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## COORDINATION AND ORGANIZATION DESIGN: THEORY AND MICRO-EVIDENCE.

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## Abstract

We explore the relationship between the volatility of a firm's local environment, the need for coordination among sub-units, and a firm's organizational structure. Using micro-level data on a large retailer, we empirically test and provide support for our hypothesis that a more volatile local environment results in more decentralization only when coordination needs are small or moderate. In contrast, more local volatility is associated with more centralization when coordination needs are high. Our evidence supports theories that argue that centralized organizations are better at coping with local shocks when coordinated adaptation is important.



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# Coordination and Organization Design: Theory and Micro-evidence.*


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**Abstract**

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# 1 Introduction

The use of authority is a central feature of the way firms coordinate the production and provision of goods and services (Coase 1937; Simon 1951; Williamson 1975). While top managers are endowed with formal authority, they are unable to master all relevant information. As a result, they delegate tasks and responsibilities down the hierarchy to divisional managers, department managers, and so on.

Seminal economic theories on why firms delegate authority emphasize the need to adapt decisions to local information (Holmstrom 1979; Aghion and Tirole 1997; Dessein 2002). In the spirit of Hayek (1945), lower-level managers are assumed to have better information than top managers as they are closer to the firm's field operations.[1]

However, as asserted by the organizational theorist Chester Barnard (1938), what matters for organizational performance is not just autonomous adaptation to local shocks and emergent events, but also the ability to engage in what Williamson (1996, 2002) calls "coordinated adaptation". Centralized organizations may be better at such coordinated adaptation. Intuitively, despite having superior local knowledge, lower-level managers may only be able to act individually on this information. But doing so potentially results in large coordination losses for the organization (Dessein and Santos 2006; Alonso, Dessein, and Matouschek 2015).[2] Similarly, comparing centralized to decentralized decision-making structures, Aoki (1986) posits that the ability of sub-units to cope with emergent events and make use of their on-the-spot knowledge is "limited by their partial understanding of the whole mechanism operating within the firm" (p.973).[3] Incentive conflicts may also play a role: lower-level managers tend to care mainly about the performance of their particular department or unit. The need for coordination then

[1]Barnard (1938), for example, defines a formal organization as "a system of consciously coordinated activities or forces of two or more persons."

[2]As argued by Alonso, Dessein, and Matouschek (2015), while lower-level managers may have better information about shocks affecting their own unit and therefore have an advantage in terms of depth of knowledge, central management may well know more about other units and therefore have an advantage in terms of breadth of knowledge. When coordinated adaptation is essential, breadth of knowledge is more valuable than depth of knowledge.

[3]Aoki (1986) argues that central management has "perfect a priori knowledge of technological possibilities" but has incomplete knowledge of "emergent events affecting these technologies". In contrast, sub-units have incomplete knowledge of technologies at the outset, but have better on-the-spot knowledge about emerging events (p. 971).

creates an agency problem in adaptation and may result in centralization, even when local information is valuable (Alonso et al. 2008; Rantakari 2008).

Drawing on the above theories, we put forward, and empirically test, the hypothesis that a more volatile local environment results in more decentralization only when needs for coordination across sub-units are small or moderate. In contrast, we expect to see an association between more local volatility and more centralization when coordination needs are high. Our theoretical model differs from existing theories in that we examine the differential impact on organization design of an increase in the volatilty of the local environment, compared to an increase in asymmetric information about this environment. Indeed, our model predicts that an increase in asymmetric information about a given environment always results in more delegation, whereas the impact of an increase in the volatility of this environment depends on the need for coordination. As far as we know, we are the first to formally put forward the latter hypothesis.[4]

Despite being central to firms' operations, empirical evidence on the responsibilities and decision-making authority of managers is limited and has lagged our understanding of other organizational choices, such as firm boundaries and the provision of incentives in firms.[5] To empirically examine the relationship between the volatility of a firm's local environment, the need for coordination of sub-units and the firm's organizational structure, we analyze a novel hand-collected data set that contains rich micro-level information on the job scope and authority of 189 managers employed by a larger retailer. Our usage of individual-level data sheds more light on the exact mechanisms which drive managerial authority, and distinguishes us from previous empirical work which

[4]Acemoglu et al. (2007) focus on the impact of informational asymmetries on organization design. Building on a literature that emphasizes a trade-off between a loss of control and a loss of information (Aghion and Tirole 1997; Dessein 2002), they show how a firm becomes more centralized as there is more publicly available information or when it is easier for the principal to learn about the local environment. Alonso et al. (2015) derive comparative statics with respect to the need for adaptation to a given local environment, and show how these depend on the need for coordination. In their model, an increase in local volatility increases both the need for coordination and the need for adaptation. As such, it has no impact on organization design. Finally, Rantakari (2013) argues that firms operating in more volatile environments tend to be more decentralized. In his model, the need for coordination is a choice variable and firms optimally choose to be more loosely integrated in more volatile environments.

[5]For empirical tests of incentive theories inside firms, see e.g. Lazear (2000), Bandiera, Barankay, and Rasul (2007), Lo, Ghosh, and Lafontaine (2011), and Larkin (2014), and Prendergast (1999) for a survey. For empirical tests of vertical integration theories, see e.g. Hubbard (2001), Gil (2009), and Forbes and Lederman (2009), and Lafontaine and Slade (2007) for an overview.

has used establishment or firm-level data in a cross-section of industries (Colombo and Delmastro 2004; Acemoglu et al. 2007; Bloom, Sadun, and Van Reenen 2012; Bloom et al. 2014; Lo et al. 2016). Our study is also the first to provide direct evidence on the impact of local volatility on the job scope and authority of middle-level managers.

In our study, we equate local volatility with the unpredictability of local demand, sales, or profits faced by an individual manager. While local volatility has, on average, no significant correlation with managerial authority,[6] we find a large positive association when coordination needs are limited, but a negative association with managerial authority when coordination is very important. In all our regressions, this negative interaction effect between local volatility and the need for coordination on managerial authority is highly significant. We interpret these results as supportive of our hypothesis and, more generally, of organizational theories that emphasize trade-offs in organization design between adaptation and coordination.

## 1.1 Institutional Context

The institutional context of our study is one of the largest retail operators in the world with a focus in Japanese and Asian markets. Our data pertains to twelve large general merchandise stores ("stores" hereafter) located within a metropolitan area of Tokyo.[7] Each of our 189 managers are uniquely responsible for one of 24 departments within one of these twelve stores. Examples of departments include kid's apparel, lady's wear, home furnishing, cosmetics, grocery, deli, ecommerce, and customer service. We find qualitatively similar results when we exclude departments (e.g., customer service) that do not generate sales revenue.

Each store is managed by a general manager ("store manager"), to whom the department managers report. Performance evaluations of those managers are explicitly tied to the performance of the department assigned to them. In contrast, the store manager is responsible for the overall mall performance.

[6]Depending on the measure of local volatility, the correlation with task delegation is either weakly (non-significant) positive or weakly (non-significant) negative.

[7]We provide exact definition and detailed summary on these general merchandise stores in sub-section 4.1.

Our empirical context is appealing to test our theory for two major reasons. First, all the twelve stores are located within proximity (all contained in a 25-mile radius circle) and under the administration of the same regional headquarters in Tokyo. As such, the same unobserved heterogeneity in macroeconomic, technological, or cultural factors would affect, if at all, managerial task allocation and authority. Moreover, uniform policies on management, personnel, and compensation structure eliminate variations at the corporate level, which in turn increases the reliability of our analysis relative to a multi-corporation study. Second, each of the 24 departments covers a distinct product or service but may involve frequent coordination with other departments, for instance, on pricing, promotions, merchandise and inventory, or customer service. With a shared environment and rich micro-level data, our "insider econometrics" study (Ichniowski and Shaw 2013) provides an appealing context to examine managerial issues related to the way organizations coordinate sub-units, delegate tasks to managers, and cope with uncertainties.

For each of the department managers, we survey data regarding their responsibilities and authority with respect to fifteen tasks. Examples of tasks include sales, merchandise, ecommerce, pricing, training, and so on. To measure managerial authority, we collected data on the job scope of each department manager in terms of the number of tasks delegated to her. Concretely, the company provided us with fifteen tasks which a manager's job may be involved in. The job scope of a manager, however, typically only includes a subset of the fifteen possible tasks. On average, the task allocation of a given manager consists of just 11.3 tasks out of fifteen. For example, a manager may not have any responsibility for ecommerce or training. Importantly, there is a substantial variance in the job scope of a department manager: the standard deviation is just above four tasks. We view the job scope of a manager as a central measure of a manager's authority as it is both a relative objective measure and the clearest indication of a manager's authority. A task not being part of a manager's job is the ultimate sign of a lack of authority and responsibility. Other empirical papers which partially use job design and task allocation are Bloom, Sadun, and Van Reenen (2012), who survey manufacturing managers to see if they have responsibilities for marketing and sales decisions.[8]

[8]Among theory papers, see Dessein, Garicano, and Gertner (2010) for a model that explicitly analyzes which functions should be centralized at headquarters, and which ones should be decentralized at the

As a proxy for the need for coordination, we have survey data, for each department manager, on how important coordination between different departments and functional managers is to successfully perform her job as a whole. As a proxy for the volatility of the local environment, we have survey data, for each department manager, on the volatility of local demand and its impact on her overall job in terms of sales and profits. We are also able to construct alternative, objective measures of sales volatility by taking advantage of departmental transaction data. Our preferred objective measure uses the (average absolute) difference between actual monthly sales and planned monthly sales (or sales goals). This neatly captures the unpredictability of local sales. As a robustness check, we further use a measure that only relies on actual sales (that is month-to-month sales changes).

## 1.2 Additional analysis

While our main measure for managerial authority is the overall job scope of a manager – namely overall task delegation, we also glean insights in the mechanism behind our results by dissecting the fifteen tasks in two categories, based on how much coordination they require with other departments in the same store. Concretely, we identified five tasks – including marketing, customer service, and ecommerce – that required much more coordination than average, as reported by the department managers. We refer to those as functional tasks, and the remainder – for instance, sales, pricing, personnel management – as departmental tasks. We obtain two results. First, consistent with existing theories (Alonso et al. 2008; Dessein, Garicano, and Gertner 2010), these five functional tasks are, on average, more likely to be centralized than the ten departmental tasks. Second, if one excludes these five coordination-intensive tasks from the data, the negative interaction effect between local volatity and the need for coordination (at the job-level) becomes non-significant.[9] Similarly, when coordination is important for the whole job, we only find a negative effect of local volatility on delegation for the subset of tasks that are coordination-intensive. Intuitively, it is only for those tasks that coordinated adaption is important. All our main analysis above controls for store fixed effects,

division level.

[9]See sub-sections 4.2.2 and 5.5 for detailed descriptions of - and the difference between - need for coordination at the job-level and at the task-level.

experience, education, age, and gender of managers. Not surprisingly, experience is an important driver of task delegation.

We also perform a couple of robustness checks. First, we find similar qualitative results when we use department fixed effects, even though some departments (e.g. deli, groceries, fish, processed meats) receive significantly more task delegation than others (e.g. pharmacy). Second, to control for sorting of workers into jobs, we include personality traits in our regressions such as "agreeableness", "risk loving", and "career aspiration." Again, our results are robust though managers with a high "agreeableness" may sort into jobs that are more coordination intensive, whereas "'risk-loving" managers tend to match with jobs facing more local volatility. Managers with a higher score for "career aspiration" may ask for – and receive – more delegation of authority.

To conclude our analysis, we test a final prediction of our theory. Keeping the volatility of local shocks fixed, an increase in the center's cost of information acquisition or a decrease in the center's ability to learn about a local shock, should always result in more delegation, even when the need for coordination is high. To test this hypothesis, we construct a proxy, namely experience difference, for how difficult it is for the center to ascertain local shocks. It is reasonable that a superior manager who is relatively inexperienced to a department manager will be less capable to understand and assess local shocks. Consistent with the prediction of our theory, we find a significant positive effect of experience difference on delegation, and only a small, non-significant interaction effect with the need for coordination. In contrast, for the same set of departments, local volatility has a significant positive effect on delegation only when the need for coordination is small (and a negative marginal effect when coordination needs are high). As such, our results extend and complement studies such as Baiman et al. (1995), Acemoglu et al. (2007), and Huang (2017) where, like our experience difference measure, they focus on examining the unambiguous effect of the information disadvantage of central management on the propensity to delegate.

Conceptually, the volatility of local shocks and asymmetric information about local shocks capture different aspects of 'local information' (Hayek 1945). The contribution of our paper is to show how an increase in local volatility may have very different consequences for organization design compared to an increase in asymmetric information.

# 2 Literature Review

## 2.1 Determinants of delegation

Empirical studies on the determinants of delegation have been relatively scant, but often focus on measures of local information. In one early study, Baiman et al. (1995) shows that managers whose business unit is in a different 2-digit SEC code as their parent are delegated more authority. Acemoglu et al. (2007) find that firms closer to the productivity frontier or firms who are operating in more heterogeneous industries (as measured by heterogeneity in productivity growth) are more likely to be decentralized. Recently, Huang et al. (2017) shows how state-owned-enterprises in China are more likely to be decentralized when the distance to the government is farther. The proxies for local information used in the above studies mainly measure the information disadvantage of central management – that is how difficult it is for headquarters to be informed about local circumstances. In contrast, our measures of local volatility capture the unpredictability and variations of the local environment itself. As our theoretical model shows, higher information costs or a lower ability to assess local shocks for central management always results in more decentralization. In contrast, the impact of an increase in local volatility has an ambiguous impact on decentralization and depends on the need for coordination.

A number of other studies provide indirect tests of the impact of local information, for example by examining the impact of product market competition (Bloom, Sadun, and Van Reenen 2010; Meagher and Wait 2013), information and communication technology (Colombo and Delmastro 2004; Guadalupe, Li, and Wulf 2013; Bloom et al. 2014) or the experience of salespeople (Lo et al. 2016). Still others have studied the role of firm and plant size (Colombo and Delmastro 2004; McElheran 2014) and cultural aspects such as trust (Bloom, Sadun, and Van Reenen 2012). While the trade-off between adaptation and coordination plays a central role in the recent theories of organizational design, there are few papers that consider the impact of the need for coordination. One exception is McElheran (2014) which studies the delegation of decision rights over IT investments across establishments and firms. Whereas she observes more delegation in establishments that contribute more to firm sales, she finds less delegation in establishments whose production is more integrated with the rest of the firm.

As noted above, all of the above research uses firm-level or establishment-level data in a cross-section of industries, typically manufacturing firms. This stands in contrast with many influential studies on the provision of incentives in firms, which often focus on data from one establishment.[10] Similarly, recent empirical work on vertical integration decisions has tended to focus on a single industry (e.g., Hubbard 2001; Gil 2009; Forbes and Lederman 2009).

## 2.2 Japanese employment features

While not its main contribution, our paper adds to the understanding of Japanese employment practices. Close coordination among same rank peers is a distinct characteristic of Japanese companies. Aoki's (1986) pioneering study formalizes the comparison between American-style and Japanese-style firms as one of vertical control versus horizontal coordination respectively. He observes that American firms are apt to stipulate clear job descriptions, rules and operation manuals for employees to follow, and focus on specialization and hierarchical control to attain efficiency. In contrast, Japanese firms tend not to be specific about descriptions of daily tasks, but emphasize the capability of employees to cope with uncertainties through learning by doing. Their focus is on the use of on-the-spot knowledge and horizontal coordination by sub-units (p. 973).

Similarly, Nonaka (1994) identifies learning on the spot as a key feature of Japanese management. He conceptualizes that lower-level employees first acquire information and knowledge through their daily activities and coordination and then the acquired knowledge is codified and formalized at the organizational level. As such, Japanese firms are more likely to accord a higher degree of task authority to lower level employees. Morita (2005) also notes that, unlike American firms, Japanese firms frequently use job rotations and on-the-job training to enrich employees' experiences and expand their skill set. These practices generate "multi-skilled" employees who work efficiently with one another to cope with emergent events (p.70).

[10] See, for example, Baker, Gibbs, and Holmstrom (1994), Lazear (2000), Bandiera, Barankay and Rasul (2007). For more recent "within-firm" studies, see Larkin (2014), Friebel et al. (2017) and Frederiksen, Kahn, and Lange (2018).

# 3 Theory: A Model of Coordinated Adaptation

Consider an organization which consists of $n$ departments $i \in \mathcal{I} = \{1, ...., n\}$ . Each department is operated by a department manager, $m_i$, with $i \in \mathcal{I}$. In addition, there is also one general manager $m_g$. Each department $i$ must carry out a set of tasks $(t_{i,k})_{k\in\mathcal{K}}$. Following Dessein and Santos (2006), Alonso, Dessein and Matouschek (2008, 2015), and Rantakari (2008), every task must be responsive to a department specific shock, but also coordinated with the tasks of other departments. The main organizational choice is whether to keep task $t_{i,k}$ in headquarters, or to delegate task $t_{i,k}$ to the department manager $m_i$. To simplify notation, we will drop the subscript $k$, and present the model as if there was only one task per department. The extension to $K > 1$ tasks per department is immediate.

## 3.1 Pay-offs and information

Formally, each task $t_i$ with $i \in \mathcal{I}$, requires taking a *primary action* $a_i$. This action must be adapted to a local shock $\theta_i$, which is a random variable $\theta_i$ with mean $\mu_i$ and variance $\sigma_i^2$. Department manager $i$ perfectly observes $\theta_i$. Whenever there is imperfect adaptation, that is $a_i \neq \theta_i$, department $i$ suffers adaptation losses $-(a_i - \theta_i)^2$. In addition, each task $t_j$ with $j \in \mathcal{I}_{-i}$ must take a *coordinating action* $c_{ji}$. Whenever $c_{ji} \neq a_i$, the organization incurs a coordination loss $-\beta_{ji}(a_i - c_{ji})^2$. Given the above discussion, profits of the organization are given by

$$\pi_g = \sum_{i\in\mathcal{I}} \left\{ h(\theta_i) - (a_i - \theta_i)^2 - \sum_{j\in\mathcal{I}_{-i}} \beta_{ji}(a_i - c_{ji})^2 \right\}$$

## 3.2 Managerial Preferences

We follow Alonso, Dessein and Matouschek (2008, 2015) and Rantakari (2008) in assuming an incentive conflict between department managers and the general manager. In particular, we posit that manager $i$ only cares about the performance of his own department, given by

$$\pi_i = h(\theta_i) - (a_i - \theta_i)^2 - \lambda \sum_{j \in \mathcal{I}_{-i}} \beta_{ji}(a_i - c_{ji})^2 - (1-\lambda) \sum_{j \in \mathcal{I}_{-i}} \beta_{ij}(a_j - c_{ij})^2 \tag{1}$$

In contrast, the general manager cares about the performance of all divisions, $\pi_g = \sum_{i \in \mathcal{I}} \pi_i$. In expression (1), the term $\lambda > 0$ is the fraction of coordination losses caused by action $a_i$ which are internalized by department manager $i$. It follows that whenever $\lambda < 1$, the department manager is too eager to adapt to the local shock $\theta_i$. Note that our model allows for the special case where $\lambda = 1$ and preferences between department manager and general manager are fully aligned.

Departmental preferences are consistent with the institutional settings of our empirical analysis, where performance evaluations of department manager are directly tied to the peformance of their department. They can further be endogenized along the lines in Athey and Roberts (2001), Dessein, Garicano, and Gertner (2010), Friebel and Raith (2010) or still Rantakari (2013), at the expense of a more complex and cumbersome model.

## 3.3 Organization Design

The main organizational design decision is whether or not to centralize task $t_i$ at headquarters, or delegate task $t_i$ to the agent. Task centralization allows for better coordination, but requires costly information acquisition by the general manager.

### 3.3.1 Information and organization design

Under *task delegation*, only the department manager observes $\theta_i$. The assumption that the department manager has better local information is standard in the literature (see, e.g., Jensen and Mackling 1995; Aghion and Tirole 1997; Dessein 2002).

Under *task centralization*, at a cost $R_i$, the general manager learns $\theta_i$ with probability $q_i$. This is similar in spirit to Aghion and Tirole (1997), where the principal is assumed to have a higher cost of information acquistion than the agent. An alternative interpretation of $R_i$ is that it represents the higher (opportunity) cost of the general manager to carry out task $t_i$. Note that this interpretation allows $R_i$ to be negative, in which case it is 'cheaper' for a task to be carried out at headquarters than at the departemental level. In order to derive comparative statics on the *probability of delegation*, we assume that the general manager's cost $R_i$ is a uniformily distributed random variable, with cdf $G(.)$, whose value is realized prior to the organization design decision.

### 3.3.2 Coordination and organization design

Task $i$ and $j \neq i$ must be coordinated, which requires that department manager $j$ chooses an action $c_{ji}$ as close as possible to $a_i$. Action $a_i$, in turn, is either chosen by the department manager $i$ (task delegation) or by the general manager (task centralization). There are two ways to achieve such coordination:[11]

*Ex ante coordination:* As long as $E(\theta_i) = \mu_i$ is common knowlegde across the organization, the department or general manager can always avoid coordination losses by setting $a_i = \mu_i$. No communication is then needed to achieve coordination. Intuitively, in the absence of any communication, department manager $j$ then optimally chooses $c_{ji} = \mu_i$ and perfect coordination is achieved.

*Ex post coordination:* The general manager or the department manager $i$, however, may want to adapt $a_i$ to the local shock $\theta_i$ in which case effective communication about $a_i$ is required in order to achieve coordination. When $a_i$ is chosen by deparment manager $i$, we assume that such ex post coordination is successful with probability $p_D < 1$ and fails with complimentary probability $1 - p_D$.[12] In contrast, when $a_i$ is chosen by the general manager, we assume that ex post coordination is successful with probability $p_C = 1$.

The assumption of perfect coordination under centralization is made for simplicity. What matters for our results is that vertical coordination is more effective than horizontal coordination, that is $p_C > p_D$.[13] Intuitively, while the general manager lacks local

[11] The terminology of 'ex ante' and 'ex post' coordination follows Dessein and Santos (2006).

[12] One possble interpretation is that $p_D$ is a measure of communication quality – that is the ability of agent $i$ to communicate effectively his non-standard action to agent $j$. In Alonso et al. (2008), the quality of coordination also depends on the ability to communicate, but communication breakdowns stem from communication being strategic and noisy, as in Crawford and Sobel (1982).

[13] This assumption is similar to that in Alonso et al. (2008, 2015). In the latter models, however, a task is either centralized across all divisions, or decentralized to all division. Under centralization, there is then no need for communication to achieve coordination. Consistent with our data, our model allows for a

knowledge, she has general firm-wide knowledge and a better understanding of how to coordinate departments. As such, she understands better - or can communicate better — what action $c_{ji}$ department $j$ must undertake to achieve coordination with department $i$. For our purposes, it is not important whether the general manager centralizes $c_{ji}$ or can perfectly communicate to department $j$ the desired choice of $c_{ji}$.

We summarize the timing of model and action choices as follows:

(1) Headquarter cost $R_i$ is realized.

(2) **Organization Design**: The general manager (GM) decides whether to centralize task $t_i$ and incur cost $R_i$ or to delegate task $t_i$ to the department manager $i$ (DM)

(3) Local Information $\theta_i$ is realized and observed by manager $m_i$. If task $t_i$ is centralized, GM learns $\theta_i$ with probability $q_i$.

(4) **Action Choice** $a_i$ and realization of adaptation losses $-(a_i - \theta_i)^2$.

(5) **Coordination**. If task $t_i$ is centralized, $c_{ji} = a_i$ (coordination is perfect). If task $t_i$ is delegated to manager $i$, manager $j$ learns $a_i$ with probability $p_D < 1$ in which case she sets $c_{ji} = a_i$. With probability $1-p_D$, communication fails and manager $j$ sets $c_{ji} = E(a_i)$.

## 3.4 Optimal Task Allocation

### 3.4.1 Task delegation

For a given realization of $\theta_i$ and action $a_i$, expected pay-offs to department manager $i$ equal

$$E(\pi_i|a_i, \theta_i) = h(\theta_i) - (a_i - \theta_i)^2 - \lambda \sum_j \beta_{ji} E((a_i - c_{ji})^2) - (1-\lambda)T.$$

In the above expression, $T$ is a term which is independent of $a_i$. We further have that $c_{ji} = a_i$ with probability $p_D$ and $c_{ji} = \mu_i$ with probability $1 - p_D$ : when ex post coordination fails, manager $j$ optimally sets $c_{ij} = E(\theta_i) = \mu_i$. We will later verify that, in equilibrium, $E(a_i) = \mu_i$ so that $c_{ij} = \mu_i$ is indeed the optimal choice for manager $j$ whenever coordination fails.

task to be centralized for some departments and decentralized for others.

It follows that

$$\begin{aligned} E(\pi_i|a_i,\theta_i) &= h(\theta_i)-(a_i-\theta_i)^2-\lambda\sum\nolimits_j(1-p_D)\beta_{ji}(a_i-\mu_i)^2-(1-\lambda)T \\ &= h(\theta_i)-(a_i-\theta_i)^2-\lambda(1-p_D)\beta_i(a_i-\mu_i)^2-(1-\lambda)T \end{aligned}$$

where $\beta_i \equiv \sum_j \beta_{ji}$. Hence, maximizing her pay-offs, division manager $i$ chooses

$$a_i = a_i^D \equiv \mu_i + \left(\frac{1}{1+\lambda\beta_i(1-p_D)}\right)(\theta_i-\mu_i).$$

It follows that under delegation, expected coordination losses to the whole organization are given by

$$\begin{aligned} CL_D &= -E\left(\sum_{j\in\mathcal{I}_{-i}}\beta_{ji}(a_i-c_{ji})^2\right) \\ &= (1-p_D)\beta_i(a_i^D-\mu_i)^2 \\ &= (1-p_D)\beta_i\left(\frac{1}{1+\lambda\beta(1-p_D)}\right)^2\sigma_i^2 \end{aligned}$$

A fraction $\lambda$ of those are internalized by department manager $i$. Expected adaptation losses are given by

$$\begin{aligned} AL_D &= E((a_i^D-\theta_i)^2) \\ &= \left(\frac{\lambda\beta_i(1-p_D)}{1+\lambda\beta_i(1-p_D)}\right)^2\sigma_i^2 \end{aligned}$$

Total organizational pay-offs related to action $a_i$ are then given by

$$h(\theta_i)-AL_D-CL_D = h(\theta_i)-\sigma_i^2+\frac{1+(2\lambda-1)\beta_i(1-p_D)}{\left(1+\lambda\beta_i(1-p_D)\right)^2}\sigma_i^2$$

## 3.5 Task Centralization

Under task centralization, the GM chooses $a_i = \theta_i$ if informed and $a_i = \mu_i$ if inuninformed. There are no coordination losses, $CL_C = 0$, as GM can perfectly communicate

$a_i$ to manager $j$. If the GM acquires information (cost $R_i$), she is informed with probability $q_i$ and expected adaptation losses under centralization equal

$$AL_C^I = \sigma_i^2 - q_i\sigma_i^2.$$

Total organizational pay-offs related to task $i$ then equal

$$h(\theta_i) - AL_C^I - R_i = h(\theta_i) - (1 - q_i)\sigma_i^2 - R_i.$$

If the general manager does not acquire information, she is never informed and expected adaptation losses under centralization equal

$$AL_C^{NI} = \sigma_i^2$$

Total organizational pay-offs related to task $i$ then equal

$$h(\theta_i) - AL_C^{NI} = h(\theta_i) - \sigma_i^2.$$

## 3.6 Organization Choice

Note first that the general manager will never delegate, regardless of the realization of $R_i$, whenever

$$AL_C^{NI} < AL_D + CL_D$$

or still, whenever

$$1 + (2\lambda - 1)\beta_i(1 - p_D) < 0.$$

Indeed, the GM is then strictly better of centralizing task $i$ and taking an uninformed decision rather than delegating task $i$ to manager $i$.

Assume therefore that

$$1 + (2\lambda - 1)\beta_i(1 - p_D) > 0 \tag{2}$$

so that it is never optimal for the GM to centralize and not acquire information. The GM then optimally chooses to centralize a task if and only if

$$R_i \leq AL_D + CL_D - AL_C$$

where $R_i$. Or still, if and only if

$$R_i \leq \overline{R}_i \equiv q_i\sigma_i^2 - \frac{1 + (2\lambda - 1)\beta_i(1 - p_D)}{(1 + \lambda\beta_i(1 - p_D))^2}\sigma_i^2.$$

Hence, the probability that task $i$ is delegated to manager $i$ is given by

$$P_i = 1 - G(\overline{R}_i)$$

where $G(.)$ is the cdf of $R_i$, assumed to uniformily distributed.

It follows that whenever $P_i \in (0, 1)$,

$$\frac{\partial P_i}{\partial \sigma_i^2} = g(\overline{R}_i)\left[\frac{1 + (2\lambda - 1)\beta_i(1 - p_D)}{(1 + \lambda\beta_i(1 - p_D))^2} - q_i\right].$$

If $P_i \in (0, 1)$, inequality (2) must be satisfied. Hence

$$\frac{\partial P_i}{\partial \beta_i \partial \sigma_i^2} = -g(\overline{R}_i)(1 - p_D)\frac{[1 + \lambda(2\lambda - 1)\beta_i(1 - p_D)]}{(1 + \lambda\beta_i(1 - p_D))^3} < 0.$$

Finally, for $\beta_i = 0$,

$$\frac{\partial P_i}{\partial \sigma_i^2} = g(\overline{R})(1 - q_i) > 0$$

whereas

$$\lim_{\beta_i \to \infty} \frac{\partial P_i}{\partial \sigma_i^2} = -q_i g(\overline{R}) < 0.$$

It is further easy to verify that, given $P_i \in (0, 1)$, $\frac{\partial P_i}{\partial \beta_i} = -g(\overline{R}_i)\frac{\partial \overline{R}_i}{\partial \beta_i} < 0$; $\frac{\partial P_i}{\partial(1 - q_i)} = -g(\overline{R}_i)\frac{\partial \overline{R}_i}{\partial(1 - q_i)} > 0$ and $\frac{\partial P_i}{\partial \lambda} = -g(\overline{R}_i)\frac{\partial \overline{R}_i}{\partial \lambda} > 0$.

We summarize as follows:

**Proposition 1.** *Let $P_i$ be the probability of task delegation. We have that*

$$\frac{\partial P_i}{\partial \beta_i \partial \sigma_i^2} \leq 0$$

*and there exists a* $\overline{\beta} > 0$ *such that*

$$\begin{aligned} \frac{\partial P_i}{\partial \sigma_i^2} &\geq 0 \text{ if } \beta_i < \overline{\beta} \\ \frac{\partial P_i}{\partial \sigma_i^2} &\leq 0 \text{ if } \beta_i > \overline{\beta} \end{aligned}$$

*where the inequalities are strict whenever* $P_i \in (0,1)$ *. In contrast, we have that*

$$\frac{\partial P_i}{\partial \beta_i} \leq 0; \quad \frac{\partial P_i}{\partial (1-q_i)} \geq 0 \text{ and } \frac{\partial P_i}{\partial \lambda} \geq 0$$

*where the inequalities are strict whenever* $P_i \in (0,1)$ *.*

Proposition 1 contains the main testable predictions of our model:

1. An increase in the need for coordination $\beta_i = \sum_j \beta_{ji}$ reduces the likelihood that task $i$ is delegated to manager $i$.
2. There is a negative interaction effect between local volatility $\sigma_i^2$ and the need for coordination $\beta_i$ on the likelihood that task $i$ is delegated to manager $i$.
3. An increase in local volatility $\sigma_i^2$
   (a) increases the likelihood of task delegation if the need for coordination $\beta_i$ is below some cut-off value.
   (b) decreases the likelihood of task delegation if the need for coordination $\beta_i$ is above some cut-off value.
4. A decrease in $q_i$, the ability of the general manager to learn local shock $\theta_i$, increases the likelihood of task delegation.
5. An increase in $\lambda$, the alignment of the department manager, increases the likelihood of task delegation (prediction not tested in our data).

# 4 Empirical Context and Datasets

## 4.1 The company and sampled stores

Japan's retail market generated over US$1.3 trillion in sales in 2017 and is among the largest in the world. The focal company that provided our access to data is a major retailer that operates a large portfolio of various retail formats such as shopping malls and convenience stores throughout the country. Our sample covers all of the twelve general merchandise stores ("stores") in a designated sales region in the metropolitan area of Tokyo. North American Industry Classification System (NAICS: code number 452) defines general merchandise stores as "establishments in this subsector are unique in that they have the equipment and staff capable of retailing a large variety of goods from a single location." Target, Wal-Mart, Marks and Spencer, and Tesco are examples of companies that operate similar stores outside of Japan. Two of our sampled stores are located inside shopping malls while the remainder are standalones. The average floor space of the twelve stores is over 20,000$m^2$, with a typical store employing about 480 employees and catering to over 11,000 daily shoppers. Annual sales per square footage in 2017 is US$340, which is slightly higher than the average for retailers in the United States (US$325).

### 4.1.1 Store managers and department managers.

A store manager who directly reports to the regional headquarters is the head of a store. A given store may operate all or a subset of the following 24 departments (or functions): kids apparel, lady's wear, clothing and accessories, underwear, men's wear, home furnishing, cosmetics, grocery, liquor, daily food, deli, produce, processed meat and poultry, fish, home appliances, fast moving consumer goods (FMCG), pharmacy, online business, sales operation, cashier, customer service, information technology (IT), partners, and shop-in-shop. Each department has one, and only one, manager ("department manager") who formally reports to the store manager, and who manages the department's staff and daily business. Figure 1 shows the organizational structure of the sampled region and its stores.[14] Our survey and company-supplied data include 189 department managers, who are of the same rank, working in one of the twelve stores. However, missing entries reduce our sample size to about 170. In our empirical analysis, a department manager is the focal unit of analysis. Consistent with common management practice in Japan, many managers have gone through job or site rotations and on-the-job training (Morita 2005).

<Insert Figure 1 and Table 1 about here>

#### 4.1.2 Cross-departmental coordination

Coordination among departments is an important part of store operations. Each month the store manager and all department managers hold several meetings together to come up with a monthly master sales plan. The master plan defines targets and activities in terms of major store operations such as targeted customers, sales and marketing activities, merchandise, and inter-departmental coordination. Managers also participate in weekly (e.g., Sunday evening) and daily morning meetings in which the store manager and/or department managers review progress with respect to goals set in the monthly master plan. One of the main topics in a weekly and daily meeting is how to allocate tasks and coordinate store operations. In addition, headquarters may also make top-down, impromptu requests on stores to organize promotional events to attract traffic. For instance, a store may have to organize a "World's Fare" event on short notice when an important foreign ambassador will visit the store.[15] The store has also to keep tracks on large sports events and concerts if they are held in its proximity. In both routine and ad hoc meetings, under the leadership of store managers (and her deputies), department managers have to synchronize merchandising (e.g., inventory level and timing of its product arrival), decoration (e.g. signs, banners, and floor layout), pricing and bundling (e.g., coupons and discounts), staffing (e.g., overtime and part-time employees), and marketing materials (e.g., content of advertisement and pamphlets). They may

[14] Figure 1 also includes the list of 15 managerial tasks. We describe the tasks in the next sub-section on Data and Measurement.

[15] Incidentally, the French Ambassador to Japan visited a store during a French Product Promotion event a few days before our onsite visit.

also work and agree on standards and possible variations on customer services, training, hygiene, and resolve conflicts and buyer complaints.

Besides group meetings, we observed department managers often exchange ideas and information and make small decisions in the office, hallways, or on the shop floors. All these managerial practices are consistent with emphasis on both rank-hierarchy and peer coordination in the literature of Japanese corporate governance (e.g., Jackson and Miyajima 2007, pp.5-6).

#### 4.1.3 Performance evaluation and compensation

Similar to employment practices of most large Japanese corporations, the company's compensation scheme is based on qualification, ability, and performance as its major components (Jackson 2007, p.293). On the one hand, the majority of the compensation received by department managers is a fixed salary that is commensurate with their industry and company work experience, qualifications, and positions. Performance pay, on the other hand, is made up of three components: (i) a summer bonus, (ii) a winter bonus, and (iii) an achievement bonus. The first two seasonal bonuses sum up to a maximum of four months of the base salary while the achievement bonus can equal one month's worth of base salary. The amount of performance pay is partly based on the achievement of "numerical" targets (i.e., sales revenue and gross profit) and partly based on "behavioral" aspects that relate to corporate and store missions (e.g., merchandise development) and special priority areas (e.g., cross-merchandise selling, food waste rate, price discount depth). In conjunction with a senior manager in the store or a panel of senior managers, and based on company evaluation guidelines, the store manager formally evaluates and decides on the performance pay for each department manager. Importantly, the level of fixed salary and the evaluation and structure of performance pay are identical across departments and across stores. Hence, this uniform compensation structure and process at the department and store levels provides an ex ante incentive scheme that is not variant among department managers (Lo et al. 2011).

## 4.2 Data and Measurement

### 4.2.1 Selection of survey Participants and data Collection Procedure

To shed light on issues of managerial authority and coordination among peer managers, secondary data are unlikely to come by. Instead, we chose to use a survey to collect primary data. To design our questionnaire, we conducted two rounds of meetings with company executives and managers. The first round of meetings involved executives working in the strategic planning function of the company president's office. These face-to-face meetings, accompanied by email exchanges, provided an overview of the mission and strategy, geographic coverage, organizational issues, types of retail formats, financial performance, major challenges, and store operations. The company eventually designated all of the twelve stores belonging to a regional Tokyo metropolitan sales district for our study. After gathering more specific information on internal organization, compensation scheme, and performance metrics of managers in the stores, we designed a list of pilot questions and conducted full-day visits to two stores. At the two stores, we met the store managers, senior managers (e.g., merchandise manager), and several department managers. These onsite pilot interviews provided detailed information on types of tasks, coordination issues, and challenges from local shocks, which in turn was helpful in our questionnaire design. We conducted the survey in January 2018 by distributing hardcopies of the questionnaire to all of the 189 department managers across the twelve stores. Managers at each store returned their completed questionnaires in a sealed envelope (printed with one of our universities name and logo) and then put this envelope into a box designated for our survey usage. In the process, we ensured that the content of each questionnaire remained confidential to company executives who would only receive selected store-level overview. All 189 managers filled out the questionnaire; however, a few had missing entries in various questions so the actual sample size in our regressions varies and is somewhat smaller.

To supplement our survey, the company headquarters agreed to supply demographic data such as education, age, and gender of each manager. Moreover, we also received monthly transaction data on sales revenue and sales-to-plan ratio. Based on the original transaction data and some further work, we are able to obtain a total of 24 months' data on sales revenue, sales changes, and sales-to-plan ratio.

### 4.2.2 Variables and measurement

We begin by briefly describing the variables we used in our empirical analysis. While some of our measures are cardinal (e.g., task delegation, sales deviations, age), other variables are ordinal and are reported by managers on a 1-7 scale (e.g., demand uncertainty, need for coordination). See Table 2 for detailed descriptions and their summary statistics.

<Insert Table 2 about here>

*Task delegation*: To measure the tasks allocated to a department manager and hence the extent of delegation, the company provided us a list of fifteen tasks in which a manager may be involved in his job. These fifteen tasks are: sales, marketing, customer service, property management, IT management, e-commerce, merchandise, product, personal selling, pricing, personnel, training, shop floor, ordering, and checkout. We asked each manager to indicate which of the fifteen tasks her job covers. A higher number of tasks bundled into a manager's job indicates a larger extent of delegation from her superiors. We created this measure *de novo*. See Figure 1 for a schematic representation of these tasks..

*Functional* versus *Departmental task delegation*: In addition to treating overall delegation as the dependent variable, we also examine how local shocks and the importance of coordination affect the extent of delegation for two subgroups of tasks: functional and departmental tasks. Functional tasks such as customer service and marketing are inter-departmental coordination-intensive, whereas departmental tasks such as product and sales are less coordination intensive with other departments. Section 5.3 provides a more detailed discussion. This classification is based on the need for coordination of *a particular task*.

*Need for coordination*: As discussed in Section 4.1.2, cross-departmental coordination is a major part of department managers' job in both routine and ad hoc business operations. To capture their perception on its importance, we ask department managers to rate on a seven-point scale how important smooth coordination among departments and peer managers is for the manager to perform her job well. It is important to notice that this question is about a manager's *whole job*. We created this measure *de novo* for our context.

*Local volatility*: Volatility in local demand for a product category may disrupt routines and thus require adaptive actions from departments. To capture local shocks that matter to managers at the department level, we use a total of three different measures. The main measure is from our survey of all 189 department managers while we use transaction data to construct two alternative measures for a subset of about 130 departments which directly generate revenues. We describe these measures as follows.

*Demand uncertainty*: our questionnaire asks managers to rate on a seven-point scale the unpredictability of local customer demand and its impact on sales and profits at their units.

*Sales deviations*: using transaction data on monthly sales-to-plan ratios at the department level, this measure captures deviations between actual sales and sales targets. Actual sales are recorded in the company archive. Planned sales are decided in the following process: The company headquarters first allocates its aggregate sales goals to sales regions and further down to the store level in a series of semi-annual and quarterly meetings. Executives in the regional and store levels then sub-allocate their goals to the department level for planning and bonus purposes. Newly renovated or brand new stores, which do not exist in our transaction data, would receive discretionary treatment in the goal planning process. We view the planned sales numbers as the best estimates of expected sales revenues. Then matching to our theoretical setup, any deviation of realized monthly sales may be viewed as local volatility caused by unexpected local shocks. Original data are expressed in the form of a sales-to-plan ratio, with 100 being on target. For instance, 94 and 115 mean actual sales are 94% and 115% respectively of the monthly planned target. We take the average of the absolute difference between the monthly sales-to-plan ratio and 100 across the 24-month transaction data period as the measure. We use its logarithm values in our regressions to minimize skewness of the original measure.

*Sales changes*: this measure equals the variance of monthly sales changes in percentage points across the 24-month period of transaction data. As a result, each sales-generating department has 23 data points. This measure might be subject to expected factors such as seasonality so it is used as a robustness check. For example, higher sales in December should not be viewed as a local shock as they are anticipated. We use its logarithm values in our regressions to minimize skewness of the original measure.

Aside from the main variables of interest mentioned above, we also obtained information on individual characteristics. Each manager reported the number of years – including work and training – she has had in each of the fifteen tasks; the average value is called Experience. Moreover, the human resources department provided archival data on each manager's education level, age, and gender. These four variables are included in all regressions.

To minimize omitted-variable bias potentially caused by sorting into jobs or biased reporting, we further include three personality traits – career aspiration, agreeableness, and risk loving – in additional analysis.

#### 4.2.3 Sources of variations

Before using regressions to analyze how local volatility and need for coordination affect organization design, we first examine the sources of variations by sorting stores and departments in our three key variables: *Need for coordination*, *Demand uncertainty*, and *Task delegation*. While the correlation between demand uncertainty and (i) need for coordination ($\rho$=-0.090) and (ii) task delegation ($\rho$=0.083) are not statistically significant, the negative correlation between need for coordination and task delegation ($\rho$=-0.161) is statistically significant at the 0.10 level. We summarize the means and standard deviations of coordination need, demand uncertainty, and task delegation by department in Table 3 and by stores in Table 4.

<Insert Tables 3 and 4 about here>

Column 1 in Table 3 show that, on the one hand, the mean values of coordination need are quite different across departments: scores range from 4.00 to 6.00 and the standard deviation of these mean values is 0.56. It is reasonable that Fish and Meat departments and Pharmacy need the least coordination with others whereas Shop-in-shop and Partners departments intensively coordinate with others. On the other hand, columns 1 in Table 4 shows that differences in the mean values of coordination need across stores are much smaller, with a range of 4.80 to 5.83 and the standard deviation of the *mean values* being 0.28. When we inspect the standard deviations for a given department across stores (Table 3, column 2) and those for a given store across departments (Table 4, column 2), the *mean value* of the former is larger than that of the latter: 0.93 versus 1.17. Moreover, between-department variations in the ANOVA also show marginal significance (F=1.34; p=0.15) but between-store variations are not significant at all (F=0.75; p=0.69). As such, we infer that the need for coordination varies more across departments - thus, products and services offered to customers and internally - but varies much less across stores – thus, specific locations. We use box plots in Figure 2 to visualize such differences where the middle boxes represent *Need for coordination* by store and by department in Panels A and B respectively.

<Insert Figure 2 about here>

We replicate the same exercise on *Demand uncertainty* and find (i) the standard deviation of the mean value by department (Table 3, column 3) is almost identical to that sorted by stores (Table 4, column 3): 0.55 versus 0.56; and (ii) the mean values of the standard deviations (column 3's) exhibit much smaller differences: 0.95 (by department) versus 1.07 (by store). These results imply that (i) the overall variation in average demand uncertainty is smaller across departments than stores; and (ii) variations shown by different departments within a given store are slightly larger than those shown by different stores for a given department. The former result is confirmed by the non-significant between-department variations (F=1.27; p=0.20) but significant between-store variations (F=3.78; p=0.00) in the ANOVA. The bottom boxes in Figure 2 visually show these results.

For brevity, we omit tables and box plots for the transaction measures on local volatility. ANOVA of the variable, *Sales deviations*, shows between-department and between-store variations are both statistically significant (F=2.94; p=0.00 and F=4.19; p=0.00). Yet the The ANOVA of *Sales changes* reports that between-department variations are significant (F=1.69; p=0.06) but not between-store variations (F=1.20; p=0.30). Hence, patterns of variations on all three alternative measures of local volatility are different. Indeed, the correlations between *Demand uncertainty* and the logarithm values of *Sales deviations* and *Sales changes* are respectively 0.10 and -0.01. These are not significant at a 0.10 level. The correlation between the two transaction measures is 0.28 ($p<0.10$). All these support the idea that the survey measure and the transaction measure may capture different aspects of volatility.

Lastly, columns 5 and 6 in the two tables show the extent of *Task delegation* by departments and by stores respectively. The mean values across departments in column 5 of Table 3 range from 5.00 to 15.00, with Pharmacy and Information Technology having least task discretion and Fast Moving Consumer Goods (FMCG) and Deli having the highest number of tasks. The mean values across stores shown in column 5 of Table 4, however, show a much tighter range. Indeed, the standard deviation of the mean values of task delegation sorted by department is larger than that sorted by stores: 1.12 versus 0.98. The variation within a given department across stores, however, is much smaller than that within a given store across departments: the *mean* of the standard deviations (columns 2, both tables) is 2.92 (by department) versus 4.08 (by store). This suggests that the main source of variation in task delegation in our data comes from departments, as clearly shown by the top boxes in Figure 2. This result is further confirmed by the ANOVA which shows between-department variations being statistically significant ($F=4.27$; $p=0.00$) but not for between-store variations ($F=0.79$; $p=0.65$).

In sum, our preliminary analysis shows that departments exhibit larger variations than stores in terms of both need for coordination and task delegation. Yet in terms of local volatility, departments and stores appear to be of different sources of variations, depending on which one of the three alternative measures one looks at.

# 5 Results

## 5.1 Econometric specifications

Our regression analysis proceeds as follows. We first use overall Task delegation in a job as the outcome or dependent variable. This variable indicates how many tasks are delegated to a department manager out of a total of 15 possible tasks. We subsequently compare the extent of delegation of *Functional tasks* (that are coordination intensive) and *Departmental tasks* (that are less coordination intensive) by treating them as separate dependent variables. These main regressions use *Demand uncertainty* as a key variable of interest. In order to make use of our alternative measures of local volatility, based on transaction data, we then restrict our analysis to sales-generating departments. This analysis covers two transaction measures of local volatility, *Sales deviations* and *Sales changes*, in addition to *Demand uncertainty* for comparison purposes. We then check robustness in our main regressions by including (i) alternative fixed effects and (ii) personality traits. Finally, we examine the differential effect on delegation of asymmetric information about local shocks, compared to volatility of local shocks, by using *Experience difference* between department and superior managers as a proxy for the center's ability to learn about local shocks.

Most of our regressions use ordinary least squares (OLS) in the following specification:

$$Y_i = \alpha + \beta_1 \textit{Demand uncertainty} + \beta_2 \textit{Need for coordination} + \beta_3 \textit{Demand uncertainty} \times \textit{Need for coordination} + X_i' b + \epsilon_i,$$

where i denotes the department manager, $Y_i$ is one of the aforementioned outcome variables, $\alpha$ is the intercept, and $X_i$ is a vector of control variables, including *Experience*, selected personal characteristics, and store fixed effects. Notice that $\beta_3 < 0$ is necessary to validate our main hypotheses. In some regressions, we omit the interaction term between demand uncertainty and need for coordination, i.e., suppress the value of $\beta_3$ as zero, for comparison purposes. Robustness checks use department fixed effects or clustered standard errors or include personality traits. In lieu of *Demand uncertainty,* we also use two alternative measures of local volatility constructed by transaction data, *Sales deviations* and *Sales changes*, to show consistency of our main results.

## 5.2 Overall task delegation

Table 5 shows our first results on overall *Task delegation*. In column 1, we include the two main variables of interest, *Demand uncertainty* and *Need for coordination*, and four control variables, *Experience*, *Education*, *Age*, and *Gender*. We add the interaction term of *Demand uncertainty* and *Need for coordination* in column 2. To control for unobserved demographic, market, and the store-manager's characteristics, we add store fixed effects in column 3. While the first three columns use robust standard errors, column 4 uses standard errors clustered by 24 departments. Notice that using clustered standard errors only changes inference (i.e., standard errors) but not estimated values of coefficients.

<Insert Table 5 about here>

Results are consistent across the four specifications in the table. Column 1 shows that, as expected, task delegation is decreasing in need for coordination ($\beta_1$ = -0.50) but increasing in demand uncertainty ($\beta_1$ = 0.26), although the latter coefficient is not statistically significant. When the interaction term of *Demand uncertainty* and *Need for coordination* is added to columns 2 to 4, the magnitude of the positive coefficient of *Demand uncertainty* increases tremendously ($\beta_1$ = 2.06, or 1.85) and turns to be significant whereas the increased standard errors render the coefficient of *Need for coordination* no longer significant. Most important of all, their interaction term is negative ($\beta_3$ = -0.33, or -0.29). This moderation effect means the impact of demand uncertainty on task delegation depends on the need for inter-departmental coordination. Specifically, we find that the marginal effects of *Demand uncertainty* on task delegation in column 2 of Table 5 at the lowest (=1), mean (=5.44), and highest (=7) possible values of *Need for coordination* are 1.73, 0.25, and -0.26 respectively. In other words, as coordination importance increases, the marginal effect of local volatility decreases and eventually turns to be negative.

Panel A of Figure 3 graphically illustrates this interaction effect by using the results obtained in column 2 of Table 5. To calculate the values of the end points, we assume that the values of control variables are at their mean values and set low and high levels of the two main variables at the 10th and 90th percentile values respectively. The downward sloping black line depicts the case when the *Need for coordination* is high (=7): an increase in *Demand uncertainty* from low (=1) to high (=5) decreases *Task delegation* by approximately 10%. On the other hand, the upward sloping grey line shows that when *Need for coordination* is low (=4), an increase of *Demand uncertainty* from low to high increases *Task delegation* by about 28%.

<Insert Figure 3 about here>

These results are consistent with our hypotheses that task delegation is increasing in local volatility when the need for coordination is low but decreasing in local volatility when need for coordination is important. Intuitively, in the former case, autonomous (decentralized) adaptation to local shocks or emergent events is optimal, whereas in the latter case coordinated (centralized) adaptation to local shocks is called for. This novel finding amends what we know from conventional wisdom and studies that an agent's advantage on local information in general positively correlates with how much authority is delegated to her (e.g., Aghion and Tirole 1997; Dessein 2002; Nagar 2002; Acemoglu et al. 2007; Huang et al. 2017).

On other variables, as one would expect, task delegation increases in *Experience* and *Education*, as both are proxies of agent ability. When ability is kept constant by these two variables, an older *Age* may indicate fewer years expected to work at the company and thus correlate with less delegation. Lastly, females are accorded with less task flexibility but the standard errors are too large to yield more precise coefficients. It is worthwhile to notice that including store fixed effects (columns 3 and 4) helps to isolate store-specific factor such as store management style and culture but that does not qualitatively change our main results (in column 2). While none of the store fixed effects is statistically significant in column 4, standard errors clustered by departments tremendously increase the overall significance of the regression.

## 5.3 Task delegation: functional versus departmental tasks

To further investigate the impact of local volatility on task delegation, we categorize the fifteen tasks into two groups, functional tasks and departmental tasks, based on how coordination intensive they are. Notice that while the our variable *Need for coordination* is about the whole job of a department manager (asked in a single survey question to each manager), the classification in F*unctional* versus *Departmental tasks* is based on the coordination need of a particular task. Concretely, for each of the fifteen tasks, managers rated on a seven-point scale the extent of discretion and flexibility they have when coordinating horizontally with peer, department managers. A score of zero is recorded if a task is not part of a manager's job. Based on the average score on each task across all managers, we classify it either as a functional or departmental task. We refer the five most coordination-intensive tasks as *Functional tasks* and the other ten less coordination-intensive tasks as *Departmental tasks*. The five functional tasks, with their scores in parentheses, are: marketing (1.88), customer service (1.97), property management (1.48), IT management (1.96), and e-commerce (2.02). The ten departmental tasks are: merchandise (3.35), product (3.59), sales (3.46), personal selling (2.99), pricing (3.19), personnel management (3.27), training (2.93), shop floor (3.48), ordering (4.23), and checkout (3.66).

One would expect that *Functional tasks* such as customer service and marketing management are more likely to be centralized whereas *Departmental tasks* such as sales and merchandise are more likely to be "entrusted" to a specific department. Following the same specifications as we did for overall task delegation, Table 6 shows these results. As in the previous table, we report four regressions, but using functional task delegation (columns 1-4) or departmental task delegation (columns 1′-4′) as the outcome variable. Our results show two major differences between functional and departmental tasks.

<Insert Table 6 about here>

First, like the previous result on overall task delegation, both columns 1 and 1′ show that *Need for coordination* has a negative correlation with the extent of delegation and *Demand uncertainty* has a positive but not statistically significant effect. However, only functional but not departmental tasks show the same pattern after the inclusion of the interaction term between the two main variables in other columns. Specifically, both the coefficients of the interaction term and *Demand uncertainty* are positive and statistically significant ($\beta_3 = -0.22$) in columns 2-4 for functional tasks but these are not the case in columns 2′-4′ for departmental tasks. Second, the intercept of the departmental task regression ($\alpha$ = 11.22) is almost four times larger than that of the functional task regression ($\alpha$ = 2.96), while there are only twice as many departmental as functional tasks (10 vs. 5). The same pattern on the intercepts holds after we include the interaction term in the remainder of the three columns (columns 2-4 and 2′-4′). Specifically, all of the intercepts for *Functional tasks* are very small and not statistically significant $\alpha$ = -0.45, or -1.30) whereas those for *Departmental tasks* are large ($\alpha$ = 9.99, or 10.87). This implies that the baseline task delegation for coordination-intensive tasks is much smaller than that for tasks that are more independent from other departments. As shown in columns 3, 4, 3′, and 4′, store fixed effects only matters in one incidence in departmental tasks regressions.

These results together in Table 6, hence, provide a more nuanced evidence of the interaction between local volatility and the need for coordination (for the whole job). While the less coordination-intensive departmental tasks are more likely to be delegated on average, the impact of local volatility on task delegation does not depend on the need for coordination. In contrast, while coordination-intensive functional tasks are less likely to be delegated on average, the impact of local volatility on the delegation of such tasks is highly dependent on the on the importance of coordination. In particular, for units with low coordination needs, local volatility has a very large positive (and significant) impact on delegation of functional tasks. In contrast, for units with high coordination needs, more local volatility reduces the extent of delegation of functional tasks. Concretely, the marginal effect of *Demand uncertainty* on *Functional tasks* delegation in column 2 is 1.06 when *Need for coordination* is at the lowest possible value (=1) but becomes -0.23 when *Need for coordination* is at the highest possible value (=7). In other words, for tasks with a low coordination-intensity (departmental tasks), autonomous adaptation to local shocks is always preferred over centralized coordinated adaptation. In contrast, for tasks with a high coordination-intensity (functional tasks), autonomous adaptation is optimal only for units who require limited or moderate coordination with other departments in the same store. The prominence of the interaction result only appearing in coordinative-intensive, functional tasks further shows the important role of coordination in organization design.

## 5.4 Sales-generating departments only and transaction based measures of local volatility

One may suspect that departments that do not directly generate sales and profits are different from other departments - for instance, local volatility may play less a role for a department which is not customer facing - and wonder whether this might drive some of our results on task delegation. To investigate this, we exclude department managers whose units do not directly generate sales revenue from our analysis in Table 7. The excluded departments are Sales Operations, Cashier, Customer Service, Partners, and IT. Except *Age* which is not statistically significant throughout, the results on our main variables (first three rows) and control variables - are qualitatively similar to those in

Tables 5 and 6.

<Insert Table 7 about here>

To supplement our analysis of sales-generating departments using the survey-based measure of local volatility, we construct two alternative measures by using sales transaction data: Sales deviations and Sales changes (see Subsection 4.2.2 on data and variables for details). Their results are shown in Tables 8 and 9 respectively. We exclude store fixed effects in these regression because of smaller samples. We find that their inclusion in regressions generates similar, albeit slightly weaker, results.

To match our theoretical model, we first use transaction data to construct the variable *Sales deviations* from the monthly ratio of realized to planned sales. Presumably, planned sales are the best measure of expected sales. As such, this variable excludes shocks to sales that are fully anticipated by the center (e.g. those based on seasonaility). Table 8 reports the results of this alternative measure (in its logarithm value) of local volatility. Both the main variables of interests and other variables show qualitatively similar results to our original, survey measure on local volatility. Specifically, in the three regressions with the inclusion of the interaction term in the table, we see (1) the direct positive effect of log(*Sales deviations*) and its interaction effect with coordination need on overall and functional task delegation, but (2) weak or little effect of these two terms on departmental tasks.

<Insert Table 8 about here>

As a robustness check, we further look at the variance in month-to-month sales changes, namely *Sales changes*. As discussed in Subsection 4.2.2, this measure only uses actual sales data and ignores data on planned sales. It therefore captures both anticipated (e.g. seasonal) and unanticipated shocks to local sales. Comparing to columns 1 and 2 in Table 7, columns 1 and 2 in Table 9 show that local volatility as measured by log(*Sales changes*) has similar effects on overall task delegation as before in terms of its primary and interaction effect with coordination need. Compared to our other two measures of local volatility, however, the interaction effect between log(*Sales changes*) and coordination need is weaker when we only consider the delegation of *Functional tasks* (column 2' in Table 9).

<Insert Table 9 about here>

All in all, our three measures of local volatility generate consistent results in terms of its direct and interaction effects on task delegation. Using the results in column 2 of Tables 5, 8, and 9, Figure 3 graphically illustrates the differential effect of local volatility for low (10th percentile) and high (90th percentile) need for coordination, and this for our three measures of local volatility: *Demand Uncertainty* (Panel A), log(*Sales Deviations*) (Panel B) and log(*Sales Changes*) (Panel C). For all three measures, local volatility has opposite effects on task delegation under high versus low coordination need.

Lastly in Table 10, we take another perspective at this novel prediction by creating a median split of our sample in terms of *Need for coordination*. In the table, all three measures of local volatility show a positive effect on overall task delegation when coordination need is low, although those of log(*Sales deviations*) and log(*Sales Changes*) are not statistically significant. In contrast, when coordination need is above its median value, log(*Sales deviations*) and log(*Sales Changes*) have a strong negative and statistically significant effect on task Delegation. The effect of *Demand uncertainty*, which was positive and significant for low coordination needs, instead becomes non-significant. Since the split samples yield much smaller sample sizes in the table, these results appear to be consistent with our main results analyzed above.

<Insert Table 10 about here>

## 5.5 Robustness checks

Finally, using our survey-based measure of local volatility, we run two checks to ensure our results presented above are robust to alternative specifications.

### 5.5.1 Department fixed effects

We used store fixed effects in the previous sets of regressions to control for unobserved heterogeneity at the store level. We can instead include department fixed effects to control for unobserved departmental characteristics. For instance, becoming a manager in a department such as Cashier, eCommerce, or Pharmacy, may require training or even a license that might correlate with our variables of interests such as need for coordination.

We organize our analysis of task delegation in two regressions, one with and one without the interaction term between demand uncertainty and coordination need. As in our main specification we sequentially report results for overall task delegation, functional task delegation, and departmental task delegation. Table 11 shows these results in six columns.

Compared to previous results when the interaction term is excluded, we find here that the coefficients of *Demand uncertainty* and *Need for coordination* in column 1 are weaker. One would expect this because, as we show above, the source of variation of need for coordination mainly comes from departments rather than stores. Using department fixed effects then removes a meaningful part of variation and thus a channel through which coordination needs affect organization design. The coefficient of the three main variables, nonetheless, are almost the same when the interaction term is included in column 2. For other variables, the results on *Experience* and *Age* are no longer statistical significant while that on *Education* remains qualitatively the same. At the bottom of columns 1 and 2 in Table 11, we see that Deli department has a higher level of overall task delegation but that tasks at the departments Cashier, eCommerce, Information Technology, Partners, and Pharmacy are more likely to be centralized.

<Insert Table 11 about here>

The results of the three variables of main interest (demand uncertainty, coordination need, and their interaction term) for functional task delegation in columns 1′ and 2′ and departmental task delegation in columns 1″ and 2″ are qualitatively similar to those in Table 6. Of the other variables, the strong, positive effect of experience, obtained in our main specification, largely disappears for both types of tasks. In addition, for departmental tasks, the negative effect of age and gender go away as well. Finally, functional task delegation has a higher baseline at Deli and Sales Operation departments, whereas departmental task delegation has a lower baseline at the departments of Cashier, eCommerce, IT, Partners, and Pharmacy.

All in all, although there are some small changes in the statistically significance levels of control variables, our key results on demand uncertainty and its interaction term with need for coordination qualitatively remain the same.

### 5.5.2 Inclusion of personality traits

Agents may sort into jobs along certain characteristics. Therefore, controlling for personality traits that endogenously sort into job profiles based on local volatility and need for coordination helps to alleviate concerns for omitted-variable bias. For this purpose, we asked managers to self-report the following three personality traits on seven-point scales.

*Agreeableness* measures how much a manager is cooperative versus going alone, which may match to tasks or jobs that need a great deal of peer coordination. Our measure is adopted from the Big Five traits in the management literature (John 1990). Extracted from one of the items in the DOSPERT scale from the management and organization literature (Blais and Weber 2006), we use *Risk loving* to measure how likely an individual would invest 5% of his annual income in a very speculative stock. A risk loving manager may be more likely to match to jobs that exhibit more local volatility. Lastly, managers reported their *Career aspiration*, that is, how consciously they were intent to pursue a career in the company as an executive.

Conceptually, we posit that subjects with a high rating for *Agreeableness* may be sorted to departments that have a high need for coordination and subjects with a high score for *Risk loving* to departments exhibiting higher local volatility. In addition, one might speculate that subjects with a high score for *Career aspiration* may be more relational, coordinative, or simply be more "power hungry." In our data, although the coefficients of correlation between *Career aspiration* and the two main task characteristics are close to zero, that between *Agreeableness* and *Need for coordination* is quite significant ( =0.297) and that between *Risk seeking* and *Demand uncertainty* is mildly positive ( =0.051).

<Insert Table 12 about here>

Table 12 reports the results of those regressions. The main results here on *Demand uncertainty*, *Need for coordination*, and their interaction term (first three rows) remain qualitatively the same across overall task delegation, functional task delegation, and departmental task delegation. On other variables that are previously included, we find similar results, except that the precision of the coefficients of *Education* is somewhat reduced. For the three newly added variables, being agreeable and thus cooperative has little to no effect on delegation. However, having a more long term, career-aspiring mentality and being more risk loving positively correlate with the three kinds of task delegation. In sum, the results on personality traits apparently show that more ambitious or relational managers may ask for and thus receive a larger scope of task delegation.

### 5.6 The impact of the center's ability to learn about local shocks.

So far, we have tested the main prediction of our theory: whether an increase in local volatility makes delegation more or less likely, depends on the need for coordination among sub-units. Our theory also has an additional, unambiguous comparative static: keeping local volatility fixed, a decrease in the center's ability to learn about local shocks always makes task delegation more likely.

In our model, local volatility corresponds to the variance $\sigma_i^2$ of the local shocks $\theta_i$. Since the department manager perfectly observes $\theta_i$, the expected asymmetric information between the department manager and the center further depends on the probability $q_i$ with which the center's signal is informative about the local shock $\theta_i$ and the cost $R_i$ of acquiring this signal. Both $1 - q_i$ and $R_i$ capture how difficult it is for the center to learn about local shocks.

Proposition 1 shows how a decrease in $q_i$ (the precision of the center's information) unambiguously increases the likelihood of task delegation. Similarly, one can show that an upwards shift in the distribution of $R_i$ (an increase in the cost of the center's information) unambiguously favors delegation.[16] Our model thus predicts that, in contrast to an increase in the volatility of local shocks, a decrease in the center's ability to learn about local shocks unambiguously makes delegation more likely.

In this section, we test this unambiguous prediction by constructing a proxy for how difficult it is for the center to observe or understand local shocks affecting a particular department. We posit that the superior manager who is relatively inexperienced to a

[16]Indeed, an upwards shift in $G(.)$, the distribution of $R_i$, reduces $G(\overline{R}_i)$ and hence increases the probability of delegation $P_i = 1 - G(\overline{R}_i)$.

department manager will have a lower ability to observe and assess local shocks. Based on this, we construct the variable *Experience difference* by taking the difference between the experience of the two as follows:

$$\textit{Experience difference}_i = \textit{Experience}_i - \textit{Experience}_{ism}$$

where the subscript *ism* denotes department manager i's superior manager. Since we do not have data on store managers' experience, the superior manager in our constructed variable is a senior manager at the store who both has a higher formal rank and works the most directly and closely with the corresponding department manager. Although the store manager is their formal reports, department managers often regard these superiors as deputy store managers. Using internal organization charts and human resource's ranking information, we are able identify each department manager's unique superior in our dataset. Rather than being a direct measure, we view this variable as a proxy for asymmetric information, i.e., the difficulty of the center's ability to learn about local shocks at the departments. It is worthwhile to note that our constructed variable *Experience difference* involves higher ranking managers' experience which never occurs in the remainder of the analysis. We also note that correlations between our new measure and our three measures of local volatility is very weak: $\rho$=0.051, 0.018, and 0.108, for *Demand uncertainty*, log(*Sales changes*), and log(*Sales deviations*) respectively. These tiny correlations confirm that our measures of local volatility, which capture local sales or demand variations, and experience differences, which captures the ability of assessing those local demand variations, are indeed two different constructs.

Since a superior manager - especially the merchandise manager - typically supervises a number of departments, one would expect that, in a same store, by subtracting the same value from a number of department manger's experience should yield a positive correlation between the two variables, *Experience difference* and *Experience*. Indeed, the two variables have a high coefficient of correlation ($\rho$=0.731). As such, we exclude *Experience* in the analysis here to avoid multi-collinearity.

<Insert Table 13 about here>

Table 13 uses the same format as our previous regressions but treats *Experience difference* and its interaction term with coordination need as the main variables of interests.

Note that we include demand uncertainty in the regressions because this prediction presumes local volatility being kept fixed in our thoeretical model. The key differences between the effect of experience difference and local volatility on task delegation are as follows:

First, *Experience difference* has little or no interaction effect with *Need for coordination*, as shown in columns 2, 2′, and 2″. Second, columns 1, 1′, and 1″ show that *Experience difference* has a stronger and more significant average effect on task delegation. Jointly these results imply that, unlike previous ones using local volatility as a main variable of interest, the difficulty of assessing local shocks has an unambiguous effect on delegation. Overall, the results in Table 13 are supportive of our theory and complement those in cross-firm studies such as Baiman et al. (1995), Acemoglu et al. (2007), and Huang (2017). The proxies for local information used in these studies mainly measure the information disadvantage of central management - that is how difficult it is for headquarters to be informed about local circumstances. As Table 13 shows and our theory predicts, the harder it is for central management to assess local shocks, the more likely she delegates. In contrast, as shown in our previous results, an increase in the volatility of local shocks has an ambiguous impact on decentralization since its effect depends on the need for coordination.

# 6 Conclusion

This paper has presented one of the first micro-level studies of managerial authority and task allocation inside firms. Our data concerns just under 200 individual department managers, employed by the same retail firm, subject to the same incentive scheme, and working at the same mid-level managerial rank. Working closely with firm management, we obtained detailed data on personal characteristics, job descriptions, department-level sales, and so on. As far as we are aware, previous studies on organizational design have instead used firm-level or establishment-level data in a cross-section of industries and/or countries.

We have shown how the relationship between local information and organizational design is much more complex than previously suggested, and depends on how organizations coordinate their responses to such information. In particular, we have put forward, and empirically tested, the hypothesis that a more volatile local environment results in more decentralization only when needs for coordination across sub-units are small or moderate. In contrast, we predict (and observe) an association between more local volatility and more centralization when coordination needs are high.

Our theoretical model differs from existing theories in that we examine the differential impact on organization design of an increase in the volatilty of the local environment, compared to an increase in asymmetric information about this same environment. Indeed, our model predicts that an increase in asymmetric information about a given environment always results in more delegation, whereas the impact of an increase in the volatility of this environment depends on the need for coordination.

Our empirical analysis differs from previous work on the determinants of delegation, such as as Baiman et al. (1995), Acemoglu et al. (2007) and more recently Huang et al. (2017), in that we construct measures of local volatility which capture the unpredictability and variations of the local environment itself. In contrast, the proxies for local information used in the above studies mainly measure the information disadvantage of central management – that is how difficult it is for headquarters to be informed. Conceptually, the volatility of local shocks and asymmetric information about local shocks capture two different aspects of local information that managers may possess. As we have shown in this paper, these two dimensions of local information may have very different consequences for organization design.

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**Figure 1: Organizational Structure: Stores, Departments, and Tasks**

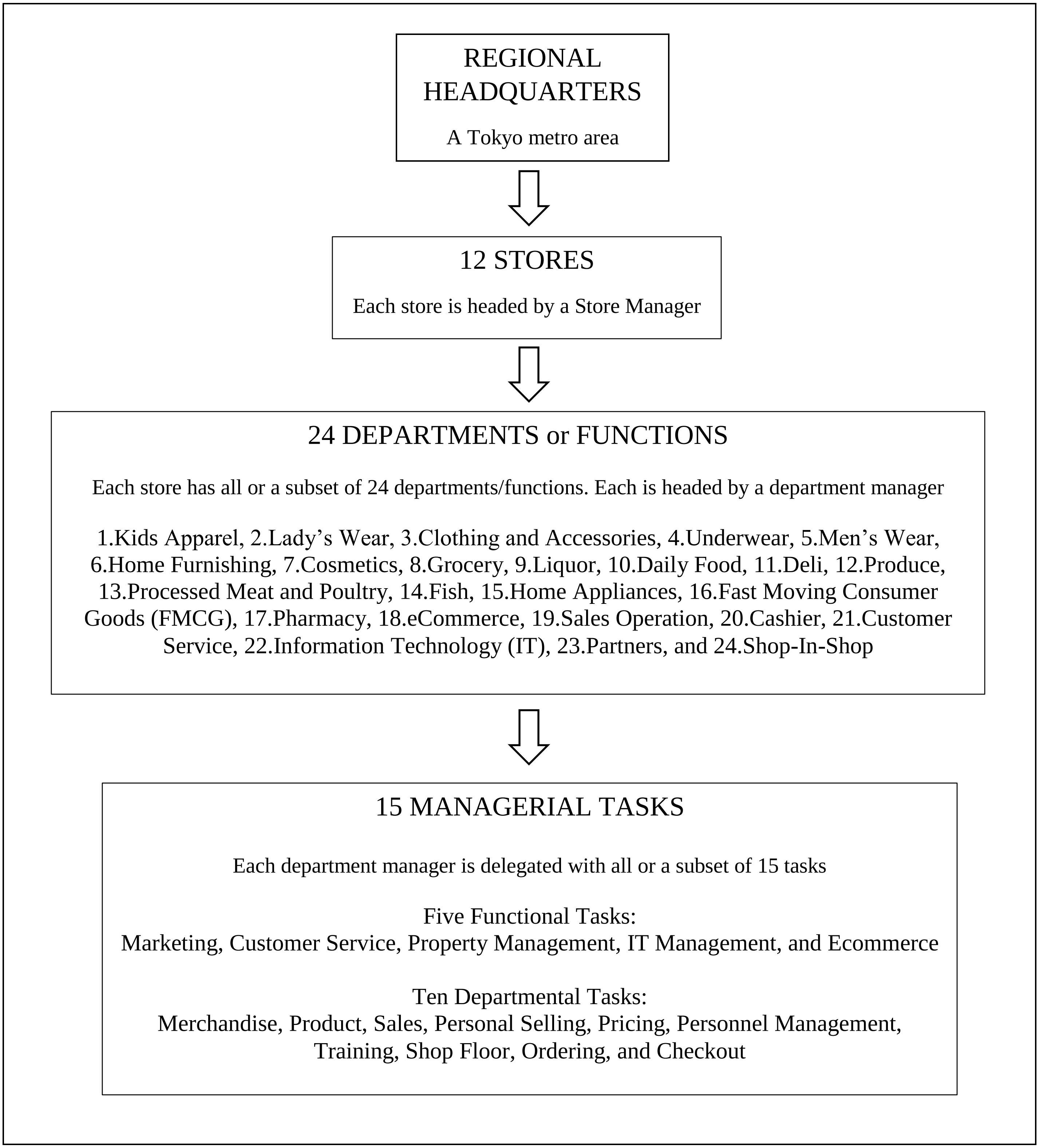
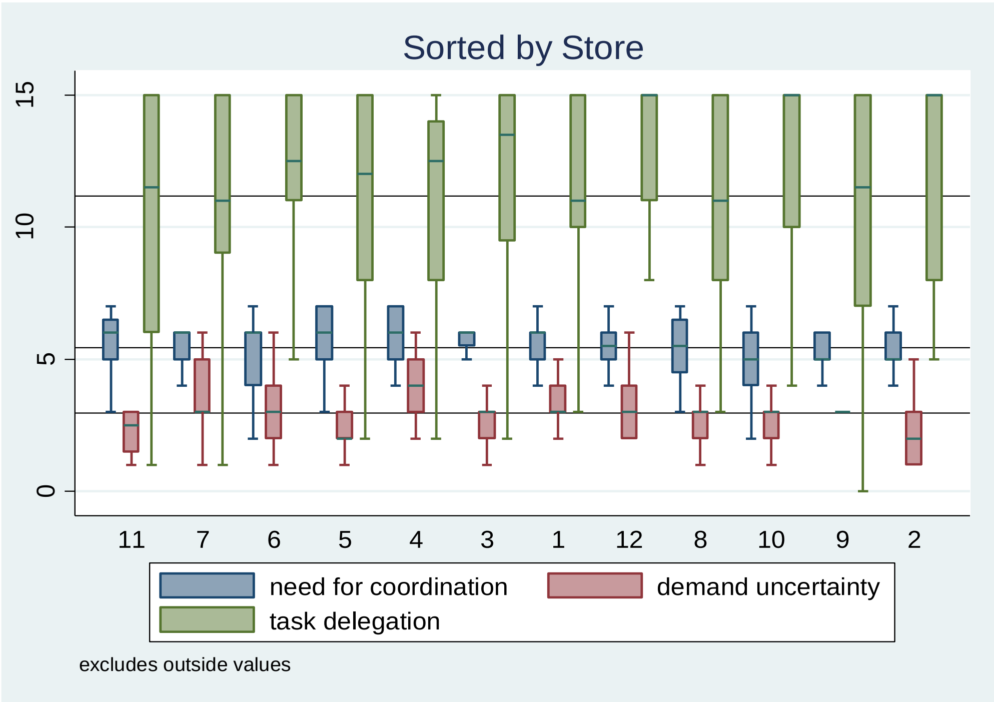


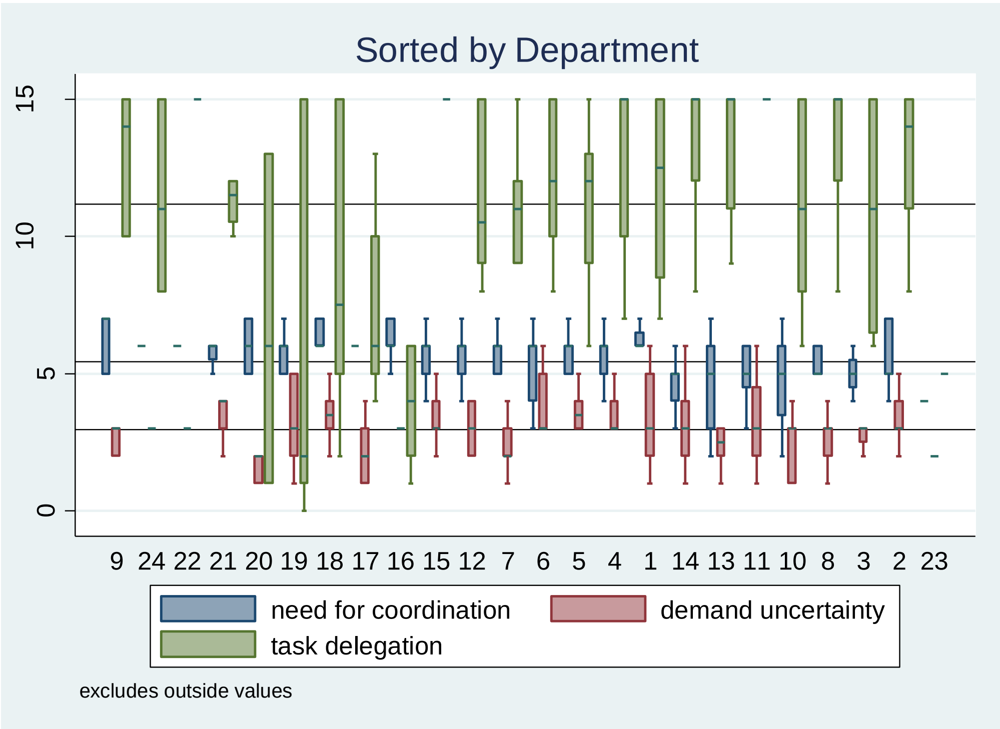
**Figure 2 Box Plot of Sources of Variation**

(Top: *Task delegation* Middle: *Need for coordination* Bottom: *Demand uncertainty*)

**Panel A**

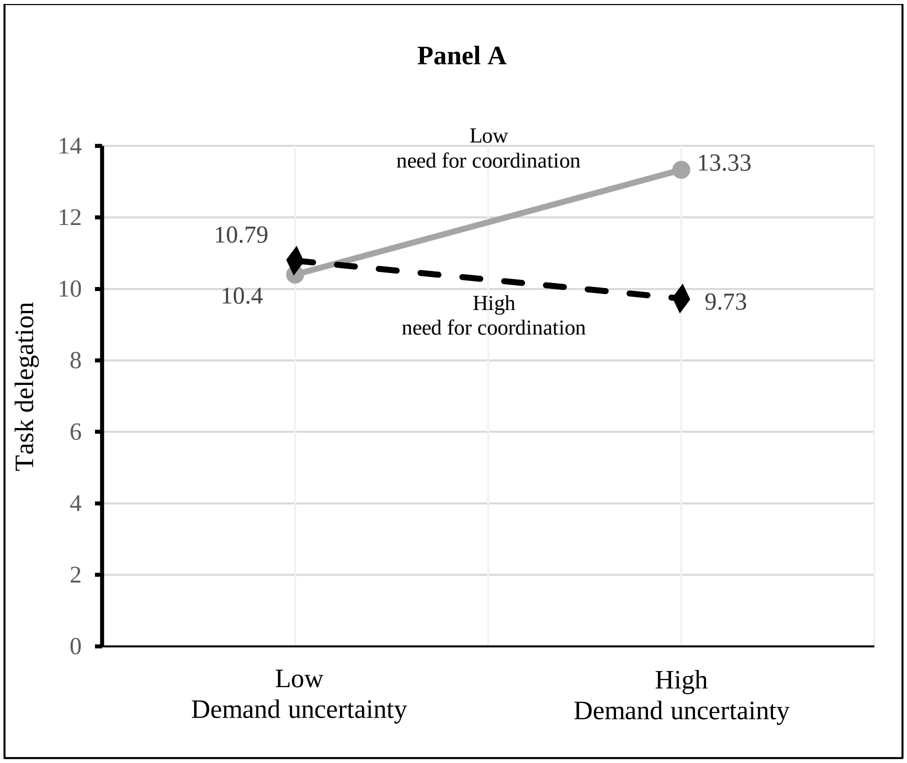


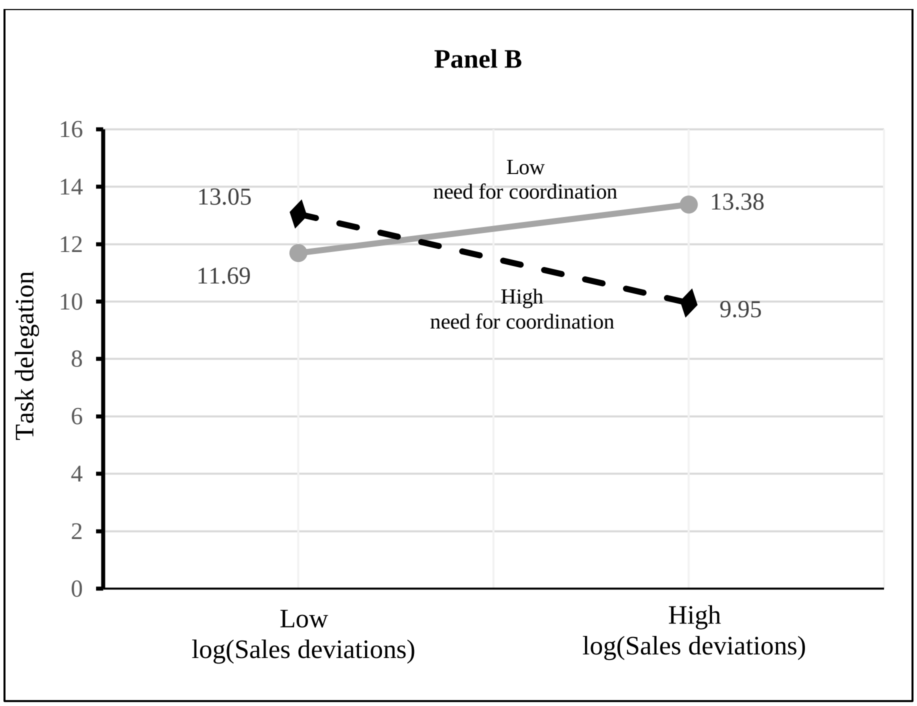

**Panel B**

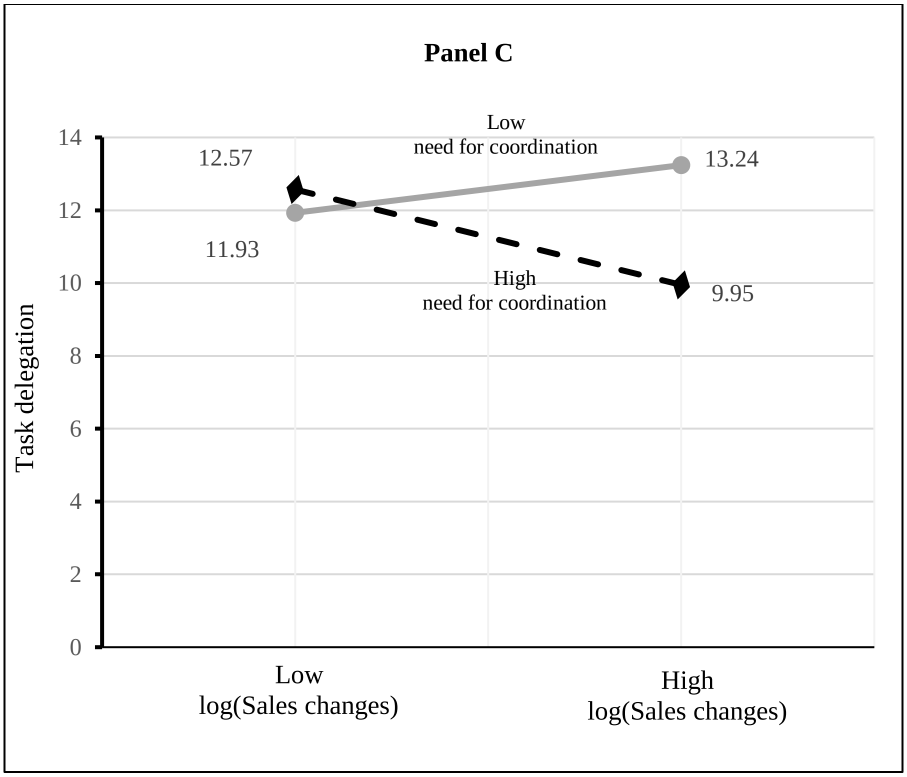



Note: (1) Long horizontal lines are corresponding mean values. (2) Stores and Departments ordered by median value of *Need for coordination* in descending order from left to right.

**Figure 3 Interaction Effect of *Need for coordination* and *Local volatility***






Note: All Low and High values correspond to the $10^{th}$- and $90^{th}$- percentile values respectively. Values associated with the four end points are the levels of *Task delegation* under their respective conditions of *Local volatility* and *Need for coordination*, plus the sum of the mean values of the control variables and the constant. Low and High values of *Need for coordination* are 4 and 7 respectively in all panels. For instance in Panel A, *Task delegation* at (Low *Demand uncertainty*), High *Need for coordination* = 10.79 = $\hat{\alpha} + \hat{\beta}_1 \times 1 + \hat{\beta}_2 \times 7 + \hat{\beta}_3 \times 1 \times 7 + \bar{X}_i'\hat{b}$ , where the estimated coefficients are obtained from column 2 in Table 9 and Low and High *Demand uncertainty* respectively are 1 and 5. Similarly for other panels. Panel B uses results from column 2 in Table 10, with Low and High log(*Sales changes*) being -4.90 and -1.08. Panel C uses results from column 2 in Table 11, with Low and High log(*Sales deviatio*ns) being 0.98 and 2.61.

**Table 1 Overview of Stores in Our Sample**

| Item | Value | Remarks |
|---|---|---|
| No. of stores | 12 | All stores under the same company subsidiary headquarters |
| No. of department managers | 189 | All managers were sampled, but some had missing answers |
| Average no. of managers per store | 15.75 | |
| Average floor space under direct management of store | Approx. 20,000 $m^2$ | From approx. 10,000 to 35000 $m^2$ |
| Average no. of employees | 483 | From 253 to 753 |
| Average no. of daily shoppers | 11,208 | From 5,200 to 18,500 |

## Table 2 Variables and Summary Statistics

| Variable | N | Description | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|---|
| *Local volatility – Demand uncertainty* | 169 | Impact of local, proximate customers on sales and profit to our unit (1 very stable<−>very volatile 7) | 2.97 | 1.23 | 1 | 6 |
| *Local volatility – Sales changes*[†] | 128 | Variance of monthly sales changes at department; monthly sales changes are in percentage points; original data on monthly sales changes included 24 months and were recorded as percentage points | 0.14 | 0.30 | 0.00 | 2.06 |
| *Local volatility – Sales deviations*[†] | 125 | Mean of the absolute differences between monthly ratio of realized-to-planned sales revenue at department and 100; original data on monthly sales-to-plan ratio included 24 months and were recorded as percentage points | 8.03 | 6.38 | 1.71 | 41.27 |
| *Need for coordination* | 168 | To perform well in my job, smooth coordination among different departments and functional managers is critical (1 completely disagree<−>completely agree 7) | 5.44 | 1.16 | 2 | 7 |
| *Task delegation* | 169 | Number of tasks the manager performs for her/his job that she/he has to involve superior manager(s) | 11.17 | 4.14 | 0 | 15 |
| *Delegation – functional tasks* | 169 | Number of coordination-intensive, functional tasks the manager performs for her/his job that she/he has to involve superior manager(s) | 2.60 | 2.09 | 0 | 5 |
| *Delegation – departmental tasks* | 169 | Number of less coordination-intensive, departmental tasks the manager performs for his/her job that she/he has to involve superior manager(s) | 8.28 | 2.68 | 0 | 10 |
| *Experience* | 169 | Number of years and months you have as experience – including training and work – in the following 15 areas. Note: please put a “0” in the cells if you don’t have any experience or training in that item. | 7.33 | 5.13 | 0 | 21.87 |
| *Education*[†] | 169 | 1 junior high, 2 high school, 3 technical school, 4 university, 5 master’s | 3.22 | 1.05 | 1 | 5 |
| *Age*[†] | 169 | Years of age | 43.72 | 9.22 | 24 | 65 |
| *Gender*[†] | 169 | 0 male, 1 female | 0.27 | 0.45 | 0 | 1 |
| *Career aspiration* | 168 | How consciously are you intended to pursue a career inside the company as an executive? (1 not much <−> very much 7) | 2.95 | 1.52 | 1 | 7 |
| *Agreeableness* | 168 | The following item relates to your personality: agreeable, organized (i.e., sympathetic, cooperative, but not aggressive or going alone) (1 completely disagree<−>completely agree 7) | 4.57 | 1.32 | 1 | 7 |
| *Risk seeking* | 165 | Investing 5% of your annual income in a very speculative stock (1 extremely unlikely<−>extremely likely 7) | 2.39 | 1.54 | 1 | 7 |

† Constructed from original data provided by company headquarters. Others are self-reported in questionnaire.

**Table 3 *Need for coordination*, *Demand uncertainty*, and *Task delegation*: Sorted by Department**

| | | *Need for coordination* | | *Demand uncertainty* | | *Task delegation* | | |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | |
| | Department | Mean | Std. Dev | Mean | Std. Dev | Mean | Std. Dev | N |
| 1 | Kids | 5.750 | 1.581 | 3.375 | 1.768 | 11.750 | 3.327 | 8 |
| 2 | Ladies wear | 5.667 | 1.118 | 3.333 | 1.500 | 12.778 | 2.539 | 9 |
| 3 | Cloth accessories | 5.000 | 0.816 | 2.750 | 0.500 | 10.750 | 4.924 | 4 |
| 4 | Underwear | 5.700 | 0.823 | 3.100 | 1.287 | 12.900 | 2.961 | 10 |
| 5 | Menswear | 5.833 | 0.753 | 3.667 | 0.816 | 11.143 | 2.911 | 6 |
| 6 | Home furnishing | 5.444 | 1.424 | 4.000 | 1.323 | 12.222 | 2.863 | 9 |
| 7 | Cosmetics | 5.636 | 1.120 | 2.364 | 0.809 | 11.182 | 1.888 | 11 |
| 8 | Grocery | 5.000 | 1.342 | 2.727 | 1.104 | 13.091 | 2.587 | 11 |
| 9 | Liquor | 6.333 | 1.155 | 2.667 | 0.577 | 13.000 | 2.646 | 3 |
| 10 | Daily food | 4.833 | 1.642 | 2.417 | 1.165 | 11.250 | 3.696 | 12 |
| 11 | Deli | 5.000 | 0.953 | 3.167 | 1.642 | 14.333 | 2.015 | 12 |
| 12 | Produce | 5.700 | 0.823 | 2.900 | 0.876 | 11.300 | 2.830 | 10 |
| 13 | Processed meat | 4.700 | 1.636 | 2.400 | 0.699 | 13.300 | 2.312 | 10 |
| 14 | Fish | 4.600 | 0.843 | 3.200 | 1.398 | 13.100 | 2.726 | 10 |
| 15 | Sales operation | 5.556 | 0.882 | 3.100 | 1.101 | 13.556 | 3.127 | 9 |
| 16 | Cashier | 6.000 | 0.943 | 3.000 | 1.054 | 5.600 | 5.232 | 10 |
| 17 | Online business | 5.833 | 0.983 | 2.167 | 1.169 | 7.333 | 3.502 | 6 |
| 18 | Customer service | 6.000 | 1.095 | 3.500 | 1.049 | 8.667 | 5.391 | 6 |
| 19 | IT | 5.714 | 0.756 | 3.143 | 1.464 | 5.286 | 6.676 | 7 |
| 20 | Partners | 6.000 | 1.000 | 1.667 | 0.577 | 6.667 | 6.028 | 3 |
| 21 | Home appliances | 5.750 | 0.500 | 3.500 | 1.000 | 11.250 | 0.957 | 4 |
| 22 | FMCG | 6.000 | 0.000 | 3.000 | 0.000 | 15.000 | 0.000 | 1 |
| 23 | Pharmacy | 4.000 | 0.000 | 2.000 | 0.000 | 5.000 | 0.000 | 1 |
| 24 | Shop-in-shop | 6.000 | 0.000 | 3.000 | 0.000 | 11.333 | 3.512 | 3 |
| Total | | 5.440 | 1.162 | 2.972 | 1.212 | 11.301 | 4.109 | 175 |

**Table 4 *Need for coordination*, *Demand uncertainty*, and *Task delegation*: Sorted by Store**

| | *Need for coordination* | | *Demand uncertainty* | | *Task delegation* | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | |
| Store | Mean | Std. Dev | Mean | Std. Dev | Mean | Std. Dev | N |
| 1 | 5.833 | 0.857 | 3.278 | 1.074 | 11.222 | 3.750 | 18 |
| 2 | 5.364 | 1.206 | 2.091 | 1.300 | 11.818 | 3.842 | 11 |
| 3 | 5.500 | 0.966 | 2.813 | 1.047 | 11.813 | 4.119 | 16 |
| 4 | 5.778 | 1.003 | 4.000 | 1.029 | 10.889 | 4.013 | 18 |
| 5 | 5.467 | 1.356 | 2.400 | 0.986 | 11.200 | 3.968 | 15 |
| 6 | 5.278 | 1.526 | 3.056 | 1.474 | 12.278 | 3.083 | 18 |
| 7 | 5.353 | 0.862 | 3.529 | 1.375 | 10.235 | 4.507 | 17 |
| 8 | 5.375 | 1.408 | 2.625 | 0.916 | 10.889 | 4.512 | 8 |
| 9 | 5.214 | 0.802 | 2.929 | 0.475 | 10.143 | 5.127 | 14 |
| 10 | 4.800 | 1.549 | 2.636 | 0.924 | 12.909 | 3.833 | 10 |
| 11 | 5.625 | 1.310 | 2.250 | 0.856 | 10.063 | 5.434 | 16 |
| 12 | 5.286 | 1.204 | 3.286 | 1.383 | 12.769 | 2.743 | 14 |
| Total | 5.440 | 1.162 | 2.972 | 1.212 | 11.301 | 4.109 | 175 |

## Table 5 Task Delegation

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| *Demand uncertainty* | 0.26 | 2.06*** | 1.85** | 1.85*** |
| | (0.24) | (0.79) | (0.82) | (0.67) |
| *Need for coordination* | -0.50** | 0.46 | 0.40 | 0.40 |
| | (0.24) | (0.48) | (0.49) | (0.40) |
| *Demand uncertainty × Need for coordination* | | -0.33** | -0.29* | -0.29** |
| | | (0.15) | (0.15) | (0.12) |
| *Experience* | 0.30*** | 0.31*** | 0.32*** | 0.32*** |
| | (0.08) | (0.08) | (0.08) | (0.08) |
| *Education* | 0.57** | 0.57** | 0.56* | 0.56* |
| | (0.29) | (0.29) | (0.31) | (0.32) |
| *Age* | -0.09* | -0.09* | -0.09* | -0.09* |
| | (0.05) | (0.05) | (0.05) | (0.05) |
| *Gender* | -0.70 | -0.61 | -0.58 | -0.58 |
| | (0.70) | (0.70) | (0.74) | (0.88) |
| Constant | 12.96*** | 7.69** | 7.96** | 7.96*** |
| | (2.48) | (3.22) | (3.43) | (2.75) |
| 12-store fixed effects# | No | No | Yes (0) | Yes (0) |
| Clustered standard errors (by 24 departments) | No | No | No | Yes |
| $R^2$ | 0.174 | 0.188 | 0.222 | 0.222 |
| F-statistic | 5.41 | 5.89 | 2.79 | 32.18 |
| N | 168 | 168 | 168 | 168 |

* p < 0.10; **p < 0.05; ***p < 0.01. Robust standard errors in parentheses in columns 1, 2, and 3. # Number of statistically significant (p< 0.10) fixed effects in parentheses.

**Table 6 Task Delegation – Functional Tasks vs. Departmental Tasks**

| | Delegation - Functional Tasks | | | | Delegation - Departmental Tasks | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1’ | 2’ | 3’ | 4’ |
| *Demand uncertainty* | 0.11 | 1.27*** | 1.42*** | 1.42*** | 0.21 | 0.63 | 0.42 | 0.42 |
| | (0.13) | (0.47) | (0.49) | (0.42) | (0.14) | (0.50) | (0.51) | (0.36) |
| *Need for coordination* | -0.30** | 0.32 | 0.38 | 0.38 | -0.31** | -0.09 | -0.18 | -0.18 |
| | (0.14) | (0.29) | (0.29) | (0.26) | (0.14) | (0.28) | (0.27) | (0.21) |
| *Demand uncertainty × Need for coordination* | | -0.22** | -0.22** | -0.22*** | | -0.08 | -0.04 | -0.04 |
| | | (0.08) | (0.09) | (0.07) | | (0.10) | (0.10) | (0.07) |
| *Experience* | 0.09*** | 0.09*** | 0.10*** | 0.10*** | 0.25*** | 0.25*** | 0.26*** | 0.26*** |
| | (0.03) | (0.03) | (0.04) | (0.03) | (0.05) | (0.05) | (0.05) | (0.06) |
| *Education* | 0.18 | 0.18 | 0.21 | 0.21 | 0.40** | 0.40** | 0.39** | 0.39** |
| | (0.16) | (0.15) | (0.17) | (0.18) | (0.17) | (0.17) | (0.19) | (0.20) |
| *Age* | -0.01 | -0.01 | -0.01 | -0.01 | -0.11*** | -0.11*** | -0.11*** | -0.11*** |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.03) | (0.03) | (0.03) | (0.03) |
| *Gender* | -0.27 | -0.21 | -0.24 | -0.24 | -0.72* | -0.70* | -0.60 | -0.60 |
| | (0.38) | (0.37) | (0.40) | (0.44) | (0.39) | (0.40) | (0.42) | (0.65) |
| Constant | 2.96** | -0.45 | -1.30 | -1.30 | 11.22*** | 9.99*** | 10.87*** | 10.87*** |
| | (1.29) | (1.92) | (2.00) | (1.61) | (1.42) | (1.70) | (1.93) | (1.82) |
| 12-store fixed effects# | No | No | Yes (0) | Yes (0) | No | No | Yes (1) | Yes (1) |
| Clustered standard errors (by 24 departments) | No | No | No | Yes | No | No | No | Yes |
| $R^2$ | 0.098 | 0.121 | 0.165 | 0.165 | 0.291 | 0.293 | 0.333 | 0.333 |
| F-statistic | 3.82 | 4.25 | 2.06 | 49.53 | 9.89 | 8.58 | 3.94 | 15.86 |
| N | 168 | 168 | 168 | 168 | 168 | 168 | 168 | 168 |

* p < 0.10; **p < 0.05; ***p < 0.01. Robust standard errors in parentheses in columns 1, 2, 3, 5, 6, and 7. Clustered standard errors in parentheses in columns 4 and 8. # Number of statistically significant (p< 0.10) fixed effects in parentheses.

**Table 7 Sales-Generating Departments Only – Task Delegation**

Excludes: Sales Operations, Cashier, Customer Service, Partners, and Information Technology

| | Task Delegation | Task Delegation | Delegation – Functional Tasks | Delegation – Functional Tasks | Delegation – Departmental Tasks | Delegation – Departmental Tasks |
|---|---|---|---|---|---|---|
| | 1 | 2 | 1' | 2' | 1'' | 2'' |
| *Demand uncertainty* | 0.31 | 2.14*** | 0.16 | 1.77*** | 0.18* | 0.42 |
| | (0.24) | (0.70) | (0.17) | (0.50) | (0.10) | (0.36) |
| *Need for coordination* | -0.34 | 0.63 | -0.30* | 0.56* | -0.19* | -0.06 |
| | (0.22) | (0.45) | (0.15) | (0.30) | (0.10) | (0.22) |
| *Demand uncertainty × Need for coordination* | | -0.35*** | | -0.31*** | | -0.05 |
| | | (0.13) | | (0.09) | | (0.07) |
| *Experience* | 0.19** | 0.20** | 0.09* | 0.10* | 0.14*** | 0.14*** |
| | (0.08) | (0.08) | (0.05) | (0.05) | (0.04) | (0.04) |
| *Education* | 0.56* | 0.57* | 0.25 | 0.26 | 0.30* | 0.31* |
| | (0.30) | (0.30) | (0.19) | (0.19) | (0.16) | (0.16) |
| *Age* | -0.02 | -0.03 | -0.00 | -0.00 | -0.05* | -0.05* |
| | (0.05) | (0.05) | (0.03) | (0.03) | (0.03) | (0.03) |
| *Gender* | 0.05 | 0.15 | 0.06 | 0.15 | -0.03 | -0.01 |
| | (0.72) | (0.69) | (0.48) | (0.45) | (0.34) | (0.34) |
| Constant | 10.08*** | 4.88 | 1.91 | -2.65 | 9.64*** | 8.94*** |
| | (2.29) | (3.13) | (1.51) | (2.09) | (1.16) | (1.60) |
| 12-store fixed effects# | Yes (0) | Yes (0) | Yes (0) | Yes (1) | Yes (0) | Yes (0) |
| $R^2$ | 0.122 | 0.148 | 0.138 | 0.187 | 0.166 | 0.168 |
| F-statistic | 1.27 | 1.85 | 1.45 | 1.97 | 1.35 | 1.30 |
| N | 137 | 137 | 137 | 137 | 137 | 137 |

* p < 0.10; **p < 0.05; ***p < 0.01. Robust standard errors in parentheses. # Number of statistically significant (p< 0.10) fixed effects in parentheses.

## Table 8 Effect of Departmental Sales Deviations

| | Task Delegation | Task Delegation | Delegation – Functional Tasks | Delegation – Functional Tasks | Delegation – Departmental Tasks | Delegation – Departmental Tasks |
|---|---|---|---|---|---|---|
| | 1 | 2 | 1' | 2' | 1'' | 2'' |
| log(*Sales deviations*) | -0.27 | 4.95** | -0.22 | 2.50† | 0.19 | 0.67 |
| | (0.41) | (2.04) | (0.30) | (1.56) | (0.17) | (1.08) |
| *Need for coordination* | -0.37* | 1.41** | -0.33** | 0.60 | -0.14* | 0.02 |
| | (0.20) | (0.69) | (0.15) | (0.56) | (0.09) | (0.44) |
| log(*Sales deviations*) × *Need for coordination* | | -0.98*** | | -0.51* | | -0.09 |
| | | (0.37) | | (0.29) | | (0.21) |
| *Experience* | 0.12* | 0.15** | 0.06 | 0.08 | 0.06** | 0.07** |
| | (0.07) | (0.07) | (0.05) | (0.05) | (0.03) | (0.03) |
| *Education* | 0.40 | 0.48* | 0.20 | 0.24 | 0.23** | 0.24** |
| | (0.26) | (0.27) | (0.19) | (0.20) | (0.10) | (0.10) |
| *Age* | 0.01 | 0.01 | 0.01 | 0.01 | -0.01 | -0.01 |
| | (0.04) | (0.04) | (0.03) | (0.03) | (0.02) | (0.02) |
| *Gender* | 0.12 | 0.29 | 0.34 | 0.43 | -0.05 | -0.04 |
| | (0.69) | (0.66) | (0.49) | (0.46) | (0.26) | (0.26) |
| Constant | 11.85*** | 2.01 | 2.99* | -2.15 | 8.66*** | 7.75*** |
| | (2.03) | (4.17) | (1.57) | (3.27) | (0.70) | (2.16) |
| 12-store fixed effects# | No | No | No | No | No | No |
| $R^2$ | 0.084 | 0.130 | 0.083 | 0.108 | 0.096 | 0.098 |
| F-statistic | 2.50 | 3.13 | 1.94 | 2.34 | 2.61 | 2.44 |
| N | 125 | 125 | 125 | 125 | 125 | 125 |

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. † $p < 0.10$ one-tail test. Robust standard errors in parentheses. # Number of statistically significant ($p < 0.10$) fixed effects in parentheses. Including store fixed effects generates almost identical results since none of the fixed effects is statistically significant.

Note: *Sales deviations* = average of absolute values of (100 - monthly realized sales / planned sales ratio) at each department, where the monthly ratio was recorded in percentage points. This variable measures a form of unexpected department-specific sales volatility. We use log values reduce skewness.

## Table 9 Effect of Departmental Sales Changes

| | Task Delegation | Task Delegation | Delegation – Functional Tasks | Delegation – Functional Tasks | Delegation – Departmental Tasks | Delegation – Departmental Tasks |
|---|---|---|---|---|---|---|
| | 1 | 2 | 1’ | 2’ | 1’’ | 2’’ |
| log(*Sales changes*) | -0.07 | 1.71* | -0.04 | 0.72 | 0.04 | 0.59* |
| | (0.20) | (0.87) | (0.14) | (0.62) | (0.08) | (0.32) |
| *Need for coordination* | -0.36* | -1.46*** | -0.32** | -0.79** | -0.12 | -0.46*** |
| | (0.20) | (0.54) | (0.15) | (0.40) | (0.08) | (0.17) |
| log(*Sales changes*) × *Need for coordination* | | -0.34** | | -0.15† | | -0.11* |
| | | (0.16) | | (0.11) | | (0.06) |
| *Experience* | 0.13* | 0.14* | 0.07 | 0.07 | 0.07** | 0.07** |
| | (0.07) | (0.07) | (0.05) | (0.05) | (0.03) | (0.03) |
| *Education* | 0.42 | 0.41 | 0.23 | 0.22 | 0.20** | 0.20** |
| | (0.27) | (0.26) | (0.19) | (0.19) | (0.10) | (0.10) |
| *Age* | 0.01 | 0.01 | 0.01 | 0.01 | -0.01 | -0.01 |
| | (0.04) | (0.04) | (0.03) | (0.03) | (0.02) | (0.02) |
| *Gender* | -0.04 | 0.14 | 0.16 | 0.24 | -0.01 | 0.05 |
| | (0.67) | (0.65) | (0.47) | (0.46) | (0.26) | (0.26) |
| Constant | 11.12*** | 16.53*** | 2.46 | 4.76* | 9.11*** | 10.80*** |
| | (2.22) | (3.64) | (1.75) | (2.69) | (0.78) | (1.25) |
| 12-store fixed effects# | No | No | No | No | No | No |
| $R^2$ | 0.083 | 0.121 | 0.078 | 0.091 | 0.087 | 0.108 |
| F-statistic | 2.41 | 2.35 | 1.86 | 1.61 | 2.68 | 3.61 |
| N | 128 | 128 | 128 | 128 | 128 | 128 |

* $p < 0.10$; **$p < 0.05$; ***$p < 0.01$. † $p < 0.10$ one-tail test. Robust standard errors in parentheses. # Number of statistically significant ($p < 0.10$) fixed effects in parentheses. Including store fixed effects generates almost identical results since none of the fixed effects is statistically significant.

Note: *Sales changes* = log(variance of departmental month-to-month sales changes). This variable measures department-specific sales volatility. We use log values to reduce skewness.

## Table 10 Effect of Local Volatility on Task Delegation under High versus Low Coordination Need

**(Need for coordination by median split)**

| | Task delegation | | Task delegation | | Task delegation | |
|---|---|---|---|---|---|---|
| | Low | High | Low | High | Low | High |
| | 1 | 1' | 2 | 2' | 3 | 3' |
| *Demand uncertainty* | 0.57* | 0.06 | | | | |
| | (0.32) | (0.33) | | | | |
| log(*Sales deviations*) | | | 0.55 | -1.24** | | |
| | | | (0.50) | (0.59) | | |
| log(*Sales changes*) | | | | | 0.40† | -0.54** |
| | | | | | (0.29) | (0.27) |
| *Experience* | 0.29** | 0.32*** | 0.11 | 0.15 | 0.12 | 0.18* |
| | (0.12) | (0.10) | (0.09) | (0.11) | (0.09) | (0.11) |
| *Education* | 0.24 | 0.64* | 0.44 | 0.33 | 0.33 | 0.40 |
| | (0.49) | (0.37) | (0.42) | (0.35) | (0.43) | (0.33) |
| *Age* | -0.11 | -0.06 | 0.00 | 0.02 | -0.01 | 0.00 |
| | (0.08) | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) |
| *Gender* | 0.37 | -1.43* | 0.47 | -0.27 | 0.61 | -0.55 |
| | (1.18) | (0.86) | (1.07) | (0.82) | (1.05) | (0.76) |
| Constant | 12.04*** | 9.28*** | 9.01*** | 11.07*** | 12.16*** | 7.11*** |
| | (3.38) | (2.64) | (2.94) | (2.58) | (3.47) | (2.43) |
| $R^2$ | 0.149 | 0.195 | 0.067 | 0.147 | 0.086 | 0.166 |
| F-statistic | 2.00 | 4.06 | 0.78 | 2.30 | 1.29 | 2.93 |
| N | 73 | 95 | 62 | 63 | 62 | 66 |

* p < 0.10; **p < 0.05; ***p < 0.01. † p < 0.10 one-tail test. Robust standard errors in parentheses. *Need for coordination* by median split: Low = ratings are 2, 3, 4, and 5; High = ratings are 6 and 7. Store fixed effects excluded to save degree of freedom.

## Table 11 Task Delegation with Department Fixed Effects

| | Task Delegation | Task Delegation | Delegation – Functional Tasks | Delegation – Functional Tasks | Delegation – Departmental Tasks | Delegation – Departmental Tasks |
|---|---|---|---|---|---|---|
| | 1 | 2 | 1’ | 2’ | 1’’ | 2’’ |
| *Demand uncertainty* | 0.09 | 2.01* | 0.06 | 1.32** | 0.02 | 0.55 |
| | (0.24) | (1.05) | (0.13) | (0.58) | (0.13) | (0.56) |
| *Need for coordination* | -0.14 | 0.90 | -0.20 | 0.48 | -0.10 | 0.18 |
| | (0.26) | (0.61) | (0.14) | (0.34) | (0.13) | (0.32) |
| *Demand uncertainty × Need for coordination* | | -0.36* | | -0.23** | | -0.10 |
| | | (0.19) | | (0.10) | | (0.10) |
| *Experience* | 0.05 | 0.05 | 0.05 | 0.05 | 0.03 | 0.03 |
| | (0.07) | (0.07) | (0.04) | (0.04) | (0.04) | (0.04) |
| *Education* | 0.58** | 0.59** | 0.20 | 0.21 | 0.35** | 0.35** |
| | (0.28) | (0.28) | (0.16) | (0.15) | (0.15) | (0.15) |
| *Age* | 0.05 | 0.06 | 0.02 | 0.02 | -0.00 | -0.00 |
| | (0.04) | (0.04) | (0.02) | (0.02) | (0.02) | (0.02) |
| *Gender* | -0.30 | -0.02 | -0.11 | 0.07 | -0.45 | -0.38 |
| | (0.83) | (0.83) | (0.46) | (0.46) | (0.44) | (0.44) |
| Constant | 6.97** | 0.79 | 1.00 | -3.05 | 8.47*** | 6.77*** |
| | (3.09) | (4.49) | (1.72) | (2.49) | (1.63) | (2.39) |
| 12-store fixed effects | No | No | No | No | No | No |
| 24-departments fixed effects‡ | Yes (+: deli; -: cashier; -ecomm, IT, partners, pharmacy) | Yes (+: deli; -: cashier, ecomm, IT, partners) | Yes (+: deli, sales operation) | Yes (+: deli, sales operation) | Yes (-: cashier, ecomm, IT, partners, pharmacy) | Yes (-: cashier, ecomm, IT, partners, pharmacy) |
| $R^2$ | 0.431 | 0.445 | 0.308 | 0.332 | 0.627 | 0.629 |
| F-statistic | 3.76 | 3.82 | 2.21 | 2.36 | 8.34 | 8.08 |
| N | 168 | 168 | 168 | 168 | 168 | 168 |

* $p < 0.10$; **$p < 0.05$; ***$p < 0.01$. † $p < 0.10$ one-tail test. Standard errors in parentheses.. ‡ Base department = kid apparel: + means positive and negative coefficient at a minimum of $p<0.10$ level.

## Table 12 Effect of Personality Traits on Task Delegation

| | Task Delegation | Task Delegation | Delegation – Functional Tasks | Delegation – Functional Tasks | Delegation – Departmental Tasks | Delegation – Departmental Tasks |
|---|---|---|---|---|---|---|
| | 1 | 2 | 1' | 2' | 1'' | 2'' |
| *Demand uncertainty* | 0.27 | 1.81** | 0.23 | 1.59*** | 0.18 | 0.15 |
| | (0.26) | (0.92) | (0.16) | (0.51) | (0.14) | (0.54) |
| *Need for coordination* | -0.34 | 0.48 | -0.22 | 0.51* | -0.23 | -0.25 |
| | (0.27) | (0.55) | (0.15) | (0.31) | (0.15) | (0.31) |
| *Demand uncertainty × Need for coordination* | | -0.29* | | -0.25*** | | 0.01 |
| | | (0.17) | | (0.09) | | (0.10) |
| *Experience* | 0.30*** | 0.30*** | 0.10*** | 0.10*** | 0.24*** | 0.24*** |
| | (0.08) | (0.08) | (0.04) | (0.04) | (0.05) | (0.05) |
| *Education* | 0.35 | 0.36 | 0.16 | 0.16 | 0.23 | 0.23 |
| | (0.31) | (0.30) | (0.17) | (0.17) | (0.18) | (0.18) |
| *Age* | -0.07 | -0.07 | -0.00 | 0.00 | -0.10*** | -0.10*** |
| | (0.04) | (0.04) | (0.02) | (0.02) | (0.03) | (0.03) |
| *Gender* | -0.11 | -0.05 | -0.13 | -0.08 | -0.25 | -0.26 |
| | (0.73) | (0.73) | (0.41) | (0.40) | (0.40) | (0.40) |
| *Career aspiration* | 0.47** | 0.45** | 0.21* | 0.20* | 0.25* | 0.25* |
| | (0.22) | (0.22) | (0.12) | (0.12) | (0.13) | (0.13) |
| *Agreeableness* | -0.08 | -0.09 | -0.10 | -0.11 | 0.02 | 0.02 |
| | (0.27) | (0.27) | (0.14) | (0.13) | (0.16) | (0.16) |
| *Risk loving* | 0.33* | 0.33* | 0.11 | 0.11 | 0.28** | 0.28** |
| | (0.20) | (0.20) | (0.11) | (0.10) | (0.12) | (0.12) |
| Constant | 10.03*** | 5.56 | 1.25 | -2.71 | 9.83*** | 9.93*** |
| | (2.70) | (3.68) | (1.54) | (2.09) | (1.50) | (2.03) |
| 12-store fixed effects# | Yes (0) | Yes (0) | Yes (1) | Yes (1) | Yes (1) | Yes (1) |
| $R^2$ | 0.235 | 0.244 | 0.162 | 0.190 | 0.366 | 0.366 |
| F-statistic | 2.50 | 2.68 | 1.83 | 2.13 | 4.08 | 3.86 |
| N | 163 | 163 | 163 | 163 | 163 | 163 |

* p < 0.10; **p < 0.05; ***p < 0.01. Robust standard errors in parentheses. # Number of statistically significant (p< 0.10) fixed effects in parentheses.

## Table 13 Effect of Experience Difference

(Difference of experience between department manager and superior manager)

| | Task Delegation | Task Delegation | Delegation – Functional Tasks | Delegation – Functional Tasks | Delegation – Departmental Tasks | Delegation – Departmental Tasks |
|---|---|---|---|---|---|---|
| | 1 | 2 | 1' | 2' | 1'' | 2'' |
| *Experience difference* | 0.24*** | 0.17 | 0.06** | 0.06 | 0.21*** | 0.13 |
| | (0.07) | (0.18) | (0.03) | (0.09) | (0.04) | (0.11) |
| *Need for coordination* | -0.34 | -0.34 | -0.22 | -0.22 | -0.20 | -0.20 |
| | (0.24) | (0.24) | (0.15) | (0.15) | (0.13) | (0.13) |
| *Experience difference × Need for coordination* | | 0.01 | | 0.00 | | 0.01 |
| | | (0.03) | | (0.02) | | (0.02) |
| *Demand uncertainty* | 0.31 | 0.31 | 0.22 | 0.22 | 0.17 | 0.17 |
| | (0.26) | (0.26) | (0.16) | (0.16) | (0.13) | (0.13) |
| *Education* | 0.39 | 0.38 | 0.17 | 0.17 | 0.29 | 0.28 |
| | (0.32) | (0.32) | (0.18) | (0.18) | (0.19) | (0.19) |
| *Age* | -0.06 | -0.06 | 0.01 | 0.01 | -0.08*** | -0.08*** |
| | (0.04) | (0.05) | (0.02) | (0.02) | (0.03) | (0.03) |
| *Gender* | -0.87 | -0.86 | -0.36 | -0.36 | -0.66 | -0.65 |
| | (0.78) | (0.78) | (0.44) | (0.44) | (0.42) | (0.42) |
| Constant | 12.90*** | 12.88*** | 2.03 | 2.03 | 11.62*** | 11.60*** |
| | (2.74) | (2.75) | (1.43) | (1.43) | (1.60) | (1.60) |
| 12-store fixed effects# | Yes (2) | Yes (2) | Yes (1) | Yes (1) | Yes (2) | Yes (2) |
| $R^2$ | 0.189 | 0.190 | 0.131 | 0.131 | 0.313 | 0.316 |
| F-statistic | 2.13 | 2.06 | 1.53 | 1.50 | 3.89 | 3.89 |
| N | 163 | 163 | 163 | 163 | 163 | 163 |

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. † $p < 0.10$ one-tail test. Robust standard errors in parentheses. # Number of statistically significant ($p < 0.10$) fixed effects in parentheses.