviations from the objectives of the principal. In previous studies, authors have generally conformed to the notion that discrete choice modeling assumes that a principal is acting optimally and her design choice reflects a rational cost and benefit calculation. In Acemoglu et al (2007) it was shown that younger firms are generally associated with more decentralization. However, this study made no reference to any outcome measure. In our empirical investigation we provide actual evidence to suggest that this design choice is in fact beneficial for younger firms.

4   Bivariate Probit Model

Having analyzed the effect that organizational-design choices have on overall firm productivity we will now consider, more closely, the effects on relative profits rather than productivity measures. Colombo and Delmastro (2008) have argued that productivity is not a sufficient index of firm performance when considering organizational design, as certain high performance workplace practices are generally characterized by higher labor costs and thus it is uncertain whether these design choices are in fact beneficial for the firm as a whole. Here we use an alternative measure of firm performance that accommodates for this potential increase in labor costs. We code profitability $\pi_i \in \{0, 1\}$ as equal to unity if firm i earns above average profits in their respective industry division and zero otherwise. This measure takes in to consideration possible increases in wages as derived profit in BLS95 consists of total income minus wages and salaries, employer contributions to superannuation, worker compensation costs, payroll taxes, rent expenses and other operating costs.

4.1 Econometric Model

To eliminate possible problems associated with estimating firm performance as a function of the endogenous regressor, *Decentralization*, we will now estimate a bivariate probit model that will estimate these correlated binary outcomes jointly. This multiple equation extension of our base model is a consistent specification of our previous empirical analysis. The general specification of this model is in the same spirit as seemingly unrelated regression models and is defined as follows,

$$d_i^* = \mathbf{x}_i^{'}\beta + \varepsilon_i$$

$$\pi_i^* = \mathbf{x}_i^{'}\gamma + \xi_i$$

where d_i^* and π_i^* are unobservable latent variables. We only observe whether a firm is decentralized or centralized $d_i \in \{0, 1\}$ and whether a firm earns above average profit in their respective industry or does not $\pi_i \in \{0, 1\}$. Given our observations our bivariate probit regression is of the form,

$$d_i = \begin{cases} 1 & \text{if } d_i^* > 0 \\ 0 & \text{if } d_i^* \leq 0 \end{cases} \tag{5}$$

$$\pi_i = \begin{cases} 1 & \text{if } \pi_i^* > 0 \\ 0 & \text{if } \pi_i^* \leq 0 \end{cases} \tag{6}$$

Fitting the bivariate probit model describe above involves estimating the vectors of coefficients β, γ and the correlation between (ε_i, ξ_i) which is denoted by ρ.

The purpose of the next section is to provide results that are consistent with those provided in the previous section. We include the variables, *Skilled Labor*, *Age* and other organizational characteristics to see whether a different empirical strategy provides similar results. To check for robustness we show that the

results do not depend on the precise functional form of our regression model.

4.2 Empirical Results

Table 6 provides coefficients for a bivariate probit model that was summarized above. The results in this table imply correlations in our data set between our vector of explanatory variables and our dependant variables for decentralized decision making and firm performance.

First let us draw our attention to the coefficients for *Decentralization*. Here we notice that the result a quite similar to those in to those in our first stage probit regression in the previous section. Generally speaking, the evidence on the allocation of decision-making authority is fairly consistent with our previous regressions. Here we notice that larger firms are relatively more decentralized, as are younger firms. Similarly, the arguments summarized in our theoretical predictions are all consistent with these empirical results.

It is important to note that the coefficient for the variable *Skilled Labor* is positive and significant at the 1% level. This result suggests that increases in skilled labor are associated with a higher degree of decentralized decision-making. This result is consistent with both our theoretical result, which suggests that the marginal returns to decentralization are increasing in the skill of those subordinates that are allocated authority, and the skill-biased organizational design literature which contends that we observe "clustering" behavior when decentralized decision making and skilled labor are complements. Although this result is not equivalent to the results in the previous section it is consistent with the general premise that firms with higher levels of skilled labor are more likely to decentralize.

In regards to *Profit* we observe several interesting results relating a firm's performance to its internal characteristics. Beginning with firm age, the coefficient on the *Age*, *Age*≤ 2, $2 < Age \leq 5$ and $5 < Age \leq 10$ are all negative and statistically significant, This result implies that relatively younger firms are less profitably than their older counterparts. This is consistent with the notion that younger firms generally suffer from a lack of information relating to their productive capacity and thus results in poor performance in the early stages of entry. One possible explanation for this result is that once a firm becomes sufficiently established, and it accumulates information relating to its productive capacity and thus, these firms benefit from this survival. Since the coefficient on *Age* becomes less negative for the older cohorts, we argue that older

firms perform better than their younger counterparts which is consistent with our empirical results. It is also important to note that the results of a bivariate probit share similarities with the results in our IV regression. More precisely, both results suggest that younger cohorts are less profitable in the early stages of ownership.

Finally we will consider the affect that the level of human capital has on firm performance. In Table 6 the coefficient on the *Skilled Labor* variable is positive and significant at the 1% level. The implications of this result, when analyzing the effects of human capital on performance, are that higher levels of skilled labor are associated with a higher probability of earning above average profits. In the context of our model, the nature of skilled labor imposes the idea that more skilled agents are more able in gathering information relating to decision making and are more efficient in responding to high powered incentives. In general, skilled workers perform better at there tasks and thus, this comparative advantage in labor inputs should equate to a higher level of overall firm performance.

5   Concluding comments

In this study we have considered the consequence that decentralized decision making has on the relative performance of the firm. For this purpose, we look at alternative empirical strategies in estimating an "organizational design production function" which consists of endogenous regressors. A Wu-Huassman test on the endogeneity of decentralization confirms our intuition that the choice to decentralize decision making authority is highly correlated with the disturbances of the model and provides an inconsistent vector of parameter estimates. Thus, by estimating firm performance by a two-staged IV model we attempt to identify the relationship between the choice to decentralize decision making rights and other elements of the firm. This approach is a considerable improvement with respect to previous literature who have incorporated lagged variables to eliminate problems of endogeneity. We contend that by estimating a first-stage reduced-form probit regression with an instrumental variable, and using these estimates in a second-stage regression, we can directly address the issue of endogeneity rather than assuming lagged variables properly eliminate this problem.

In accordance with the literature on the impact of clusters of organizational variables, we find that there are important relationship between performance and the adoption of "high performance" work practices, in particular the potential benefits of decentralization of decision making is greater in organizations with skilled managers and in organizations with newer owners.

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Table 1: Summary statistics ($N = 6421$)

Variable	Mean	Std Dev.
Decentralize	.372	.483
Skill Labor	.223	.512
Lnsize	2.478	1.280
Lncapital	4.446	1.926
Comparison	.274	.446
Network increase	.422	.494
Export	.154	.361
Equity	.064	.229
Flat	.334	.291
Contract out	.076	.264
Age < 2	.098	.298
$2 \leq$ Age ≤ 5	169.	.375
$5 \leq$ Age ≤ 10	.254	.436
$10 \leq$ Age ≤ 20	.276	.447
Family *decisions* makers	.025	.155
Business Plan	.287	.452

Notes: Source BLS95.

Table 2: Explanatory of Key Variables and Predictions

Name	Description	Prediction
Skilledlabor	Natural log of number of managers with tertiary qualifications	−
LnSize	Natural log of number of employees	+
LnCapital	Natural log of value of capital stock	?
Decisions	Number of non-working family decision makers	+
Equity	Percentage of equity not controlled by a director	+
Size	Natural logarithm of total employees	+
Contract Out	Dummy for contracting out activities	−
Locations	Dummy for operating over multiple locations	+/−
Business Plan	Dummy for having documented strategic plan	−
Comparison	Dummy for making comparison with other firms	−
Flat	Proportion of managers as part of total employees	+
X≤Age< Y	Period of current ownership	+
Export	Dummy for exporting goods and services	+/−
Network	Dummy for computer network	+/−

Notes: (+) indicates decentralization more likely; (-) indicates centralization more likely.

Table 3: Decentralization (first-stage results): probit coefficient results (standard errors in parentheses)[a]

Variable	Coeff	Std Err.
Skill Labor	.070*	.039
Lnsize	.240***	.030
Lncapital	.003	.012
Comparison	-.226***	.039
Network	-.139***	.035
Export	-.160***	.051
Equity	.313***	.069
Flat	.100	.069
Contract out	-.131**	.063
Age < 2	.229***	.065
2 ≤ Age ≤ 5	.277***	.055
5 ≤ Age ≤ 10	.217***	.0499
10 ≤ Age ≤ 20	.072	.049
Family *decisions* makers	.078	.106
Business Plan	-.155***	.041
Log likelihood	-4070.91	
Pseudo R2	0.03	
No. of obs	6421	

Notes: a. *** Significant at 1% level, ** significant at 5% level, * significant at 10 % level. Other controls include industry dummies (1-digit).

Table 4: Value added (second-stage IV results): OLS coefficient results (standard errors in parentheses)[a]

Variable	Coeff.	Std Err.
Decentralizationhat	-1.719***	.230
DecentralizationhatXSkill	.053*	.027
Skilled Labor	.107*	.065
Lnsize	.865***	.033
Lncapital	.439***	.010
Improvement	.183***	.042
Age < 2	-.109**	.055
2 ≤ Age ≤ 5	-.075	.048
5 ≤ Age ≤ 10	-.056	.044
10 ≤ Age ≤ 20	.072	.049
Wald χ^2	8731.80	
R2	0.49	
No. of obs	6292	

Notes: a. *** Significant at 1% level, ** significant at 5% level, * significant at 10 % level. Other controls include industry dummies (1-digit).

Table 5: Value added (second-stage IV results): OLS coefficient results (standard errors in parentheses)[a]

VARIABLE	COEFF.	STD ERR.
Decentralizationhat	-2.608***	.494
DecentralizationhatXSkill	.052*	.028
Skilled Labor	.119*	.067
Lnsize	.847***	.034
Lncapital	.441***	.011
Improvement	.169***	.044
Age < 2	-.741***	.231
$2 \leq$ Age ≤ 5	-.560***	.212
$5 \leq$ Age ≤ 10	-.468**	.189
$10 \leq$ Age ≤ 20	-.336*	.180
DecentralizatonhatX(Age < 2)	1.215**	.608
DecentralizationhatX($2 \leq$ Age ≤ 5)	1.270**	.565
DecentralizationhatX($5 \leq$ Age ≤ 10)	1.149**	.531
DecentralizationhatX($10 \leq$ Age ≤ 20)	.854	.528
Wald χ^2	8360.62	
R2	0.47	
No. of obs	6292	

Notes: a. *** Significant at 1% level, ** significant at 5% level, * significant at 10 % level. Other controls include industry dummies (1-digit).

Table 6: Bivariate probit coefficient results: dependent variables decentralization and profit (standard errors in parentheses)[a]

	DECENTRALIZATION		PROFIT	
	Coeff	Std Err.	Coeff	Std Err
Skilled Labor	.104***	.035	.107***	.038
Lnsize	.148***	.021	.378***	.0024
Age < 2	.187***	.058	-.401***	.066
$2 \leq$ Age ≤ 5	.264***	.050	-.211***	.055
$5 \leq$ Age ≤ 10	.188***	.045	-.128***	.049
$10 \leq$ Age ≤ 20	-.051*	.045	-.018	.048
Export	-.144**	.048	.359***	.053
Equity	.347***	.043	.120***	.046
Flat	.351***	.075	.004**	.085
Location	-.104**	.041	-.010	.043
Comparison	-.213***	.036	-.003	.039
Network	-.155***	.032	.0416	.035
Contract out	-.124**	.059	-.130**	.065
Business plan	-.153***	.038	.057	.040
Log Likelihood	-8927.35			
ρ	.0005	.021		
No. of obs	7771			

Notes: a. *** Significant at 1% level, ** significant at 5% level, * significant at 10 % level. Other controls include industry dummies (1-digit).