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Decentralization of Decision Authority in Complex Task Structures DRUID

Magdalena Dobrajska
Copenhagen Business School
Department of Strategic Management and Globalization
md.smg@cbs.dk

Stephan Billinger
University of Southern Denmark
Department of Marketing and Management
sbi@sod.dias.sdu.dk

Samina Karim
Boston University
Strategy and Innovation
samina@bu.edu

Abstract

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Decentralization of Decision Authority in Complex Task Structures:
An empirical investigation

ABSTRACT

We investigate tradeoffs associated with delegating authority over multiple interrelated decisions in a complex task structure. The empirical setting is a business process of a global Fortune 50 firm. The firm decentralized its organization and redefined decision authority across organizational hierarchies between 2008 and 2011. We employ regression analysis of micro-level data on the organization design of 761 decision tasks and we investigate the allocation of decision authority at the level of all observable individual decision tasks. Our findings show how the specialization of decision-relevant knowledge, the matching of required knowledge and manager's expertise, and information processing intensity affect (a) the occurrence of delegation, and (b), if delegation occurs, how far down the organizational hierarchy authority is delegated. We discuss how these findings complement existing theories on delegation by providing insights into how multiple interrelated decisions are delegated within a complex task structure.

Keywords: Delegation of decision-making, formal authority, organization design

INTRODUCTION

Delegation serves as an adaptive organizational mechanism which is fundamentally rooted in how the organization distributes decision-making authority and designs an effective division of labor. In this paper we use an in-depth study to examine some of the underlying mechanisms of delegation. Delegation is one of the key dimensions of organizational design and its roots can be found in many classics in organization theory (March and Simon, 1958, Cyert and March, 1963; Thompson, 1967; Galbraight, 1973; Mintzberg, 1979). Scholars have discussed several reasons that explain why organizations rely on delegation, including the improvement of decision quality (Jensen and Meckling, 1992; Grant, 1996), the timeliness of decisions (Radner, 1992; Patacconi 2009), the economizing on managerial time and attention (Harris and Raviv 2002; Wernerfelt, 2007), facilitating employee initiative (Gagné and Deci, 2005, Benabou & Tirole, 2003, Rantakari 2012), or boosting the responsiveness to business environments (Mendelson, 2000, Bloom, Sadun and Van Reenen, 2010). Most of the existing studies provide conceptual clarity by explaining why delegation can occur within an organization. They focus on single instances of delegation and largely neglect that multiple co-dependent occurrences of delegation are most prevalent in medium or large organizations that have large complex task structures. In these contexts two fundamental, yet previously not answered questions emerge: When does delegation occur, and if it occurs, how far down the hierarchy is authority delegated?

Literature on delegation, often based in microeconomics, depicts delegation as a tradeoff between improving decision quality by utilizing an individual's specific knowledge, and loss of manager's control over delegated decisions that results in agency costs (Hayek, 1945; Jensen and

Meckling 1976, 1992; Holmström, 1979). Firms approach this tradeoff by allocating formal authority, i.e. the right to decide, and real authority, i.e. an effective control over decisions, over particular decision tasks to selected employees located within the firm's hierarchy (Aghion and Tirole, 1997). Exercising real authority arises from an individual's superior expertise which comprises of specialized and often tacit knowledge that is difficult and costly to transfer among people (Aghion and Tirole, 1997; Grant, 1996; Dessein, 2002). A formal authority holder (FAH) may efficiently draw on that expertise by delegating effective control over decision to a real authority holder (RAH), and simply rubberstamp this person's decision proposals (Aghion and Tirole, 1997; Rivkin and Siggelkow 2003). While such delegation allows the firm to efficiently utilize its distributed knowledge resources, its implementation is constrained by information processing that arises from the multiplicity and interrelatedness of decisions within complex task structures (Cyert and March 1963, Aghion and Tirole 1997).

Interestingly, there is a lack of empirical research on multiple interrelated instances of delegation in large complex task structures. Classic contributions to organization design outline a general logic of delegation based on descriptive, qualitative empirical accounts (Galbraith, 1973; Lawrence & Lorsch, 1967; Mintzberg, 1979). More recent contributions, mainly in organizational economics, provide detailed insights into the delegation mechanisms through stylized formal models of organizations (Aghion & Tirole, 1997; Jensen & Meckling, 1976; Rantakari, 2011, 2012; Siggelkow & Levinthal, 2003). Large N empirical studies corroborate the drivers of delegation at a highly general, the firm level of analysis (Bloom, Sadun, & Van Reenen, 2010; Colombo & Delmastro, 2004, 2008). Yet, what is missing to date, and what we try to cover in the present study, is the examination of how firms design and redesign co-dependent delegations within complex task structures.

We empirically study delegation structures in a global Fortune 50 firm that designs and delivers wind farms. The firm has both onshore and offshore business units that are responsible for the delivery of wind farms. Both business units were centralized in 2008, decentralized in 2010, and had their decentralization efforts fine-tuned in 2011. We have collected longitudinal micro-level data which allows for an examination of the organizational design of decentralization in the centralized as well as the decentralized state. In both we examine the units' major business process and study all FAH-RAH relationships on the most granular level of the individual task. In this setting we ask when and how does delegation occur and which underlying rationale explains the actual implementation of delegation. We address these questions by drawing on Aghion and Tirole's (1997) notion of formal and real authority and investigate how specialization of decision-relevant knowledge, the organization's ability to match manager's expertise and decision's knowledge requirements, as well as information overload affect the split of formal and real authority between FAH and RAH and the hierarchical distance between them. . Our findings allow for a discussion of the actual mechanisms that organizational designers can strategically use when delegating authority. The results have implications for several streams of research.

The paper is organized as follows. It begins with background on relevant literature and introduces our hypotheses. This is followed by methods and measures which outline the data and sample, operationalization of variables, and the methodology of this study. Finally, the paper concludes with results, implications and discussion.

RELEVANT LITERATURE

Decision whether to delegate: Formal Authority versus Real Authority in Decentralization

Decentralizing decision-making authority in firms requires deciding 1) whether to delegate the authority on a specific matter, and 2) how far down the hierarchical structure to delegate. The question whether to delegate is a matter of granting effective control over the decision to the agent. The authority to make decisions may be shared by a principal who has the formal authority[1]over an activity and an agent submitting a decision proposal. While the principal, having *formal decision authority,* can always overrule an agent's decision, a well-informed agent who participates in decision-making by recommending a solution may have effective control over the decision (Aghion and Tirole 1997). It is a common assumption in the literature that the agent holds decision-relevant knowledge that is superior to the knowledge of the principal. (Dessein 2002). Tapping into that superior knowledge is the key reason for delegation (Hayek, 1945; Jensen and Meckling, 1992). The decision whether to delegate real authority and rubberstamp agents' recommendation depends on the cost and effort of the principal to acquire relevant knowledge herself (Aghion and Tirole, 1997; Rivkin and Siggelkow; 2003). A distinction between various degrees of authority delegation is reflected in prior studies applying both empirical and formal methods. Table 1 provides an overview of prior studies capturing various degrees of delegation of decision authority. In this paper we adopt the distinction between formal and real authority over decisions put forth by Aghion and Tirole (1997). While key antecedents of delegating real authority identified by formal literature relate to knowledge

[1] We recognize that formal decision rights deriving from property rights of the asset owner can be formally delegated only through asset sales and divestitures (Baker, Gibbons, & Murphy, 1999; Grossman & Hart, 1986). Our analysis is grounded in the zone of "informal" delegation, or "loaning" decision authority to subordinates within the firms (Baker et al. 1999, p. 56), which offers more nuanced insights into the mechanisms at play in decentralizing firms.

asymmetries and communication costs (Aghion and Tirole, 1997; Dessein, 2002), empirical literature, which is scarce on this topic, reflects drivers of delegation of real authority concerned with technology (Collins, Ryan, and Matusik, 1999), firm and country level management practices (Bloom et al 2010; Colombo and Delmastro, 2004; Lincoln, Hanada and McBride, 1986), or industry dynamism (Mendelson, 2000). It remains empirically unexplored how knowledge characteristics, knowledge asymmetry and information processing intensity among decision makers affect delegation of real authority at the level of a system of related individual decisions.

Insert Table 1 about here

On a more granular level, firms implement delegation of formal and real decision authority through the charting of responsibilities, where individuals are assigned specific roles for particular tasks and task related decisions (Galbraith 1973, p.147; Kendrick 2006; McCann and Gilmore; 1983, Smith and Erwin; 2005). Both the economic and the project management literatures point out that only one person can ultimately be accountable for each task. The decision authority of this person involves veto power and the right to overrule proposals of other task participants, as well as bearing consequences related to the task's overall objectives (Kendrick, 2006; Smith and Erwin, 2005; McCann and Gilmore, 1983). This function reflects formal decision making authority (Aghion and Tirole, 1997). We refer to an individual holding such a function for a task-related decision as the '*Formal Authority Holder'* (FAH). A task's FAH

may exercise only formal authority and intervene in decision making mainly to handle exceptions, while task related decisions are de facto taken by the individual who actually *delivers and executes* the task. In this case, this latter individual is drawing on his/her own knowledge and skills as well as on information and contributions from other task participants, as typically she has an easy access to decision-relevant information. Such an individual, whom we refer to as the task's *Real Authority Holder'* (RAH), may exercise real decision authority (Aghion and Tirole, 1997). Note that it can be the case that the FAH does not delegate away decision authority. In such a case FAH is also the RAH (e.g. Colombo and Delmastro, 2004, 2008). In the following we use the term *task decision authority* to refer to both roles of task FAH and RAH.

Delegation span: How far down the hierarchy should authority be delegated?

Separation of decision authority between two individuals poses an organizational design challenge. Managers who delegate real authority face a decision of how far down the organizational hierarchy real authority should be allocated. Our second research question addresses the determinants of delegation span, which we define as the number of hierarchical layers separating FAH and RAH. The proximity of delegation span has been recognized in the economic literature as an important organizational design variable, as it carries vital organizational consequences. Essentially, delegation span poses a tradeoff between making best use of decision-relevant knowledge that resides in individuals throughout hierarchical levels and the agency costs which take form of loss of control over delegated decisions (Jensen and Meckling, 1992; Aghion and Tirole, 1997; Mookherjee 2006; Rantakari 2012).

As organizational hierarchy serves as a structure of information (Thompson, 1967; Galbraight, 1973), delegation span creates "informational distance" (Foss, Foss and Vazquez 2006, p. 805)

between holder of formal authority and the individual to whom real authority has been delegated. Such informational distance affects the length of the path through which information travels between actors involved in decision-making. The longer the informational distance, the noisier the vertical communication between the individuals is. Delegation span influences the efficiency of information transmission and communication and between those actors (Dessein, 2002; Radner, 1992), reflects the "closeness of contact" between them (Ouchi & Dowling, 1974), as well as the degree to which hierarchical coordination is required (Rantakari 2011).

Due to informational distance, high delegation span also reduces FAH's capacity to evaluate decisions taken by RAH. The more layers separate FAH and RAH, the more difficult the hierarchical communication and coordination, and the harder it is for FAH to exercise judgment over delegated decisions (Foss, et al., 2006). Large delegation span reduces closeness of contact between FAH and RAH and the amount of FAH's supervisory time for RAH's decision (Ouchi & Dowling, 1974). In the light of the classical monitoring perspective on delegation, which is prominent in the principal-agent literature (Holmstrom, 1979), informational distance arising from delegation span constrains FAH's possibilities of observing RAH's actions. Large delegation span generates difficulties in monitoring and increases the risk of loss of FAH's control over delegated decision, hence, it increases agency costs should RAH act in a self-interested way (Jensen& Mecking, 1976; 1992). As observability of RAH's actions is reduced with high delegation span, the basis on which FAH would control and intervene in RAH's decisions become less apparent. Therefore FAH's involvement and intervention in decisions delegated to RAH is expected to be less beneficial or valuable for the firm when delegation span is high.

On the one hand, high delegation span is associated with negative consequences of delegation, i.e. a potential loss of control over delegated decisions. On the other hand, the literature on motivation, empowerment and employee discretion recognizes positive aspects of limited managerial intervention into delegated decisions (Conger & Kanungo, 1988; Osterloh & Frey, 2000). Manager's inference in delegated decision makes employee's effort redundant, which demotivates the employee (e.g. Aghion & Tirole 1997). Limiting selective interventions (Williamson, 1996) signalizes confidence in decisions taken at lower levels, what in turn enhances employee motivation, creativity, initiative and effort (Gagné and Deci, 2005, Benabou & Tirole, 2003). Boosting employee initiative helps managers to better utilize knowledge resources that are distributed in the organization, what constitutes the second element of the delegation tradeoff. Managers can enhance employee initiative both through reducing managerial involvement in decision-making, as well as through signaling the intention of not intervening (Aghion & Tirole, 1997, Foss, 2003, Rantakari 2012). As large delegation span involves difficulties in hierarchical coordination, information transmission and monitoring, it provides a signal to employees that RAH is less likely to intervene in delegated decision. We therefore argue that large delegation span is conductive to promoting employee initiative, which facilitates the use of employees' knowledge in decision making.

Summing up, the delegation span separating FAH and RAH reflects a tradeoff between enhancing employee initiative and therefore benefiting from distributed knowledge resources and a potential loss of control over delegated decisions. In the following section we explore the two parts of our research question, namely, a) the conditions under which a firm splits decision authority between FAH and RAH, and b) given the split, we identify drivers that lengthen or shorten delegation span.

HYPOTHESES

Delegation and Information processing

Centralization can be defined as organization design where “all the power for decision-making rests at a single point in the organization – ultimately in the hands of a single individual” (Mintzberg, 1979: 181). The extent to which decision-making authority is concentrated on a single manager is constrained by her limited cognitive capacity. In the face of bounded rationality, orchestrating the execution of a complex set of tasks in a firm generates information processing needs that exceed the cognitive capacity of any individual (March and Simon, 1958; Mintzberg, 1979; Rivkin and Siggelkow, 2003). ‘Wealth of information’ may lead to ‘poverty of attention’, thereby resulting in information overload and reducing decision-making effectiveness (Mendelson, 2000; Simon, 1982). The negative consequences of information overload of centralized decision-making have been well recognized in the literature. Information overload slows down the speed of organizational decision-making, what in consequence may result in low responsiveness to the business environment and inappropriate or obsolete decisions (Galbraith, 1973; Khandwalla, 1973; Lawrence & Lorsch, 1967; Mintzberg, 1979; Radner, 1992; Thompson, 1967; Tushman and Nadler, 1978). The risk of information overload is greater if a large number of decisions rest within the authority of a single individual. Increasing the number of decisions that need to be taken by one individual leads to less time and attention devoted to each decision (Ocasio, 2011; Ouchi & Dowling, 1974)FAH can reduce the cognitive burden of decision overload by sharing the authority with RAH without the need to fully delegate and give up his

decision-making authority. We therefore expect a greater likelihood of authority being split between FAH and RAH in situations when FAH is responsible for a large number of decisions.

> *Hypothesis 1a. Increasing the number of decisions that a single individual is responsible for is positively associated with the likelihood of authority split between FAH and RAH.*

At the same time, delegation of decision authority generates agency costs arising from loss of control (Jensen and Meckling, 1976, 1992; Aghion and Tirole, 1997). If FAH is responsible for too many decisions, she has little time to invest in acquiring information relevant for high quality decision making and therefore her control over decisions is limited (Ouchi & Dowling, 1974, Aghion and Tirole, 1997). FAH can reduce loss of control over decisions delegated to RAH when actions of RAH are easier to observe and monitor. One way to make actions more easily observable is positioning both actors close to each other within the organizational hierarchy. Such organizational proximity reflects closeness of contact between FAH and RAH, and the efficiency of the supervisory time spent on each decision shared with RAH (Ouchi and Dowling, 1974). It ensures a short chain of commands, facilitates direct communication and makes coordination among decision tasks easier. In addition, increasing the number of decisions under responsibility of a single FAH increases the opportunity cost of time spent on monitoring and intervening in each decision. The marginal cost of intervention in each of those decisions increases with increasing number of decisions (Foss et al., 2006). So the more decisions there are to monitor for a single FAH, the more costly it is to get involved in intervening into each of them (Rantakari, 2012). Should FAH want to exert effort into monitoring the decision-making of a

RAH, time and cost of such involvement is greater when these two authority holders are located far from each other in the hierarchy, as the informational distance is longer. We therefore expect that FAH counteracts loss of control due to authority split by delegating authority to a RAH that is located close to FAH in the organizational hierarchy, i.e. by implementing short delegation span:

> *Hypothesis 1b. Increasing the number of decisions that a single individual is responsible for is negatively associated with delegation span between FAH and RAH.*

Delegation and distributed knowledge resources

Decisions made in a large organization are often heterogeneous. As complex tasks involve decisions that draw on knowledge from various areas of expertise, such as customer preferences, product design, or local market requirements, it is highly unlikely that a single person possesses an expert knowledge in all the local aspects of the business. Individuals in the firm specialize in tasks and decisions they make, what typically results in increasing returns from task specialization (Becker & Murphy, 1992; Bolton & Dewatripont, 1994; Colombo & Delmastro, 2008; Grant, 1996). For organization design this means that knowledge necessary for decision-making within a complex task structure is distributed among multiple individuals who specialize in their respective tasks and are located at various functional or divisional organizational units. Specifically, this implies that some employees may hold expert knowledge that is more relevant for certain decisions than knowledge held by FAH, as decision authority may be assigned to FAH

on merits other than expert knowledge, e.g. seniority, tenure, general knowledge or managerial skills.

FAH can improve the quality of decisions either by acquiring necessary knowledge or by delegating decision authority to an employee that possesses superior, decision-relevant knowledge (Hayek, 1945, Jensen and Meckling 1992). Individual decisions may rely both on general as well as on specific knowledge (Jensen and Meckling 1992). While general knowledge is easy and relatively inexpensive to aggregate and transfer among individuals in the organization, specific knowledge is not, as it involves specialized knowledge which is often tacit (Hayek 1945; Jensen and Meckling, 1992; Kogut & Zander 1992, Grant, 1996). Difficulties in transferring such specialized knowledge from an employee to FAH arise from the time and effort necessary to transmit and absorb that knowledge. These knowledge transfer costs may outweigh the benefits of knowledge acquisition by FAH (Jensen and Mecking 1992). In any case, limited cognitive capacity makes it difficult and time consuming to learn specialized knowledge from other individuals (Grant, 1996 Org Science). We therefore expect that authority over decisions which require *specialized* knowledge is more likely to be split between formal and real authority holders, as it allows the firm to efficiently tap into distributed specialist knowledge:

> *Hypothesis 2a. Specialization of knowledge required for decision making is positively associated with the likelihood of authority split.*

As firms reach out for specialized knowledge residing in employees, they are likely to employ mechanisms that promote best utilization of that knowledge. These mechanisms need to address the tradeoff associated with delegation which entails maintaining control over delegated decision and inducing RAH to exert effort into utilizing own knowledge in decision making. Firms

benefit from delegation when decision-making authority is delegated to a RAH whose decision-relevant knowledge is superior to that of FAH (Jensen and Meckling 1992). In that case, it is likely that FAH has confidence in RAH's use of specialized knowledge, and therefore may relax the control over RAH. Signaling confidence in employee ability is conductive to employee empowerment and motivating the employee to exert effort (Bénabou & Tirole, 2003; Conger & Kanungo, 1988). Recall that long delegation span is conductive to stimulating employee initiative and motivation, as it signals no intention of overruling or of managerial intervention into delegated decision which would make employee effort redundant (Aghion & Tirole, 1997). Therefore, managers that want to stimulate (intrinsic) motivation and initiative of RAH that holds specialized, decision-relevant knowledge, may want to purposefully limit their own intervention and overruling behavior. High delegation span is therefore a suitable mechanism for increasing employee motivation and initiative in instances when decision making relies on highly specialized knowledge and narrow expertise residing in employees distributed in the firm.

> *Hypothesis 2b. Specialization of knowledge required for decision-making is positively associated with delegation span.*

One of the key reasons for delegation lies in the need to access knowledge that is necessary for high quality decision-making (Hayek, 1945; Jensen and Meckling, 1992). Having formal authority to make a decision does not guarantee possessing the necessary expertise. This may, however, well be the case that one individual holds both decision authority and decision-relevant knowledge. When a decision lies within the area of expertise of FAH, then this FAH has the ability to make the assigned decisions. In such instance two critical resources for decision-making, i.e. decision-relevant knowledge and decision authority are collocated (Jensen and Meckling, 1992), so the knowledge-based driver of delegation is absent and there is therefore no

need for FAH to delegate decision authority to another specialist. We therefore expect that the likelihood of splitting decision authority among FAH and RAH diminishes if the expertise domain of FAH matches with the knowledge domain required for decision making:

Hypothesis 3a. A match of FAH's expertise with the knowledge domain required for decision- making is negatively associated with the likelihood of authority split.

When decision authority is split between FAH and RAH despite the fact that FAH holds decision-relevant knowledge, both of these actors can increase the decision quality by contributing with own expertise. When both actors jointly participate in decision-making, the need for coordination between them emerges. Short delegation span means that as informational distance is shorter (Foss et al., 2006) and knowledge is transferred throughout fewer hierarchical layers, direct communication and mutual adjustment between these individuals is easier and less noisy (Dessein 2002). Short delegation span is conductive not only to knowledge coordination, but also to maintaining control over delegated decisions. As FAH possesses decision-relevant knowledge, she typically has an opinion on decisions made by RAH, which makes it easier not only to contribute to decision making, but also to evaluate the quality of RAH's decisions and to exercise indirect monitoring (Rantakari, 2012). That leads us to the expectation of observing low delegation span when the expertise domain of FAH is overlapping with the knowledge domain required for making the decision, as short delegation span is conductive to both monitoring and knowledge coordination.

Hypothesis 3b. A match of FAH's expertise with the knowledge domain required for decision making is negatively associated with delegation span.

METHODS AND MEASURES

Data and Sample

This paper is based on the study of a global Fortune 50 firm in the wind turbine industry. The firm manufactures wind turbines and installs wind farms. In this study we focus on the BUs of this firm as it allows us to construct a unique dataset. The core of the dataset comes from 'responsibility charts' in the years 2008, 2010, and 2011, which map in detail the core process that the firm uses for the planning and execution of wind farms. A responsibility chart covers a project organization, which is designed to plan and execute wind farm projects. It considers the functional organization structure of headquarters and BUs and it disaggregates an overall wind farm installation project into individual tasks (such as checking completeness of technical specifications, clarification of tax related issues, providing commercial input to risk assessment, planning transport equipment, planning site resources, etc.). It is important to note that this project planning and execution process does not include the manufacturing of wind turbines nor the physical erection of the wind farm. More specifically, only 3% of the firm's tasks involve physical labor-intense tasks[2], and thus, the great majority of the firm's tasks are specialized and decision-intense with a high degree of problem-solving. The responsibility charts define the task participants' interdependence structure, thereby defining knowledge flows, and, more generally, the firm's project planning and execution infrastructure. They also reflect the nature of the BU's business model, which excludes manufacturing as this is the responsibility of an upstream division, and also excludes labor-intense wind turbine installation tasks which are largely outsourced to suppliers.

[2]We exclude these tasks from the dataset, because the theoretical arguments of the study require an empirical setting with decision intensive tasks.

We obtained five responsibility charts from three years. For 2008, we had a chart of the centralized organization that was structured as a single BU. For 2010, the firm decentralized into headquarters and BUs serving offshore and onshore wind farm markets; thus we had a chart for offshore activities and another chart for onshore activities. For 2011, the firm fine-tuned its organization after a major decentralization exercise so we again had a chart each for offshore and onshore activities. These separate responsibility charts mapping task structures for offshore and onshore wind farm BUs have tasks allocated amongst actors located at the headquarters and BUs while displaying significantly different levels of interdependence. The tasks listed on a responsibility chart are executed in accordance with a process handbook, which codifies the underlying tasks.

A responsibility chart consists of a list of tasks (average N =151), job titles of individual actors (average N =111), and responsibility types assigned to all job titles for all given tasks (which include ‘responsible’, ‘approve’, ‘execute’, ‘contribute’ and ‘is informed’). Such a matrix is a standard way of charting task responsibilities in a project organization (see Galbraith, 1973 p.147 for an example). We use these assignment types to code the formal and real authority holder for each task. Each task has only one actor with the assignment ‘execute’. We code this role as the holder of real authority (i.e. RAH) over task decision-making, as this role actually delivers the completed task drawing on own knowledge and resources of other task participants. This person makes all task related decisions which may be overruled by a formal authority holder (i.e. FAH). We also confirmed this coding convention by reviewing the process handbook, reading job descriptions, and interviewing key managers. Formal task authority may be assigned to a single actor (i.e. the FAH) having the role ‘responsible’ who can overrule the role ‘execute’.

For tasks where ‘responsible’ role is not assigned to any actor, the formal authority is embedded in the ‘execute’ role and thus the FAH and RAH are a single person. In our dataset formal and real authority over task is distributed between two separate actors in 40.5% of the observations. In total, across the five responsibility charts within our sample, we have a total of 4329 task assignments for the 5 responsibility type assignments.

In order to code and operationalize our variables, we used organization charts to identify the hierarchical allocation of all of the actors. We reviewed all individual job titles, content-analyzed and coded job descriptions in order to obtain variables related to expertise domain of involved roles. We also content-analyzed task descriptions in order to code variables related to knowledge specialization and knowledge domain required for task decision-making. Moreover, we conducted 36 semi-structured interviews to understand the nature of the process and the rationale behind reassigning the responsibilities to roles both due to the decentralization of the organization structure in 2010 and the following incremental changes in 2011. Finally, we used process handbooks, internal documents and departmental newsletters as additional secondary data to verify and triangulate our data.

Variables and Operationalizations

Dependent variables

Our first dependent variable is **split of decision authority between FAH and RAH**. We operationalize this measure of delegation by observing the *formal authority holder (FAH)* and *real authority holder (RAH)* in each task. FAH maps the actor from the responsibility chart having the task assignment of being “responsible”, and RAH maps the actor with the task assignment “execute”. We coded authority split between FAH and RAH as a binary variable with

value 1 when assignments of being “responsible” and “executing” the task are assigned to two different individuals.

Delegation span counts the number of hierarchical levels separating FAH and RAH on organizational charts. Delegation span of 0 means that FAH ad RAH are located at the same hierarchy level, i.e. are separated from the CEO by the same number of hierarchical levels. It is often the case that FAH may delegate real authority to RAH located in different department. As various departments have hierarchical structures of various depths, our dataset contains few cases when FAH delegates real authority to RAH from another department where RAH is separated from the CEO by fewer layers and therefore appears on a higher hierarchy level than FAH. Because these cases do not concern delegation of real authority to functional superior from the same department (e.g. to direct boss), but to specialists from other departments, we recoded such hierarchical span to 0, as such coding is conceptually equivalent to delegation of real authority to specialists from the same hierarchical level.

Independent variables

Hypothesis 1a (H1a) and Hypothesis 1b (H1ba) predict the effects of information overload of FAH on our measures of decentralization. We capture information overload by counting the number of individual decisions that the FAH of a task is responsible for (**Number of FAH’s decisions**). We obtain that measure by identifying the job title of a task’s FAH on the responsibility chart and counting for how many tasks in the responsibility chart that job title carries the task assignment of being “responsible”.

Hypothesis 2a and 2b refer to the effect of knowledge specialization required for decision making on decentralization of decision authority. We code required knowledge specialization by conducting content analysis of task description. We code binary variable specialized knowledge as 1 when task decision making requires specialized knowledge (e.g. related to engineering expertise, tax or export regulations etc.) and as 0 when task decision making relies on general knowledge (e.g. tasks related to coordination, administrative assignments that can be performed without prior specialist training, etc). Finally, H3a and H3b predict the effect of FAH having expertise that is relevant / necessary for task decision making on decentralization. In order to code **knowledge-expertise match,** we conduct content analysis of task description as well as of job description of FAH's job title. We check whether knowledge domain required for task decision making matches the expertise domain of job description of FAH and code 1 when match takes place and 0 otherwise.

Control variables

We include several control variables to account for changing characteristics. We control for the sequential ordering of tasks by grouping them in accordance with what is described in the process handbook. The descriptions reflect the sequential nature of tasks in the business process, where clusters of tasks must be completed before specified milestones. Tasks are arranged into three consecutive project stages: project planning, execution and completion. These phases are important as planning and completion stages naturally require greater centralization for the purpose of maintaining overview over whole project, while decision related to project execution may be delegated to various specialists. *Year2010 and Year2011* are dummy variables coded as 1 for tasks in the 2010 and 2011 responsibility charts respectively. Lastly, we control for business

unit, as BU delivering offshore wind farms faces greater environmental complexity than BU responsible for onshore wind farms. Table 2 provides an overview of our variables.

Insert Table 2 about here

Methods

We use a two-step Heckman selection estimation procedure (Heckman 1979, Greene 2003) since it is useful for handling linear regression models when there is a self-selection bias arising from using a non-randomly selected sample. In our study, this is the case for delegation span which we only can observe for the sample of decisions for which the firm decided to split formal and real authority between two individuals.

Step one of the Heckman model estimates the selection equation which is the Probit equation estimation of the likelihood of authority split between FAH and RAH. The results from step one regression are reported in Table 5. The second step of the Heckman model then estimates the outcome equation, i.e. it estimates delegation span. Since delegation span can only be measured for decisions where authority has been split, the sample size in step 2 is reduced from N=761 to N= 293.We report results from the step two regression in Table 6.

RESULTS

We tabulate descriptive statistics and correlations of our variables in Tables 3 and 4.

Insert Table 3 about here

Insert Table 4 about here

We turn our attention, first, to Hypothesis 1a. Recall that H1a predicted that increases in number of decisions under responsibility of RAH would be positively related to the likelihood of authority split between FAH and RAH. Table 5 reveals our analysis in which the dependent variable is the authority split between FAH and RAH.

Model1 shows significant positive effect of the number of decisions under responsibility of FAH on to the likelihood of authority split ($p<0.01$). Thus, managers delegate real decision authority to other individuals when they are responsible for many decisions, thereby reducing their risk of information processing overload. This result lends support to Hypothesis 1a and is aligned with the argument that boundedly rational decision makers reduce their cognitive burden by sharing decision-making with RAH.

Hypothesis 1b predicted that increases in the number of decisions under responsibility of FAH would be negatively associated with delegation span between FAH and RAH. Model 1 in Table 6 shows a significant negative coefficient ($p<0.01$), thereby yields support to H1b: information overload of the FAH makes her inclined to delegate decision authority, however, she delegates to individuals positioned on adjacent hierarchy levels. As short hierarchical distance

makes it easier for FAH to observe and supervise RAH's actions, it is conductive to maintaining control over decisions despite the delegation.

Having interpreted how information overload affects our measures of delegation, we now move to analyzing the impact of knowledge specialization. Hypothesis 2a predicted that specialized nature of knowledge required for decision making would be positively related with authority split between FAH and RAH, while Hypothesis 2b predicted its positive effect on delegation span. Positive and significant ($p<0.01$) effect of knowledge specialization in table 5 yields support for H2a, what shows that when decision making requires narrow expertise, authority holders seek to increase decision quality by delegating real decision authority to experts. We do not find a significant effect of knowledge specialization on delegation span, which leaves H2b not supported. This result indicates that FAH searches for specialized knowledge of experts , regardless of their location in the organizational hierarchy. This does not support the reasoning that long delegation span would motivate experts to exert initiative. We further explore this relationship by analyzing the interaction effects of knowledge specialization and the number of decisions on delegation span.

Model 7 in Table 6 shows a positive ($p<0.01$) main effect for knowledge specialization, a non-significant main effect of the number of FAH's decisions, and a positive interaction effect ($p<0.01$). This shows that at medium and low levels of FAH's decision load, knowledge specialization has a positive effect on delegation span; it's magnitude decreases with increasing number of decisions under the responsibility of the FAH. This result qualifies the relationship which we propose in H2b. It shows that high delegation span serves as a motivational device for promoting RAH's initiative by signaling no intention to intervene in decisions that have been delegated to a specialist RAH. This only holds when the cognitive capacity of FAH is not

overloaded by the amount of decisions to be made. When the number of decisions that FAH is responsible for increases to high levels, the effect reverses and specialization of required knowledge becomes negatively associated with delegation span. This result indicates that when FAH faces the risk of information overload, she tends to focus on control, as opposed to promoting RAH's initiative, and seeks for communication with experts that are located closer in the hierarchy.

We now move to testing the hypotheses predicting the impact of existing match of required knowledge with FAH's expertise on delegation. We hypothesize that overlap of FAH's knowledge with knowledge domain required for decision making is negatively related with the likelihood of authority split (H3a) and negatively related with delegation span between FAH and RAH (H3b). Negative and significant ($p<0.01$) effect in table 5 yields support for H3a, confirming that FAH is indeed less likely to delegate if he/she already possesses the necessary knowledge resources, While the analysis presented in table 6 shows only a marginally significant result ($p<0.1$), showing a weak support for H3b. We investigate this further through the interaction effects of knowledge-expertise match and number of decisions under responsibility of RAH.

Both variables knowledge-expertise match and the number of decisions are associated with short delegation span. There is, however, a positive interaction effect between them ($p<0.001$), which is presented in Model 6 in Table 6. When FAH's decision load is low, then the presence of knowledge-expertise match has a negative effect on delegation span, which is aligned with the main effect of knowledge-expertise match on delegation span illustrating no need for delegation when relevant knowledge is in place. The magnitude of this effect however becomes smaller as the number of decisions increases and FAH faces a high number of decisions. This shows that the

effect of knowledge-expertise match reversed at high levels of decisions under FAH's responsibility. When FAH is at a high risk of information overload, he delegates decisions far down the organizational hierarchy to the appropriate experts despite having relevant knowledge him/herself, which should encourage them to exert initiative to utilize own knowledge in decision-making. Having relevant knowledge allows FAH to understand and evaluate delegated decisions regardless of communication difficulties arising from large delegation span. These results demonstrate that as information overload increases, it becomes a stronger driver of delegation, while FAH's knowledge provides a notion that helps to maintain control over delegated decisions, thereby counteracting the agency costs.

Interpretation of control variables

We now interpret the effects of the control variables on the likelihood of authority split between FAH and RAH in Tables 5 and 6. Controlling for phases of the business process reveals that decisions made in the project execution phase, as opposed to project planning and project closure, tend to involve authority split between FAH and RAH. This is intuitive as tasks related to execution of individual milestones in the business process are delegated more readily than decisions related to planning, which requires high coordination efforts, as well as to project closure, which requires overview and monitoring of results and their contribution to the overall project performance. Decision authority in business unit operating in the offshore wind farm market which represents more complex environment tends to be split more frequently than authority in onshore business unit (Table 5). Offshore business does not have a significant effect on the extent of delegation span (Table 6). Year dummies are not significant predictors of authority split between FAH and RAH (Table 5), however, their significant negative effect in

Table 6 reveals that the firm adopted shorter delegation span in second and third year of analysis as compared to the initial organization design from year 2008.

DISCUSSION AND CONCLUSIONS

This paper finds that firms strategically use delegation to balance the tradeoff between encouraging better utilization of distributed local knowledge while maintaining control over delegated decisions and managing managerial attention and capacity. Delegation is fundamentally rooted in how the organization distributes formal and real authority and designs an effective division of labor. Delegation serves as an adaptive organizational mechanism to manage information flows and expertise across hierarchies. Delegation is critical in complex task structures to both facilitate and restrict information flows necessary to complete tasks within an adaptive organization. We contribute to several streams of research that study delegation. First, while much of the agency literature analyses singular principal-agent dyads of delegation in isolation (e.g. Dessein, 2002; Harris and Raviv, 2005; Holmstom, 1979), we shed light on delegation of multiple, interdependent decisions which are most prevalent in medium and large organizations. The interrelatedness of delegations poses organizational problems because of the need for coordination among decisions (e.g. Rantakari 2012, coordination among divisions Mintzberg 1979, classics), or information overload of boundedly rational individuals (e.g. Aghion and Tirole 1997, Galbraight 1974). We add to that literature by demonstrating how managerial overload changes the way the firm uses delegation across hierarchies in knowledge-driven complex task structures. We show that the decisions whether to delegate and how to

delegate are based on distinct knowledge conditions that fundamentally shape organizational decision structures.

Our key finding shows that the effect of knowledge-related variables on delegation span is reversed at high levels of FAH's decision overload. Specifically, we find that high decision load of FAH reverses the effect of the relevance of FAH's knowledge domain and of knowledge specialization on delegation span. This result demonstrates that information processing is a factor that augments the effect of knowledge on delegation. Increasing number of decisions under the responsibility of an individual FAH poses constraints on her cognitive capacity, and changes organizational response to knowledge-based delegation. These results uncover the conditions under which firms prioritize the enhancement of employee initiative (Rantakari 2012, Aghion & Tirole 1997, Gagné & Deci, 2005, Benabou & Tirole, 2003), actively design organizational attention (Ocasio, 2011 and Gavetti et al., 2012), and control (Jensen & Meckling 1976, 1992, Aghion & Tirole 1997) co-dependent decisions in complex decision structures.

Our findings contribute to the body of literature which departs from stylized principal-agent delegation-models, and focuses on motivational effects of delegation (Rantakari 2012; Foss, Foss and Vazquez, 2006; Benabou & Tirole, 2003; Gagnè & Deci, 2005). This stream of research finds that delegation and reduced managerial involvement motivate employees to exercise initiative and to exert effort into utilizing own knowledge in decision-making, thereby allowing the firm to benefit from its distributed knowledge resources to a greater degree. We extend this research by showing how a firm strategically uses delegation to enhance employee initiative for some tasks while prioritizing control over initiative for other tasks. These insights are important in the context of organizational attention (Ocasio, 1997, 2011, 2012 and Gavetti et al., 2012),

since they provide concrete, empirically measurable mechanisms and boundary conditions that show how an organization finetunes attention in its adaption process.

We extend research based on Aghion and Tirole's (1997) seminal paper which builds a theory of formal and real authority in organization. Aghion and Tirole analyze the effect of FAH's decision overload on delegation and find that it is optimal for firms to be in a situation of FAH's overload, as overseeing each additional decision increases the cost of monitoring and therefore reduces FAH's oversight of RAH, what in turns provides a credible commitment to rewarding RAH's initiative. This finding shows that FAH's overload positively affects RAH's effort to utilize her knowledge in decision making. While Aghion and Tirole focus on the role RAH's knowledge in the situation of overload, we add to these findings by analyzing the role of knowledge held by FAH. Our analysis shows that there is a "tipping point" beyond which decision overload flips the role that FAH's knowledge plays in delegation. While under low decision load FAHs with relevant knowledge use their knowledge to easily evaluate RAH's decision because of a short delegation span, FAHs abandon that control mechanism under high overload and use long delegation span. Long delegation span implies that using own knowledge to assess FAH's decision is more problematic due to long informational/hierarchical distance, therefore FAH's knowledge no longer serves as a monitoring device when information/decision overload is high. On the contrary, long delegation span signals to employees that monitoring by FAH is difficult, which serves as a motivational mechanism for the employee. This empirical finding is aligned with the formal model of Aghion and Tirole and demonstrates that a firm uses delegation span to promote RAH's effort/initiative in decision making in the situation of overload.

This paper contributes to the empirical literature on delegation, and more broadly, on organization design and firm adaptation. Although this study provides a novel attempt to empirically analyze delegation of multiple, interdependent decisions at this level of granularity, its contribution should be assessed in the light of its limitations. Due to data limitations we were not able to investigate the effect of incentives on delegation. While this study provides novel insights based on a study of a single firm, it invites future research on delegation of formal and real authority that employs large sample research design that could test the generalizability of our findings across firms and industries.

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TABLE 1

Overview of prior research making a distinction among degrees of decision making-authority to individuals within an organizational hierarchy

Authors	Degrees of decentralization	Definitions and operationalizations of key decentralization constructs	Dependent variable	Methods
Aghion & Tirole 1997*	Formal and real authority	Formal authority is the right to decide. Real authority is the effective control over decisions; it is determined by the structure of information. A principal who has formal authority over a decision can always overrule the subordinate but will refrain from doing so if the subordinate is much better informed and if their objectives are not too contradictory. Real authority can be exercised either by agent or the principa. The principal has both formal and real authority over decision if she is informed and can fully dispense with the agent's information and recommendation. The agent has real authority when poorly informed principal optimally rubber-stamps the agent's proposal.	Decentralization	Formal model
Mihm et al. 2010	Centralized and coordinating hierarchy	Centralized hierarchy - subordinate suggests proposals which the manager accepts or rejects. Coordinating hierarchy (decentralization) – manager does not make decisions directly, only ensures that solutions proposed by subordinates are mutually compatible.	Firm performance, solution stability, solution quality, search speed	Agent-based simulation
Siggelkow & Rivkin 2005*	Several degrees of decentralization	Several degrees of decentralization ranging from full delegation of authority to department heads to make decisions without seeking approval from superiors to full centralization, where all decisions are made by a single, central individual. The degrees of centralization depend on the power granted to department heads, which arises from four elements: generating alternative solutions, screening of department alternatives before sharing them, setting agendas for coordination meetings, veto power.	Firm performance, speed of improvement, diversity of search	
Rivkin & Siggelkow 2003*	Active and rubberstamping hierarchy	Active hierarchy (centralization)- Subordinate suggests proposals which the manager accepts or rejects. Rubberstamping (decentralization) – manager approves subordinate's proposals without review and subordinate managers have full autonomy over decisions in their departments. Managerial ability and flow of information between CEO and subordinate managers affect the degree of decentralization.	Firm performance (short run and long run), search and stability	
Chowdhury 2011	5 degrees of decentralization	Delegation of authority measured on a 5-point scale the as extent to which employees at the customer interface have the authority to make each of specified decisions.	Firm performance	Empirical study, survey data, or/ and structured interviews; regression analysis
Bloom et al. 2010a, b	5 degrees of authority delegation	The degree of authority delegation measured on a 5-step Likert scale ranging from no delegation to complete authority delegation for particular types of decisions by asking which of 4 types of decisions plant manager can take without prior authorization from the central headquarters.	Decentralization	
Acemoglu et al. 2007	4 degrees from "full" to "no" autonomy	A distinction whether the plant manager has "full" or "important" authority vs. "limited" or "no" autonomy in making investment decisions independently of central headquarters..	Decentralization	
Colombo & Delmastro 2004, 2008	centralization, partial delegation and full delegation	Partial delegation of decision authority is operationalized as an arrangement where an agent is in charge of the decision, but formal authorization of the superior is required. In case of full delegation of decision authority, decisions are taken autonomously by an agent with no intervention of the superior.	Decentralization	
Vazquez 2004	degrees of authority delegation	Decentralization is measured on 3-point scale as the degree to which certain decisions are made by the top management or taken by the workforce itself.	Decentralization	
Collins et al. 1999*	Formal authority and influence	Locus of formal *authority* is the hierarchy level of a person empowered to make given decisions/ take action without consultation with supervisors, or the level at which an	Decentralization of authority and influence	

		exception could be made. The locus of *influence* is the hierarchical position of the lowest-ranking participant in the decision-making process who gave information/advice requiring the use of discretionary judgment.		
Lincoln et al. 1986*	Formal and informal authority	Formal authority is the hierarchical level at which formal authority to make given decisions is assigned. Informal authority is the level at which decisions are usually made in practice.	Decentralization of formal and informal authority	

*studies that explicitly address the determinants or implications of various degrees of authority delegation

TABLE 2

Overview of variables

Variable name	Variable description	Format
Dependent variables:		
Authority split between FAH and RAH	Coded as 1 when formal and real decision authority over task is split among two individuals. Formal authority is derived from code "responsible" on the responsibility chart, and real authority denotes code "executes" a task.	Binary, 0-1
Delegation span	Count of hierarchical layers separating FAH and RAH. 0 means FAH and RAH at the same hierarchy level or RAH higher in the hierarchy located in different department (no direct subordinate-superior relationship). 1 means RAH is one level lower than FAH, etc. Increasing values signify greater distance.	Scale 0-3
Independent variables:		
Number of FAH's decisions	Number of decisions under responsibility of FAH	Count, 1-110
Specialized knowledge	Coded as 1 when knowledge required for task-decision making is of specialized nature.	Binary, 0-1
Knowledge - expertise match	Binary variable coded as 1 knowledge domain of FAH overlaps with knowledge domain required for task-decision making	Binary, 0-1
Control variables		
Phase planning	Coded as 1 when task belongs to the planning phase of the business process (out of three project phases: planning, execution, completion)	Binary, 0-1
Phase execution	Coded as 1 when task belongs to the execution phase of the business process	Binary, 0-1
Offshore	Coded as 1 for offshore wind farms business unit which operates in more complex environment than onshore wind farms BU	Binary, 0-1
Year 2010	Coded as 1 for tasks from the 2010 responsibility charts	Binary, 0-1
Year 2011	Coded as 1 for tasks from the 2011 responsibility charts	Binary, 0-1

TABLE 3

Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Authority split between FAH and RAH	761	.386	.487	0	1
Number of FAH's decisions	761	57.420	42.069	1	110
Delegation span	761	.173	.490	0	3
Specialized knowledge	761	.220	.414	0	1
Knowledge overlap	761	.707	.455	0	1
Phase planning	761	.452	.498	0	1
Phase execution	761	.356	.479	0	1
Offshore	761	.414	.492	0	1
Year 2010	761	.385	.487	0	1
Year 2011	761	.437	.496	0	1

TABLE 4

Correlation table

	deleg~wn	split	task_l~h	task_n~e	task_g~h	offshore	year10	year11	phase_~n	phase_~c	offshore
delegatio~wn	1.0000										
split	0.2931*	1.0000									
task_load_~h	-0.0439	0.1739*	1.0000								
task_narow~e	0.0495	0.0807*	-0.2214*	1.0000							
task_good_~h	-0.1062*	-0.2505*	-0.2295*	-0.1380*	1.0000						
offshore	0.0697	0.0739*	-0.3268*	-0.0043	0.0906*	1.0000					
year10	0.0258	0.0654	-0.1243*	0.0127	-0.0099	0.1403*	1.0000				
year11	-0.0497	-0.0250	0.0517	-0.0246	0.0700	0.1560*	-0.6993*	1.0000			
phase_plann	-0.1401*	-0.0856*	0.1165*	0.0236	0.1058*	-0.0079	0.0139	-0.0186	1.0000		
phase_exec	0.1310*	0.1309*	-0.2597*	0.0318	-0.1270*	0.0099	0.0321	-0.0140	-0.6769*	1.0000	
offshore	0.0697	0.0739*	-0.3268*	-0.0043	0.0906*	1.0000*	0.1403*	0.1560*	-0.0079	0.0099	1.0000

TABLE 5

Heckman regression, stage 1: predictors of decision authority split between FAH and RAH

VARIABLES	(1)	(2)	(3)	(4)
	Authority split between FAH and RAH			
Number of FAH's decisions	0.010***	0.005**	0.010***	0.010***
	(0.001)	(0.003)	(0.002)	(0.002)
Specialized knowledge	0.387***	0.416***	0.443**	0.288
	(0.123)	(0.125)	(0.194)	(0.201)
Knowledge –expertise match	-0.473***	-0.915***	-0.481***	-0.514***
	(0.111)	(0.223)	(0.113)	(0.131)
Phase planning	0.110	0.100	0.109	0.119
	(0.136)	(0.134)	(0.136)	(0.136)
Phase execution	0.628***	0.601***	0.625***	0.624***
	(0.146)	(0.147)	(0.147)	(0.147)
offshore	0.500***	0.493***	0.504***	0.505***
	(0.117)	(0.117)	(0.117)	(0.118)
year10	0.237	0.250*	0.235	0.230
	(0.151)	(0.152)	(0.151)	(0.152)
year11	0.032	0.052	0.027	0.024
	(0.151)	(0.151)	(0.151)	(0.152)
Number of FAH's decisions *match		0.006**		
		(0.003)		
No of FAH's decisions * Speci.knowledge			-0.001	
			(0.003)	
Match* Specialized knowledge				0.162
				(0.268)
Constant	-1.238***	-0.893***	-1.249***	-1.214***
	(0.228)	(0.273)	(0.230)	(0.232)
Constant, athrho	-0.138	-0.295	-0.142	-0.023
	(0.247)	(0.205)	(0.268)	(0.353)
Constant, lnsigma	-0.609***	-0.582***	-0.601***	-0.607***
	(0.047)	(0.055)	(0.048)	(0.042)
Observations	761	761	761	761

TABLE 6

Heckman regression, stage 2: predictors of delegation span

VARIABLES	(5)	(6)	(7)	(8)
	Delegation span			
Number of FAH's decisions	-0.003***	-0.007***	-0.001	-0.004***
	(0.001)	(0.002)	(0.001)	(0.001)
Specialized knowledge	0.058	0.086	0.399***	0.202*
	(0.081)	(0.087)	(0.136)	(0.106)
Knowledge –expertise match	-0.139*	-0.549***	-0.158*	-0.052
	(0.082)	(0.168)	(0.084)	(0.089)
offshore	0.092	0.108	0.119	0.081
	(0.084)	(0.095)	(0.084)	(0.082)
year10	-0.334***	-0.311***	-0.327***	-0.329***
	(0.107)	(0.110)	(0.106)	(0.106)
year11	-0.354***	-0.316***	-0.373***	-0.338***
	(0.105)	(0.104)	(0.103)	(0.105)
Number of FAH's decisions *match		0.006***		
		(0.002)		
No of FAH's decisions * Spec.knowledge			-0.006***	
			(0.002)	
Match* Specialized knowledge				-0.306**
				(0.147)
Constant	0.950***	1.088***	0.778***	0.940***
	(0.218)	(0.317)	(0.238)	(0.206)
Observations	293	293	293	293