

Decision making within organizations

Kieron Meagher and Andrew Wait[†]

Abstract: We study the allocation of decision-making authority within organizations using Australian data. Decision making is more likely to be decentralized to lower levels in the hierarchy of the organization the larger the workplace and the more competitive the product market. There is also a non-monotonic relationship between the probability of decentralized decision making and the number of workplaces within an organization that produce the same product, in contrast to the predictions of Aghion and Tirole (1997).

JEL Codes: D23, L23, L29

Keywords: decision-making authority, decentralisation, competition, exports

1. Introduction

Quality and timely decision making is essential for the success of any firm. In fact, how an organisation chooses to design its decision-making rules are one of the most fundamental aspects of its internal design; Brickley et al (2004) described the assignment of decision rights, along with the reward system and the way performance is evaluated, as one the key aspects of an organisation's architecture (or design). A firm's ability to make good decisions is particularly important in the face of increasing global competition, and the greater uncertainty from exposure to more competitors and a greater number more markets that this brings. This paper empirically investigates the allocation of decision-making authority in workplaces using Australian data. In particular, we are interested how both product-market characteristics as well as the internal design of a firm affect the likelihood that an organisation will choose to decentralise its decision making.

The focus here is on whom – or rather what hierarchical level – in an organisation made the decision to implement a significant workplace innovation. The study, consequently relates to the allocation of decision rights about a change, as opposed to decision rights concerning routine processes in the workplace. In our data the decision to innovate could

[†] School of Economics, University of New South Wales. k.meagher@unsw.edu.au and Discipline of Economics, University of Sydney, a.wait@econ.usyd.edu.au. Preliminary draft. We would like to thank Murali Agastya, Jeff Borland, Vladimir Smirnov and Stephen Whelan for their comments.

have been made by employees (decentralisation), other managers, the senior workplace manager or higher levels of management above the workplace within an organisation, which we interpret as the highest level of centralisation. From this information we create a decision-making hierarchy. This hierarchy index of decision-making authority is then estimated as a function of product-market and other firm characteristics, such as size and the number of similar workplaces in an organisation.

The data set used here – the Australian Workplace Industrial Relations Survey 1995 – is rich in information on the internal workings of firms, as well as more standard labour economics data. This allows us to assess the impact of how product-market competition and being an exporter affect the allocation of decision-making authority. As a small open economy Australia is particular well-suited as the data source of our study. Many of the market conditions that are likely to affect the internal structure of a firm, such as multiple sources of consumer and competitor uncertainty, are magnified by globalisation. Further, overseas effects are easier to identify in a small open economy like Australia as opposed to a large economy such as the United States of America.

This paper makes several contributions to the literature. This study is one of the first to empirically analyse decision-making rights. The study also takes an economy-wide perspective as compared with previous studies that have taken a case-study approach. This is an important contribution because, despite the number of theoretical papers on the topic, there have been very few empirical studies, Colombo and Delmastro (2004) a recent exception.¹

Second, as a consequence, this study can provide an empirical test for many of the theoretical models of decision making. In particular, the data used in this paper allows for an assessment of theories, such as Aoki (1986), that relate the speed with which a decision must be implemented with decentralisation. Further, this paper examines the span of control-decentralisation relationship proposed by Aghion and Tirole (1997).

¹ Referring to the limited number of empirical studies the internal workings of firms, including the allocation of decision-making rights in firms, Baker and Holmström (1995) suggested that there are ‘too many theories, too few facts’.

Third, the results can provide a guide to the future direction of theoretical modelling of organisations and decision making.

This paper is structured as follows. First, we review the empirical literature on decision-making authority. Second, we outline several theories as to the way decisions are in organisations. These proposed predictions frame the empirical analysis later in the paper. Section 4 details the data source and summaries the data. The empirical analysis and results are outlined in section 5. The results are summarised and some concluding observations are made in section 6.

2. Empirical literature on decision making organisation

Despite the fact that practical recommendations on market contingent organisational design are a standard part of business school and undergraduate economics curricula, there have been surprisingly few empirical studies on the allocation of managerial decision making. The vast bulk of the existing literature is case-study analysis, which has yielded seemingly contradictory results. Case-study analysis shows, for example, that some large organizations are currently moving to a more centralized structure while other firms, seemingly faced with similar pressures, are decentralizing:

General Motors announced this summer that it will merge its 5 marketing divisions into one [centralization], ... Meanwhile, Dell Computer actively decentralizes its marketing by assigning fewer market segments to divisions as they grow. Dell has 12 marketing divisions now, compared with 4 in 1994. (Donath 1998, p. 9)

As a consequence, a more systematic empirical study could be useful. There have been several previous empirical studies on decision making. Adams (1999) examined the relationship between formal training and decision-rights in Australian manufacturing workplaces, also using the Australian Workplace Industrial Relations Survey 1995. Adams suggested that formal training programs for employees and the delegation of decision-making authority were complements; a firm will have an incentive to increase the human capital of an employee if they are to be given decision-making responsibility.

The empirical results confirmed these predictions. Adams also found that decision making was more likely to be delegated when the firm faces a volatile product market. Our study differs in two main aspects from Adams. Our study takes a broader perspective than Adams, who only considered manufacturing workplaces. This allows us to make an economy-wide empirical analysis of decision making in organisations. Furthermore, the measure of decentralisation is different. Adams focused on the existence of autonomous and semi-autonomous work groups. Here, we concentrate on who made the decision to implement a significant innovation.

Christie et al (2003) studied decentralization in 121 firms in the context of whether the second level of management below the CEO was a cost centre, a profit centre or a mixture of both. A profit centre is interpreted as decentralization as it allocates more decision-making authority to lower levels of management; on the other hand, a cost centre is interpreted as centralisation. They found that larger firms are more likely to have a decentralised structure, as were firms that: require more specialised knowledge to produce their output; have fewer externalities between firms' investments; and have higher growth and greater uncertainty about the firms' return (p. 33). The analysis of Christie et al (2003) has several limitations. First, decentralisation and centralisation are implied simply from one aspect of a firm's structure. Our paper, on the other hand, has specific details about what hierarchical level actually made the decision. In addition, important aspects of the firm are implied by the authors, rather than this information being supplied as part of a survey. Last, the implied hierarchy has just two levels – decentralised and centralised – while our study allows firms a much richer decision-making hierarchy.

Colombo and Delmastro (2004) study the allocation of decision-making authority in 428 Italian manufacturing firms. The decision could be made alone by a plant manager (decentralisation), made by the plant manager with the formal authority still residing with a corporate superior (partial decentralisation) or the decision could be made by the plant manager's corporate superior. The decisions investigated are: the introduction of new technology; investment in new production lines; investment in stand-alone machinery;

hiring and dismissal of personnel; career paths; and the design of individual and collective incentive schemes. Using an ordered probit model with random effects, they find that: organisations with more complex structures (more hierarchical levels) are more likely to decentralise; firms with multiple plants are more likely to centralise decision making; the adoption of advanced communication technologies leads to an increase in the likelihood that decision-making authority is decentralised, particularly for multiple-plant firms and, notably, and the positive relationship between number of employees and delegation only holds for firms that have not adopted these technologies; and, lastly, firms with capital-intensive production are less likely to delegate. Further, Colombo and Delmastro (2004) find that labour-type decisions are more likely to be delegated to the plant manager while capital-type decisions are more likely to be centralised.

This study provides a nice complement to the paper of Colombo and Delmastro. While some of the features are similar, such as some of the decisions studied (for example the adoption of new technology) our study differs in several important ways. First, our study examines decision-making authority using economy-wide data, not just in manufacturing firms. Second, we have information about the product market – such as the level of product-market competition and international exposure of the workplace through the export market. This information, which turns out to be important in the empirical estimates, is not contained in the Colombo and Delmastro study.

On a related topic, using the same data source, Delmastro (2002) examined the relationship between firm characteristics, such as plant size, with the hierarchy structure in place using a survey of Italian manufacturing firms. He found that hierarchies typically have chains in larger plants and depend on the communication technology adopted. He also found that government owned firms had more hierarchical levels. By definition, narrowly defined industry studies necessarily exclude consideration of markedly different market conditions. As mentioned above, the study undertaken here makes an economy-wide investigation of decision-making authority.

3. Why decentralise? A review of the theoretical literature

It is not immediately obvious why someone in an organisation – such as an owner or a manager – would delegate decision-making authority. Here, we briefly review three suggested reasons for allocation decision-making rights. They broadly can be categorized as: locating decision-making rights with those who have the specific knowledge required to make an informed choice; providing incentives to motivate employees; and optimal information processing. These theories form a basis for the variables included in the empirical analysis below.

Co-locating decision authority with specific knowledge

Jensen and Meckling (1998) argued that quality decision making requires that the individual who makes a decision has the required information to make an informed choice. This can be done in two ways: locate the decision-making rights with the individual with the relevant knowledge; or, alternatively, transfer the knowledge to the decision maker. The problem arises when knowledge is difficult to transfer; Jensen and Meckling (1998) refer to this as ‘specific knowledge’. Within a firm, with specific knowledge it might be necessary to allocate decision-making rights to, for example, a subordinate in order to make use of this information.² There is, however, a trade-off when decision-making rights are allocated to individuals who do not bear the wealth effects of their decisions, as they require an incentive scheme in order to better align their interests with the principal. The optimal allocation of decision-making rights depends, as a consequence, on the trade-off between the quality of a decision (made with better information) and the control costs (required to provide the correct incentives to the decision maker). Various factors, such as firm size, technology and the rate of change, will affect this trade-off. For instance, Jensen and Meckling (1998) suggested that ‘[w]hen the marginal costs owing to poor information rise more rapidly with size than the

² Jensen and Meckling (1998) argued that in a market decision rights and knowledge co-locate as: individuals with the decision rights (ownership) expend resources to acquire knowledge; and/or those parties with the relevant knowledge have a higher willingness to pay, so they are able to buy the decision rights (which arise with ownership).

marginal costs owing to inconsistent objectives, the optimal degree of decentralization rises' (Jensen and Meckling 1998, p. 117).

Brickley et al (2004) makes a similar argument, suggesting that the benefits of decentralisation are: more effective use of local knowledge; conservation of the time of senior managers; training and motivation for local managers. On the other hand, the costs of decentralisation are; incentive problems; coordination costs and failures; less effective use of central information. Each firm will make a choice concerning the allocation of decision-making rights weighing up these costs and benefits.

These arguments suggest that workplace size, organisation size and the rate of change (unpredictability) affect the allocation of decision-making rights. All of these variables are included in the empirical analysis below.

Motivating a subordinate to invest in project

Aghion and Tirole (1997) take a different approach to delegation. They noted that a party that has the legal power to make a decision – for example an owner of a firm – may merely rubberstamp the decision made by a subordinate. In this case the party with 'formal authority' opts to accept the decision of someone else – it is in fact the latter person who has 'real authority'. In their model the principal (boss) is uncertain about which project to implement. To increase the probability that they will become informed about the potential projects both the principal and the agent (subordinate) can take a costly action. The problem for the principal is that the interests of the two parties might not be the same – the agent might prefer a project that gives her a private benefit, even if that project is of no value to the principal. Both parties have a prior belief concerning the probability that the interests of the two parties are aligned (so that the principal's preferred project is also the project preferred by the agent).

In the model, first, the legal right to make the decision is allocated; with P-formal authority the principal has the legal right to make the decision and with A-formal

authority the agent has the legal right. For the meantime, we focus on situations in which the principal has formal authority (as in most firms). Second, each party chooses their effort level that determines the probability of being informed about what is a good project. Third, if he was informed, the agent can make a recommendation to the principal.³ As the principal has formal authority, if she was also informed she will implement her preferred project. If not, she will implement the project suggested by the agent, as with some probability the agent's preferred project will also benefit her. In this case, the principal relinquishes her formal authority, merely rubberstamping the agent's decision; the agent has the real authority. The principal will relinquish her real decision-making authority to the agent when the agent has superior information (is better informed) and when the preference of the two parties are similar (there is a high degree of congruence so that it is likely that the principal's preferred project is also the agent's).

The advantage to the principal of being informed is that she gets to make the decision. The disadvantage is that the possibility that they will be overruled reduces the agent's incentive to expend effort to learn about the potential projects. In equilibrium, the agent's incentive to put in effort is decreasing in the principal's effort level, as when the principal becomes more informed the agent is less likely to have real authority. As a consequence, there is a trade off for the principal between loss of control and providing incentives to the agent. One way of giving the agent more incentive to put in effort is to give him the formal authority to make the decision. If this is not possible, the principal may wish to make credible commitments to not override the agent's proposals.

This model, as well as having a significant impact in the literature, is of relevance to this empirical study. The model focuses on the implementation of a non-routine project. This is exactly the type of decision that we are investigating in this paper. Second, the model of Aghion and Tirole (1997) has several empirically testable predictions. For example, consider the case when P-formal authority is dominated, but it is not possible for the principal to legally delegate her decision-making powers. In this case, the principal could

³ The payoffs are such that no party would opt to suggest a project without being informed – there is one potential project which, although ex ante is identical to all other projects, is catastrophic.

structure the firm to provide a credible commitment to not intervene. Aghion and Tirole propose that by increasing the number of subordinates, a principal can ‘overload’ themselves, increasing the real authority (and incentive to invest) of the subordinates. The testable prediction is, as a consequence, that the real authority of an agent is increasing in the number of subordinates a principal has.

Another empirical prediction of the model is that if the principal investigates the value of a project after the agent has made their proposal, the benefit of being better informed needs to be weighed up against the cost of an additional delay in implementing the decision – that is, the principal is more likely to cede real authority the more urgent the decision (pp. 25-26).

Zabojnik (2002) makes a similar point to Aghion and Tirole. In his model a boss needs a subordinate to work on a project. This project can either be the boss’s idea or the idea of the subordinate. The problem for the boss is that a worker may not be enthusiastic about the success of the boss’s suggested project – the worker low posterior of success makes it more costly to induce effort – so will consequently require more high-powered incentives to work on the project. If the worker is wealth constrained, it is difficult to punish the worker in the case of a bad outcome, so incentives will need to come in the form of larger bonuses in the case of a good outcome. This raises the worker’s expected pay. Thus, for some parameter values, the cost of motivating the worker outweighs the benefit of the boss’s better information. It can be that the delegation of the decision of which project to implement is delegated to the worker, even if the boss has better information. Although it has similarities, the rationale for delegation is slightly different than in Aghion and Tirole (1997). In Aghion and Tirole real authority increases the agent’s incentive to put in effort as they get a private benefit from a project; in Zabojnik’s model the benefit arises because the agent puts a higher probability of success of they get to work on their own project, making it easier to elicit more effort.

It is worth making a few additional points about allocating decision-making rights for the purpose of motivating employees. First, Baker et al (1999) extended the analysis of

Aghion and Tirole (1997) using an infinitely-repeated game. Under the assumption that the principal has the formal authority, in order to credibly commit to not interfere with a particular project, the cost to the principal from her loss of reputation in the future must outweigh the cost from the proposed (inappropriate) project. Second, there can be times when an employer will attempt to limit the incentive an employee has to influence a particular decision – in this case decision-making rights will be allocated to dampen rather than enhance a subordinate incentive to invest in decision-making effort (Milgrom and Roberts 1988). For example, employees have an incentive to expend effort in order to increase their personal gain, even if it is at the expense of the organization's goals. If the benefit to the firm from the additional information is outweighed by the lobbying costs, an organization may choose to limit lower managers' discretion (centralisation), to reduce (or eliminate) the incentive to lobby.

Information processing

With 'team theory' decision-making models, agents selflessly act to maximise firm surplus; as a consequence, the problem for the organization becomes then how to best to process information. Contributions over the last decade to hierarchy theory, such as Radner (1993), Bolton and Dewatripont (1994), Meagher, Orbay and Van Zandt (2003), Geanakoplos and Milgrom (1991), Prat (1999), Orbay (2002) and Garicano (2000) have led to a consensus over what Radner terms the 'Iron Law of Delay'. This consensus has produced a reduced-form relationship between the quantity of information and decision algorithm a hierarchy makes its decision with, the number of managers involved and the delay in making a decision. The trade off arises as the more extensive analysis of information (by people higher up in the hierarchy) increases the quality of the decision made, but there is an increase in the cost as involving more people increases the delay in the decision being made – it can be optimal, therefore, to decentralise some decisions.⁴

⁴ It is also important to distinguish between decentralised information processing – in which different agents process and then relay key information ultimately to one person who makes a decision – with decentralised decision making – which involves agents observing different information and making different decision, without necessarily communicating with one another. As shown by Van Zandt (2001) decentralised information processing hierarchies need not reflect decentralised decision making.

As an example, Aoki (1986) considered two alternative hierarchical structures for coordinating a decision. The first involves a hierarchy with a senior manager making decisions. The manager has perfect knowledge of technological possibilities *ex ante*, but is not capable of monitoring events that affect these technologies or the changes at the shopfloor level that are required as a result. The alternative structure is horizontal – decisions are made by semi-autonomous shops (decentralisation). These semiautonomous shops have imperfect knowledge *ex ante*, but can respond to changes more quickly and can make better use of local knowledge. The relative performance of each system depends on the learning ability of each subunit, the units' initial knowledge, how quickly technology becomes obsolete, how quickly management can respond to changes and the importance of coordination between subunits. As a result, Aoki (1986) argued that decentralization more likely when there needs to be a quick response to changing environments and the required knowledge is held by those in the lower levels of the hierarchy. A possible implication of the model is the following. In a highly competitive environment an organisation may need to respond quickly to any changes. This suggests that product-market competition will be positively correlated to decentralised decision making. The effect of competition on decision-making authority is assessed in the empirical model below.

The basic idea presented here is that the higher the costs of delay, the more likely it is that we see delegation of decision-making rights. A similar argument can be made concerning exports. Not only are export markets likely to be highly competitive, export markets may differ from local markets, and may be susceptible to different shocks. To the extent that knowledge of these changes, and the appropriate response, is held by those at lower levels in the organisation, a firm that is competing in export markets is more likely to decentralise their decision making. The empirical model contains variables controlling for when a workplace exports its product as well as for import competition.

4. Data set and variables

The data used in this study are from the Australian Workplace Industrial Relations Survey 1995 (AWIRS 95).⁵ The main survey sampled 2001 workplaces with over 20 employees covering all major ANZSIC divisions across all States and Territories of Australia. This paper makes use of the General Management Questionnaire completed by the most senior manager at the workplace, which was conducted by personal interview. The same size is 2001 workplaces.

Index of centralised decision making

The workplaces surveyed were asked if they implemented some significant, non-routine, change in the last two years.⁶ Those workplaces that did implement at least one significant change were then asked other questions regarding the process surrounding that change. The questionnaire asked who made the decision to implement the most significant for the employees at the workplace.⁷ Specifically, in relation to the most important innovation for employees at the workplace that occurred in the last two years, the general manager was asked how involved in the decision to introduce the innovation were: higher levels of management beyond this workplace; senior workplace managers; other workplace managers here; and employees likely to be affected at this workplace (question BF7). The possible answer options were: (1) made the decision; (2) had significant input; (3) were consulted; (4) were informed; (5) were not informed; and (6) not relevant for this organisation.

⁵ The survey and the data are described in detail in Morehead et al (1997).

⁶ AWIRS 95 Question BF1, in the General Management survey, asked 'which, if any, of the changes listed, happened at this workplace in the last 2 years? (1) technology (not just routine replacement); (2) Introduction of major new plant, machinery or equipment (not just routine replacement); (3) Major reorganisation of workplace structure (for example, changing the number of management levels, restructuring whole divisions/sections and so on); (4) Major changes to how non-managerial employees do their work (for example, changes in the range of tasks done, changes in the type of work done); or (5) None of the above'.

⁷ If there was only one change implemented, the question related to this one change. If more than one change was implemented the question was specifically about the change that 'has had the most significant effect on employees here' (question BF3).

The questionnaire implies a hierarchy with four levels, as illustrated in Figure 1. The decision to innovate could have been made, for example, by higher level managers above the workplace – this is the most centralised form of decision making possible in this data set. The first tier of decentralisation is if a decision is made by senior managers at a particular workplace. A decision can, of course, be delegate to other workplace managers who are below the senior workplace manager (the third level in the decision making hierarchy) and to employees affected by the decision, the lowest level of decentralisation. This data allows, therefore, a quite complex investigation of delegation. Christie et al (2003) in their study of decentralisation only had two levels of decentralisation (and a combination, to produce a third level). The data is unique in another way as well; the hierarchy implied from this question spans from the workplace surveyed, to the larger organisation. The three lower levels of the hierarchy are in the workplace surveyed; the highest (most centralised level) is at a level above the workplace. Further, it should be noted that it is the general manager at the workplace who was interview, which is the second highest level in our hierarchy.⁸

From this information we construct an index of centralization. To avoid issues of consultation we first examine only when there is a unique level in the hierarchy that made the decision. This means that we drop workplaces that have identified, for example, two levels of the hierarchy that made the decision or if no level at all made the decision. This creates a nature ordering of decision making, with the implied numbers increasing with centralization from 1 when the decision is made by at the employee level to 4 if the decision is made by management at higher levels above the workplace.

⁸ Although we do not have any additional information concerning these ‘higher level managers’ it is reasonable to assume that they are higher in the chain of responsibility in the organisation. There could of course be many levels above the workplace general manager, and many different methods of making decisions at these levels. Moreover, it would be interested to compare the answers of the higher level manager with the information we currently have – unfortunately this is not possible with the available data.

Table 1: Centralisation of decision-making index

Centralisation	Number of workplaces	Percent
1 (employee level)	1	0.24
2 (other managers)	14	3.36
3 (senior wp manager)	160	38.37
4 (higher level manager)	242	58.03
Total	417	100

Source: AWIRS 95

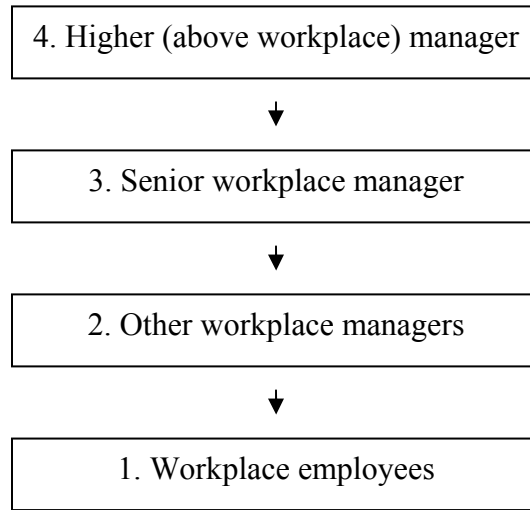
In addition, from the responses to this question – question BF7 outlined above – we also developed an index for centralization of the decision-making process. This index specifically allows us to determine at what level in the organisation the decision was made to introduce this workplace innovation.

Given the difficulties interpreting levels of input from consultation, we focused on decision-making (response 1 to question BF7 above). If a particular level made a decision, the index of decision making, $dm_i = 1$; if not, $dm_i = 0$ for $i = hm, sm, om$ and em where hm is higher levels of management, sm is senior workplace managers, om is other workplace managers and em is employees likely to be affected at this workplace. Workplaces in which no level in the hierarchy made the decision were not considered ($\sum_{i=hm,sm,om,em} dm_i = 0$).

The centralization index (c) – a measure of the average level at which a decision was made – was constructed as follows:

$$c = \frac{4.dm_{hm} + 3.dm_{sm} + 2.dm_{om} + dm_{em}}{\sum_{i=hm,sm,om,em} dm_i}.$$

Figure 1: Implied hierarchy of decision-making authority



The maximum value for c is 4, when only the higher levels of management made the decision. If employees alone made the decision the index equals 1. The variable takes on 7 possible different values at intervals of 0.5 between 1 and 4. For example, if the index of centralisation is 3.5 both the higher management levels and the senior workplace manager were both identified as making the decision. Also, an index equal to 2.5 could result from both the higher level of management and employees jointly making the decision or senior workplace and other managers jointly deciding, although the numbers of workplaces with these extreme decision-making processes were very few.

Table 2 provides the breakdown between these seven potential levels. Most decisions made were either at the higher management level or by the senior manager in a workplace. In fact, of the data used in the empirical estimations approximately 44 percent of the decisions were made by the higher level managers and at the senior workplace manager level respectively. Relatively few decisions were made at either the employee (complete decentralisation) or the other managers (the second level of decentralisation), with less than 1 percent of the decisions were completely decentralised to employees and only 4 percent of the surveyed workplaces have a centralisation index of 2. Also, only a

handful of decisions were made jointly by higher levels of management and by senior managers at a workplace, indicated by a centralisation index of 3.5; approximately three percent of workplaces had both the general workplace manager and higher levels of management making the decision.

Other workplace characteristics

The survey also contains other useful information that we utilise in the empirical estimations in the following section. First, there are several organisation characteristics, including size of the workplace in terms of the number of employees at that establishment and the number of employees in the entire organization to which the workplace belongs. From this, a variable for workplace size is constructed (size) and seven dummy variables for the different potential levels for organization size, ranging from less than 100 (dummy variable os1) to dummy variable os2 for organizations that are 20 000 employees or more.

The decision we are interested is about a change that was implemented. There are four possible types of innovation: technical change; new plant; new machinery or equipment (that is not just routine replacements); or a reorganization of the workplace or change in the work of non-management employees. A dummy variable is created for each of the types of change, with technical change used as the omitted category.

AWIRS 95 asks the general manager about how many other workplaces in the organisation produce the same product; this number is used to construct a variable for each workplace (here denoted by ‘same’).

Dummy variables were constructed for industry at the one-digit level. Dummy variables for the main occupational group at a workplace were also constructed.

Product market variables

Second, there is information in AWIRS 95 on various product-market characteristics. For example, there is a question on the level of competition the workplace faces in the product market. The possible responses are: intense competition; strong competition; moderate; some competition; and limited competition. From this information dummy variables for the different levels of competition were created.

There is also information on global competition. A dummy variable was created for firms that exported some of its output, taking on a value of 1 for exporters and 0 for workplace that sell all of their output domestically.⁹

Dummy variables for when product market demand is increasing and when product market demand is decreasing are included.

Finally, workplaces were asked if their product demand is unpredictable; a dummy variable was constructed from this information, taking on 1 if product demand was unpredictable and 0 otherwise.

5. Empirical results

Table 2 shows the list of variables and their summary statistics for the sample used in the estimations. The dependent variable in this study is taken to be the index of centralisation – representing the decision-making process; specifically, we estimate the probability of the workplace taking a decision at a certain level in its decision-making hierarchy as a function of internal and product-market factors.

5.1 Estimation method

Estimated an ordered probit on the dependent variable, c , the centralization index. Letting X be the independent regressors and β' the vector of coefficients to be estimated, the

⁹ Notably, the firms that faced import competition were not necessarily the same firms that were exporting (as would be the case with intra-industry trade).

latent variable y can be expressed as $y = \beta' X + \varepsilon$, where ε is an error vector normally distributed. The ordered probit was then estimated as:

$$\begin{aligned} Prob(c = 1) &= \Phi(-\beta' X); \\ Prob(c = 1.5) &= \Phi(\mu_{1.5} - \beta' X) - \Phi(-\beta' X); \\ Prob(c = 2) &= \Phi(\mu_2 - \beta' X) - \Phi(\mu_{1.5} - \beta' X); \dots \\ Prob(c = 4) &= 1 - \Phi(\mu_{3.5} - \beta' X) \end{aligned}$$

where $0 < \mu_{1.5} < \dots < \mu_{3.5}$ are the cut-off values to separate the discrete categories and $\Phi(.)$ is the standard cumulative normal.

5.2. Results

First, an ordered probit was estimated for the centralisation decision-making index using the full set of variables, outlined in Table 3. The coefficient results for the variables of interest are shown in the left-hand column of Table 3 (Model I). The remainder of the estimated coefficients for Model I – such as the industry dummy variable coefficients, main professional group and the type of change implemented – are displayed in Table 5. The coefficients for these variables, in Table 5, were jointly not significantly different from 0. Further the competition dummy variable for ‘some competition was not significantly different from zero and the competition dummy variables 2, 3 and 4 were not significantly different from each other. Finally, the coefficients on the dummy variables same3 and same4 were also not significantly different from each other (the test of these joint restrictions was $\chi^2 = 25.54$, d.f. = 28). For Model II, the insignificant variables in the test above were dropped, the competition 2, 3 and 4 dummies were combined (into dummy variable compz) and the same3 and same4 dummies were also combined.

The estimation results for the reduced model are shown in the right-hand column in Table 3. The coefficients on organization size and the number of workplaces in the

organization performing similar tasks were positive and significant. The coefficients on workplace size and the competition variable were all negative and significant. To aid in the interpretation of these results, Table 4 presents the marginal effects for Model II.¹⁰ For dummy variables the marginal effects are calculated as a change in the dummy from 0 to 1.

Product-market characteristics

Greater levels of competition increase the likelihood of decentralization. The probability that a decision is made by higher level managers falls when the workplace faces a more competitive product market. The probability that higher level management makes the decision decreases by 26 percentage points for a workplace facing moderate, strong or intense competition, as compared with a workplace that faces limited or some competition. In turn, the probability that the decision will be made by the senior workplace manager increases by 26 percentage points; the probability that the decision is made by other workplace managers also increases by 6 percentage points from an increase in competition from limited or some, to either moderate, strong or intense. From Table 4, these marginal effects coefficients are significant at the 1 and 5 percent levels respectively. This suggests that competition is associated not only with delegation to the senior manager at a workplace, but also with delegation down to lower levels within a workplace. Moreover, this competition-decentralisation relationship is consistent with the hypothesis that competition increases the speed with which a decision needs to be made, not allowing a firm time to filter information up through the hierarchy.

This model also tests whether there is some additional effect of being an exporter. In this specification the coefficient on the export dummy variable was not significant.

A change from predictable to unpredictable product demand was found to have an insignificant effect of the level of decentralisation of decision making. This result was not

¹⁰ Note, care is needed when interpreting the marginal effect from a change in organisation size, as both the organisation size and the relative size variables would be affected.

expected. Adams (1999) found a positive relationship between employee involvement via semi or fully autonomous work groups and unpredictable product demand for manufacturing firm in AWIRS 95; he interpreted this as unpredictable demand causing decentralisation. Our results could differ for two reasons. First, our estimations are not just for manufacturing firms. Second, Adams measure of decentralisation relates more closely to day-to-day operation in a workplace whereas our study is about the adoption of a new innovation or significant change at the workplace.

Organisation structure and decision making

An increase in the size of the workplace size increases the likelihood of decentralization. An increase in the workplace size by 100 employees increases the probability that the senior workplace manager makes the decision by 4 percentage points and decreases the probability that the higher levels of management made the decision by 4 percentage points. These marginal effects are significant at the 1 percent level. An increase in workplace size also increases the probability that other workplace managers make the decision – this is significant at the 5 percent level.

As noted above, AWIRS 95 has information as to the number of workplaces that also perform the same task. From Table 4, the greater the number of other workplaces that perform the same task, the higher the probability that a workplace will not make the decision; instead, it is more likely that the decision it will be made by higher level managers. Note, that there is non-monotonic relationship between the number of workplaces performing similar tasks and decentralisation. Table 4 suggests that having 2 to 10 workplaces performing the same task as compared with no other workplaces reduces the probability that the senior workplace manager makes the decision by 19 percentage points; correspondingly, there is a 19 percentage point increase in the probability that the higher level management made the decision. The effect of an increase in the number of workplaces undertaking similar activities increases for 11 to 50 workplaces and for 51 to 100 workplaces, but again is insignificant for when the organisation has more than 100 workplaces undertaking the activity. This is in contrast to

the prediction of Aghion and Tirole that the larger the span of control of a principal the greater the real authority of the subordinates. Aghion and Tirole assumed that the tasks undertaken by the agents are independent (p. 19). Here, of course, the tasks are not independent. But this raises an important critique of Aghion and Tirole. When designing an organisation, the principal will jointly decide on how to allocate tasks along with span of control – the trade off in Aghion and Tirole of increased incentives for subordinates with a loss of control for the principal as the span of control increases need not hold. If the principal wants to maintain real authority, by allocating similar tasks she increases her payoff from being informed about any one agent's project. Moreover, it could be that the relationship between span of control and delegation depends on the type of project being considered and the type of subordinates. For instance, a supervisor in a manufacturing workshop may have many subordinates, involved in the production process, while decision making is highly centralised. On the other hand, in a professional services firm (law or accountancy) a superior may have few subordinates but will delegate many important decisions to them. The relationship between span of control and real authority will differ in the two types of firm.

Furthermore, Aghion and Tirole consider a simple hierarchy of just one level. The empirical results in this paper suggest that as the number of workplaces that produce the same output increase, decision-making authority is transferred from low levels in the hierarchy –from other managers, joint other managers-senior workplace manager and senior workplace manager decisions – to higher level managers. This demonstrates the need for a theory that allows an organisation to jointly determine the number of levels in its hierarchy and its incentive scheme.

6. Concluding comments

This project examined: (i) the effect of product market competition on the allocation of decision making; (ii) the effect of globalisation on decision making within the firm; (iii) how firm characteristics such as plant size affect decision making; and (iv) how the predictability of market demand affects decision making. The empirical findings suggest

that an increase in workplace size increases the probability that decision making will be decentralised. An increase in the size of the organisation was associated with an increase in the probability that decision-making authority was centralised.

One of the important results of the paper is that an increase in product-market competition was associated with a higher probability of decentralisation. These results are consistent with theoretical models that suggest decentralisation is more likely when delays in making a decision are particularly costly. The same was not true if the workplace is an exporter.

These findings relating product-market competition with internal decision-making authority have several broad implications. The standard approach in organisational economics has been to develop a theory of production, isolated from the product market. This approach allowed researchers to explore the internal operation of the firm, ignoring the impact of the product market – while opening the ‘black box’ of the firm researchers in essence have made the market into a black box. The findings in this paper suggest that the internal operation of a firm is not unrelated from the product market. This suggests there is a need for a theory that connects the product market to the internal operation of the firm. Although some progress has been made in this direction – Meagher et al (2004) have shown that a monopolist’s choice of hierarchy is affected by product market uncertainty for example – this remains one of the open questions in organizational economics.

Aghion and Tirole (1997) argued that an increase in the span of control would increase the real authority of subordinates. This study found the opposite – the probability of centralisation increased with the number of workplaces performing the same task. Aghion and Tirole, of course, hold the structure of the firm constant. Allowing a firm to jointly choose its structure and its allocation of decision rights may alter their conclusion. Papers in economics have typically considered either management design or the incentive implications of allocating decision-making authority to a particular agent. A more general approach would allow a manager to design the structure of an organisation jointly with

the allocation of decision rights. Current theoretical models, typified by Aghion and Tirole (1997), make strong simplifying assumptions in order to restrict their analysis to a few agents. As a result, these types of models omit important firm design aspects and are essentially ‘partial equilibrium’ models of the firm. Generalising these models is essential for gauging whether these theories are robust to their settings; this would be a significant theoretical development. The results in this paper suggest that such an innovation is needed if we are to better interpret the observed empirical facts.

A slightly unexpected finding from the estimations was that workplaces that face unpredictable product demand are more likely to centralise decision making. This contradicts the findings of Adams (1999) although it is consistent with one of the findings of Christie et al (2003). Following Jensen and Meckling (1998), this could come about as if senior managers have better information, or if unpredictability increases control costs if decisions are decentralised.

Finally, this study is a preliminary investigation of decision making in organisation. Further studies are required to give us a better understanding of this aspect of organisation design. It is worth mentioning, at this stage, two potential extensions using this data source. First, this study has been restricted to investigating who made the decision. It does not consider consultation and input into decisions. Second, several theoretical models have suggested a firm’s ability to monitor employees (control technology) will alter the optimal allocation of decision-making authority. Both of these variables could potentially be investigated in future studies.

References

- Aghion, P. and J. Tirole (1997), ‘Formal and Real Authority in Organizations’, *Journal of Political Economy*, 105(1), 1-29.
- Aoki, M. (1986), ‘Horizontal vs. Vertical Information Structure of the Firm’, *American Economic Review*, 76(5), 971-83.
- Baker, G., R. Gibbons and K. Murphy (1999), ‘Informal authority in organizations’, *Journal of Law, Economics and Organization*, 15(1), 56-73.

- Bolton, P. and M. Dewatripont (1994), 'The Firm as a Communication Network', *Quarterly Journal of Economics*, 109(4), 908-39.
- Brickley J., C. Smith and J Zimmerman (2004), *Managerial Economics and Organizational Architecture*, 3rd Edition, McGraw-Hill, New York, New York
- Colombo, m. and M. Delmastro (2004), 'Delegation of authority in business organizations: an empirical test', *Journal of Industrial Economics*, 52(1), 53-80.
- Christie, A., M. Joye and R. Watts (2003), 'Decentralization of the firm: theory and evidence', *Journal of Corporate Finance*, 9, 3-36.
- Delmastro, M. (2002), 'The determinants of the management hierarchy: evidence from Italian plants', *International Journal of Industrial Organization*, 20, 119-137
- Donath, B. (1998), 'Pick a role model: General Motors or Dell', *Marketing News*, October 12, 32 (21), 9-10.
- Garicano, L. (2000), "Hierarchies and the organization of knowledge in production", *Journal of Political Economy*, 14, 159-181.
- Geanakoplos, J. and P. Milgrom (1991), "A Theory of Hierarchies Based on Limited Managerial Attention", *Journal of the Japanese and International Economies*, 5(3), 205-25.
- Gibbons R. (2003), 'Team theory, garbage cans and real organizations: some history and prospects of economic research on decision-making in organizations', *Industrial and Corporate Change*, 12(4), 753-787.
- Jensen, M and W. Meckling (1998), 'Specific and General Knowledge, and Organizational Structure', in M. Jensen, *Foundations of Organizational Strategy*, Harvard University Press, Cambridge Massachusetts.
- Meagher, K., H. Orbay and T. Van Zandt (2003), 'Hierarchy size and environmental uncertainty', In: M. Surtel and S. Koray (Eds.) *Advances in Economic Design*, Springer Verlag, Heidelberg, Germany, pp. 439-457.
- Meagher, K., H. Orbay and T. Van Zandt (2004), 'Market contingent managerial hierarchies', mimeo.
- Milgrom, P. and J. Roberts (1988), 'An economic approach to influence activities in organizations', *American Journal of Sociology*, 94, S154-S179.
- Orbay, H. (2002), 'Information Processing Hierarchies', *Journal of Economic Theory*, 105(2), 370-407.

Prat A. (1997), 'Hierarchies of Processors with Endogenous Capacity', *Journal of Economic Theory*, 77, 214-222.

Radner, R. (1993), 'The Organization of Decentralized Information Processing'. *Econometrica*, 61(5), 1109-46.

Zabojnik, J. (2002), 'Centralized and Decentralized decision making in organizations', *Journal of Labor Economics*, 20(1), 1-22.

Table 2: Definitions and summary statistics of the sample

Variable	Definition	Mean	Standard deviation
Central	Centralization index	3.541	.574949
WP size	Workplace size	187.37	261.28
Org. size 1	Organization less than 100	.1103	.31365
Org size 2	Organization 100 – less than 500	.1678657	.3741959
Org size 3	Organization 500 – less than 1000	.10791	.31064
Org size 4	Organization 1000 – less than 5000	.2038369	.4033331
Org size 5	Organization 5000 – less than 10000	.057554	.2331778
Org size 6	Organization 10000 – less than 20000	.0671463	.2505758
Org size 7	Organization more than 20000	.2853717	.4521337
Comp0	Limited product mkt competition	.0623501	.2420808
Comp1	Some product mkt competition	.0191847	.1373384
Comp2	Moderate product mkt competition	.1199041	.3252395
Comp3	Strong product mkt competition	.4148681	.4932911
Comp4	Intense product mkt competition	.383693	.4868687
Compdv	Strong or intense product mkt competition	.9184652	.2739833
DemandE	Workplace's mkt demand expanding	.5923261	.4919922
DemandC	Workplace's mkt demand contracting	.0959233	.2948397
Export	Firm exports product	.2925659	.4554873
Same1	No other workplace make similar product	.1199041	.3252395
Same2	1 other workplace makes a similar product	.0719424	.258703
Same3	2-5 other workplace makes a similar product	.2110312	.4085306
Same4	6-10 other workplace makes a similar product	.1151079	.3195355
Same5	11-50 other workplace makes a similar product	.1558753	.3631728
Same6	51-100 other workplace makes a similar product	.0743405	.2626394
Same7	More than 100 workplace makes a similar product	.2517986	.4345675
Same34	2-10 other workplace makes a similar product	.3261391	.469362
Unpredict	Product demand unpredictable	.2158273	.4118892
Tech	Workplace implemented technical change		
Plnm	Workplace implemented change to plant or machinery	.1918465	.1918465
Reorm	Workplace implemented reorganisation	.1918465	.4862882
Nonm	Workplace implemented change to work of non-management employees	.2182254	.4135374
Quality	Quality product important	.4135374	.4879922
Resp	Responsiveness to customers important	.0623501	.2420808
Mine	Mining industry	.0527578	.2238181
Manu	Manufacturing	.2494005	.4331857
EGW	Electricity, gas and water	.028777	.16738
Const	Construction	.0263789	.1604518
Transt	Transport	.0671463	.2505758
Busser	Business services	.2254197	.4183603
Retail	Retail	.1702638	.3763159
Whole	Wholesale	.0671463	.2505758
Arts	Arts	.0383693	.1923169
Other	Other industries	.0095923	.0975866
Accom	Accommodation	.0431655	.2034736
Govadm	Government administration, health or education	.0023981	.0489702
Labour	Main group of employees labourers	.177458	.3825148
Plant	Main group of employees plant operators	.2110312	.4085306
Tradep	Tradesperson	.1079137	.310644
Sales	Main group of employees in sales	.294964	.4565744
Clerk	Main group of employees clerks	.0983213	.2981063
Prof	Main group of employees professionals	.0719424	.258703
Parap	Main group of employees para-professionals	.0383693	.1923169

Table 3: Ordered probit results
Dependent variable is centralization index

	Model I	Model II
Variable	Coefficient (standard error)	Coefficient (standard error)
WP size	-.0010745 (.0002886)	-.0009764 (.000265)
Org size 2	.5087735 (.2607981)	.454809 (.2422759)
Org size 3	1.193467*** (.314785)	1.022156 (.2787169)
Org size 4	1.273409 (.3035773)	1.213003 (.2714041)
Org size 5	.8497331 (.405536)	.6807379 (.3569377)
Org size 6	1.890098 (.4127066)	1.791033 (.3791874)
Org size 7	2.51751 (.3892962)	2.504912 (.3507537)
Comp 1	.2503392 (.9491619)	
Comp 2	-.8973762 (.4135022)	
Comp 3	-.7811916 (.3697217)	
Comp 4	-.704293 (.3739043)	
Comp DV (3+4)		-.8433707 (.3114693)
Exporter	-.2350521 (.1765178)	-.2493544 (.1543264)
Same 2	.3850355 (.2994152)	.3158286 (.2849994)
Same 3	.6167549 (.2392503)	
Same 4	.4847281 (.2831882)	
Same 34		.538357 (.2157672)
Same 5	.8162916 (.299483)	.7061624 (.2702974)
Same 6	1.087579 (.4476608)	1.165696 (.4042958)
Same 7	.357411 (.3675803)	.4151214 (.31959)
Unpredictable Demand	.2775559 (.1769314)	.2547774 (.1638783)
Log likelihood	-229.07919	-242.40463
Pseudo R2	0.3233	0.2839
No. of obs	417	417

Table 4 **Ordered probit marginal effects for Model II – (Standard errors in parentheses)**

Variable	Level 1 (Employee)	Level 2 (Other mngs)	Level3 (Senior mng)	Level 4 (Higher mngs)
WP size	4.66e-07 (.00000)	.0000153** (.00001)	.0003536*** (.0001)	-.0003694*** (.0001)
Org size 2	-.0001382 (.00019)	-.0050781** (.00272)	-.1556718** (.07721)	.1608881** (.07895)
Org size 3	-.0001846 (.00024)	-.0072371** (.00312)	-.2993941*** (.06022)	.3068158*** (.06068)
Org size 4	-.0003102 (.00039)	-.0105969** (.00439)	-.3595858*** (.06191)	.370493*** (.06286)
Org size 5	-.0001341 (.00018)	-.0054378** (.00255)	-.2149783** (.09187)	.2205502** (.09288)
Org size 6	-.0001941 (.00025)	-.0077142** (.00331)	-.3878104*** (.03926)	.3957186*** (.03947)
Org size 7	-.0015716 (.00176)	-.0329568*** (.01166)	-.5997443*** (.04784)	.6342727*** (.05066)
Comp DV	.000155 (.00021)	.0062437** (.00276)	.2566388*** (.07134)	-.2630375*** (.07195)
Exporter	.0001483 (.00021)	.0044949 (.00356)	.0909449 (.05653)	-.0955881 (.0597)
Same 2	-.0000962 (.00013)	-.0035819 (.00261)	-.1092603 (.09291)	.1129383 (.09509)
Same 34	-.0002114 (.00027)	-.0071029** (.00356)	-.1874552*** (.07183)	.1947694*** (.07397)
Same 5	-.0001767 (.00023)	-.0066486** (.00303)	-.2295121*** (.07548)	.2363374*** (.07665)
Same 6	-.0001697 (.00022)	-.0068984** (.00302)	-.318451*** (.06795)	.3255191*** (.06839)
Same 7	-.0001482 (.00021)	-.0052058 (.0038)	-.1448411 (.10621)	.1501951 (.10943)
Unpredictable Demand	-.0000963 (.00013)	-.0033715 (.0022)	-.0902219 (.0566)	.0936897 (.05834)

Table 5: Ordered probit results for Model I (full model)

Dependent variable is centralization index (government/health care and education excluded industry category, technical change the excluded innovation, managers are the excluded occupational group)

Variable	Model I Coefficient (standard error)	Variable	Model I Coefficient (standard error)
Plnm	-.0292281 (.2483893)	Demand Contracting	-.068902 (.2499558)
Reorm	-.1240831 (.2095839)	Retail	-.5481575 (.6672678)
Nonm	-.2883467 (.2353903)	Whole	-.7021581 (.6694593)
Quality	-.043341 (.1564708)	Arts	-.1465534 (.7036749)
Resp	.3148072 (.3504151)	Other	-1.71108 (.8592261)
Mine	-.0803343 (.6789115)	Accom	-.7933207 (.6899481)
Manu	-.4372701 (.6315219)	Labour	-.003432 (.2790803)
EGW	.0089963 (.7762957)	Plant	-.3372864 (.2783497)
Const	-.9085004 (.7226823)	Sales	.1654575 (.3163819)
Transt	-.715138 (.6732096)	Clerk	.0820584 (.3631449)
Busser	-.369871 (.6076154)	Prof	-.6398629 (.3642714)
Demand Expanding	-.085981 (.160318)	Parap	.1362236 (.565814)

