# The Relationship Between Delegation and Incentives Across Occupations: Evidence and Theory*

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**Abstract**

A large literature, both theoretical and empirical, suggests that delegation of authority and incentives should have a positive relationship. Using data from a large cross section of British establishments, we show that the positive relationship between incentives and delegation that has been consistently documented in the empirical literature masks a stark difference between job types. We classify jobs into two categories: *complex* jobs include professional, technical and scientific occupations and *simple* jobs consist of all other occupations with a lower-level code in the Standard Occupational Classification (SOC) system. We find that for simple jobs the relationship between delegation and incentives is positive as has been found in the previous literature, whereas for complex jobs it is negative. To explain this negative relationship for complex jobs, we develop a model where tasks have a risk-return tradeoff and where a single performance measure has to induce both task selection and effort. We find that if task selection is valuable and effort is noisy to measure, then delegation and incentives have a negative relationship.

## 1 Introduction

A central question in organizations concerns the allocation of decision rights. For example, should workers be given the authority to select the tasks they perform on the job? Delegating authority to workers can be beneficial because workers often have better information about the tasks they perform than their employers. But workers' preferences over these tasks may differ from those of their employer, and

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this mismatch in preferences biases worker decisions. The resulting tradeoff between information and bias in decision making is at the center of several theoretical models (Holmstrom and Milgrom (1991), Jensen and Meckling (1992), Prendergast (2002), Itoh, Kikutani, and Hayashida (2008), Rantakari (2008)) and has the following implication. When workers are delegated authority, incentives must be stronger. [1] Stronger incentives ensure that, when choosing tasks and making other decisions, workers place less weight on their private benefits and more weight on the expected returns to their employer. Thus, authority and incentives are positively related.

This theoretical prediction has motivated an empirical literature to identify the sign of the relationship between authority and incentives. Some of the evidence is based on particular industries or types of jobs. Nagar (2002) finds that bank managers with more authority receive more incentive-based pay. Colombo and Delmastro (2004) analyzes a sample of manufacturing plants and their parent companies in the Italian metalworking sector, finding that delegating authority to the plant manager is more likely when monetary incentives are introduced. Wulf (2007) uses compensation survey data on division managers and finds that corporate officers with broader authority (for example, presidents, vice presidents and Chief Financial Officers of a business unit, division, or function) are more likely than non-officers with less authority to have their pay tied to global performance measures such as firm sales growth. Itoh, Kikutani, and Hayashida (2008) use data on Japanese business groups and find that delegation of authority from a core firm to an affiliated firm is positively correlated with an accountability measure. Other evidence is based on broader cross sectional samples of workers spanning a variety of industries and job types. MacLeod and Parent (1999) find that workers with more "autonomy" are more likely to be paid commissions. Foss and Laursen (2005), using data on Danish firms, and DeVaro and Kurtulus (2010), using survey data on British establishments, find a positive relationship between delegation and incentives.

Consistent with the theoretical prediction, all of the preceding empirical studies have found a positive relationship between delegation and incentives.[2] However, striking counterexamples can be seen in the real world. Consider the following example involving cardiac surgeons. The primary functions of a cardiology unit are choosing treatment plans for patients (usually either a surgical procedure like a coronary angioplasty or a medication plan) and executing those treatments. The unit has two alternatives for delegating authority. One is to specify a treatment plan based on patient characteristics and to require the surgeon to follow the plan. Another is to delegate authority to the surgeon to select the appropriate treatment. Noting that a common performance measure used for incentives in cardiac units is whether a patient survives surgery, consider what happens when a surgeon who can

[1] The strength of incentives in Holmstrom and Milgrom (1991) and Prendergast (2002) is measured by the slope of a linear, output-contingent compensation contract.

[2] The only prior evidence we are aware of suggesting a negative relationship is a bivariate correlation appearing in Table 5 of Ortega (2009), based on cross sectional data from the EU-15 group.

select a treatment plan has his pay tied more closely to his patients' mortality rates. Because this incentive scheme imposes risk on the surgeon, a risk averse surgeon may choose not to operate on a high-risk patient even though surgery might help that patient. In fact, survey evidence suggests that in an overwhelming number of cases, incentives based on mortality rates lead surgeons to avoid risky but potentially beneficial surgeries.[3] Such behavior has negative implications both for the reputation of the cardiology unit and for public health.

The preceding example highlights a tradeoff that the cardiology unit faces when it strengthens incentives. Incentive pay can induce a surgeon to work harder but at the same time distorts the surgeon's decisions concerning how to treat patients. If effort is very noisy (as is the case with surgeons), the benefits from increased effort are outweighed by the costs of distortions in treatment plans. This in turn suggests that incentives must be muted when surgeons can select treatment plans for patients. We believe that this tradeoff between inducing effort and selecting tasks is not unique to cardiac surgeons and that it plays a role in many other high-level jobs. For example, tying academics' pay to the number of research papers published leads to academics pursuing safe research topics and publication strategies. Tying scientists' pay to the commercial success of a product leads scientists to be cautious when developing features of a product. Likewise, legal and financial advisors are likely to give conservative advice if their pay depends on final outcomes. Note that in all of these examples, effort is noisy to measure, which reduces the benefits of incentive pay.

These counterexamples to the standard theoretical prediction provide the motivation for this paper, which is to explore how the relationship between incentives and delegation varies across occupations. Motivated by the preceding examples, we classify jobs into two broad categories. *Complex* jobs are those for which task selection is valuable and for which effort is noisy to measure, as in the preceding examples. The jobs we include in this category are professional, and technical and scientific jobs, which are higher-level codes in the Standard Occupational Classification (SOC) system. *Simple* jobs, on the other hand, consist of clerical and secretarial occupations, craft and skilled manual occupations, personal service occupations sales occupations, operative and assembly manual occupations, and routine unskilled manual occupations. We believe that task selection is less valuable and that effort is easier to measure for these jobs. Using data from the 1998 British WERS – a nationally representative survey of British establishments that also contains survey information from up to 25 workers per establishment – we document a new empirical finding, namely that the positive relationship between incentives and delegation that has been reported in the empirical literature masks a stark difference between these two broad job types. We find that for simple jobs, the relationship between delegation and incentives is positive, as has been found in the previous lit-

[3]Cardiologists Say Rankings Sway Choices on Surgery, The New York Times, Jan 11, 2005. Also see Dranove, Kessler, McClellan, and Satterthwaite (2003) for empirical work on this topic.

erature, whereas for complex jobs it is negative, as in the example involving cardiac surgeons.

Documenting this new empirical result is the first contribution of the paper. The second contribution is to provide a potential theoretical explanation for the negative relationship between delegation and incentives for complex jobs. To do this, we develop a model with two features that are central to the preceding example involving cardiac surgeons. The first is that a worker who is delegated authority can select the tasks on which he exerts effort, and these tasks have a positive risk-return tradeoff. Second, employers only have a single performance measure with which to induce both task selection and effort. These two features lead to a simple tradeoff. Stronger incentives on the performance measure, as is standard in many agency models, induce higher effort. But stronger incentives on the performance measure also lead the worker (when given authority to choose tasks) to inefficiently select a low risk-return task. Thus the employer must decide whether to induce effort or task selection. When task selection is relatively more important (i.e. some tasks yield high returns) and effort is noisy to measure, then the employer prefers to induce task selection. This leads to a negative relationship between delegation and incentives. We think that this sufficient condition for the negative relationship between authority and incentives, i.e. high variation in task returns and noise in measuring effort, is likely to hold in many jobs in the "complex" category.

Our work is related to some other theory papers that examine incentives for project selection. Hirshleifer and Suh (1992) show how convexity in incentive schemes induces risky project selection but distorts effort.[4] Hence, their focus is on the curvature of the contract rather than the level of incentives or delegation. Demski and Dye (1999) also consider a setting with a risk-return tradeoff, where contracts are designed not to influence a worker's project selection but rather to elicit a manager's private information about a project's attributes. Athey and Roberts (2001) show that in a setting with multiple agents, relative performance evaluation mitigates the adverse effects of risk that are borne by individual agents, as long as error terms are common or correlated across agents. However, this distorts project choice because the agent places negative weight on components of the project that show up in the performance measures of other agents. Their framework is different because they do not have a positive risk-return tradeoff across projects. Recent papers by Manso (2011) and Ederer and Manso (2008) show how tolerating early failure in a dynamic setting encourages innovation. Once again, they do not consider a positive risk-return tradeoff across projects. Furthermore, they do not consider delegation of authority, nor do they conduct empirical tests.[5] In independently developed work, Lando (2004) constructs an example with a positive risk-return

[4]Lambert (1986) and Core and Qian (2002) also study incentives for the selection of risky projects.

[5]Other papers that study incentives for innovation outside of a delegation context are Nagaoka and Owan (2008) and Hellmann and Thiele (2008).

tradeoff across projects where delegation and incentives can be substitutes. His focus, however, is on the relative distortions between a principal and agent choosing projects when both cannot commit in advance to the projects they choose.

Our paper also relates to a large literature investigating various aspects of delegation of authority. Aghion and Tirole (1997) show how delegation of authority provides incentives for an agent to exert effort (i.e. acquire information about projects). Bester and Krahmer (2008) also look at the incentive role of delegation, but in a setting in which projects are selected before the agent exerts effort and in which it is possible to contract on output. They find, in contrast to Aghion and Tirole (1997), that when higher effort must be induced, delegation is less likely. Though this could imply a negative relationship between delegation and the incentive level for an output-contingent contract, they do not emphasize this as a result. Meagher and Wait (2008) focus on delegation in an environment with delay costs. Other papers examine the tradeoff between information and bias to characterize the settings in which delegation is optimal (Dessein (2002), Alonso and Matouschek (2008), Marino and Matsusaka (2005)). Whereas our paper uses a moral hazard framework, an alternative approach studies delegation in an adverse selection setting (Mookherjee (2006)). Raith (2008) is another paper outside of a delegation framework that studies incentives when an agent has better information (i.e. specific knowledge) than the principal. Finally, Van den Steen (2007) considers a setting where the principal and agent differ in their priors and focuses on a different notion of authority, based on the agent obeying orders. He finds that agents at the receiving end of authority (i.e. who are given orders by a principal) optimally have lower powered incentives.

## 2 Data and Empirical Analysis

In this section we provide empirical evidence concerning how the relationship between incentives and authority differs between complex and simple jobs. Our data sample is drawn from both the management and worker questionnaires in the 1998 British Workplace Employee Relations Survey (WERS), jointly sponsored by the Department of Trade and Industry, ACAS, the Economic and Social Research Council, and the Policy Studies Institute.[6] Distributed via the UK Data Archive, the WERS data are a nationally representative stratified random sample covering British workplaces with at least ten employees, except for those in the following 1992 Standard Industrial Classification (SIC) divisions: agriculture, hunting, and forestry; fishing; mining and quarrying; private households with employed persons; and extra-

[6] Although a 2004 wave of the survey is available, for our purposes the 1998 wave is superior for two reasons. First, it contains more information on incentive pay within the establishment. Second, using the 1998 data means that our results are directly comparable to those in DeVaro and Kurtulus (2010) which used the same data set and the same measures of the key variables to examine the relationship between incentive pay and delegation, neglecting the distinction between complex and simple jobs.

territorial organizations. Some of the 3192 workplaces targeted were found to be out of scope, and the final sample size of 2191 implies a net response rate of 80.4% (Cully, Woodland, O'Reilly, and Dix (1999)) after excluding the out-of-scope cases.[7] Data were collected between October 1997 and June 1998 via face-to-face interviews. The respondent in the management questionnaire was usually the most senior manager at the workplace with responsibility for employment relations.[8]

To distinguish complex from simple jobs, we rely on one-digit and two-digit Standard Occupational Classification (SOC) codes for each establishment's largest occupational group. There are nine one-digit codes, and we rely on these categorizations to define jobs broadly as either complex or simple in the following definition:

*Complex* = 1 if the establishment's largest occupational group is "Professional occupations" or "Technical, scientific occupations" (= 0 if the establishment's largest occupational group is "Clerical and secretarial occupations" or "Craft and skilled manual occupations" or "Personal service occupations" or "Sales occupations" or "Operative and assembly manual occupations" or "Routine unskilled manual occupations").

Panel 1 of Appendix B displays the detailed two-digit and three-digit codes underlying the broad occupational group we refer to as "complex jobs". Panel 2 displays the two-digit codes underlying the group we define as "simple jobs".

A small number of observations (i.e. 14) have the establishment's largest occupational group reported as "Managers and senior administrative occupations". We drop these observations from our analyses given that it is unclear to us what these establishments do (i.e. in the typical case, a manager would be supervising other workers).

In defining the two broad job categories, we wanted to avoid making arbitrary judgements about a large number of detailed occupations. Our approach, therefore, was to rely only on the broad one-digit SOC codes and to assign the higher-skilled codes to the "complex" category. Based on the more detailed breakdown in Appendix B, we think that task selection is likely to be particularly important relative to effort inducement for these jobs, as a group, than for other jobs. To provide empirical justification for this way of splitting the sample, we relied on some information in the survey concerning the importance of strategy to the employer. The argument is that if strategy is particularly important at the establishment level, this suggests a higher relative importance of task selection, and in these settings we

[7]The "scope" is workplaces with 10 or more employees located in Great Britain (England, Scotland and Wales) and engaged in activities within Sections D (Manufacturing) to O (Other Community, Social and Personal Services) of the 1992 Standard Industrial Classification. The survey covers both the private and public sectors. If a case is sampled that does not meet these parameters, it is called "out of scope."

[8]Our measures of the two key variables (i.e. incentive pay and delegation) as well as controls for firm characteristics and the degree of risk in the production environment are defined as in DeVaro and Kurtulus (2010).

would expect an increased likelihood that the establishment's largest occupational group would be one involving complex jobs. The survey asks the following question: "Is this workplace covered by a formal strategic plan which sets out objectives and how they will be achieved?", with responses 1 = Yes and 0 = No. This strategy dummy variable has a positive bivariate correlation with *Complex* exceeding 0.11, which is statistically significant at the one percent level. If the two one-digit categories comprising *Complex* = 1 and the six one-digit categories comprising *Complex* = 0 are each correlated with the strategy dummy, the results are as follows. Both subcategories of the *Complex* = 1 group (i.e. professionals and technical, scientific occupations) have positive correlations with the strategy dummy of 0.10 and 0.04, respectively, both of which are significant at the five percent level. Of the six one-digit subcategories of the *Complex* = 0 group, four are negatively correlated with the strategy dummy (three of which are statistically significant at the ten percent level). The remaining two (i.e. clerical and secretarial occupations, and sales occupations) have positive correlations with the strategy dummy of 0.02, though both correlations are statistically significant even at the 25 percent level. Overall, given the argument that task selection become more important in establishments where strategy is important, we see these results as providing some empirical justification for our chosen categorization of jobs into "complex" versus "simple".

The relevant theoretical notion of the strength of incentive pay is the slope of an output-based compensation contract. Such a continuous measure of incentive pay is unavailable in the WERS, so we rely on three categorical measures, defined from the management survey. The first is:

*Incentive Pay* = 1 if any employees at the workplace received payments or dividends from individual performance-related schemes (= 0 otherwise).[9]

A potential criticism of our first measure is that an establishment might be classified as using incentive pay even if very few workers (perhaps just a single worker) receive such pay. Our second and third measures are less susceptible to this problem. Our second measure is defined as follows, where the suffix "l.o.g." denotes

[9]The actual wording of the survey question permits group-based as well as individual-based schemes. However, when non-managerial workers are eligible for incentive pay, the survey asks what measures of performance are used for awarding such pay (i.e. "1 = Individual performance / output", "2 = Group or team performance / output", "3 = Workplace-based measures", "4 = Organisation-based measures"). The majority of establishments responding to this question reports using individual-based schemes. Since the theoretical literature on incentives pertains to individual-based schemes, we classify the incentive pay measure as 0 if "individual performance / output" was not one of the performance criteria listed as the basis for incentive pay. This creates a measure equaling 1 only when we can be certain (given that non-managerial workers are eligible for incentive pay) that individual-based performance measures are used. If performance pay is used at the establishment but no non-managerial occupations are eligible for it, we have no information on what performance measures are used. This occurs in fewer than 15 percent of cases, and in such cases we classify the incentive pay measure as 1, following DeVaro and Kurtulus (2010). Given that the majority of establishments report basing incentive pay (at least in part) on individual performance measures, the likelihood of misclassifying these relatively few ambiguous cases is small.

"largest occupational group":

*Incentive Pay(l.o.g.)* = 1 if any employees in the establishment's largest occupational group received payments or dividends from individual performance-related schemes (= 0 otherwise).

One advantage of using *Incentive Pay(l.o.g.)* as the dependent variable is that *Complex* is defined with respect to the establishment's largest occupational group, which strengthens the compatibility between *Complex* and the dependent variable. As was true of our first measure of incentive pay, the actual survey question underlying the second measure permits group-based as well as individual-based incentive schemes, so we corrected the second measure so that it indicates when individual-based performance-related pay schemes are used (see footnote 9).

Our third measure, capturing the proportion of non-managerial workers at the establishment that received individual performance-related pay in the last year, is defined as follows:

*Incentive Pay*% = 1 if "None 0% "

= 2 if "Just a few 1-19% "

= 3 if "Some 20-39% "

= 4 if "Around half 40-59% "

= 5 if "Most 60-79% "

= 6 if "Almost all 80-99% "

= 7 if "All 100% "

As with our first two measures, we corrected the third measure to ensure that it pertains to individual-based performance-related schemes (see footnote 9).

Our measure of delegation is derived from the worker survey. A random sample of up to 25 employees per establishment was surveyed and asked the following question: "In general, how much influence do you have about the range of tasks you do in your job?"

Potential responses were "a lot", "some", "a little", and "none." Since our measures of incentive pay and *Complex* are establishment-wide measures, within each establishment we aggregate the individual worker responses to the delegation question by taking the modal worker response, as in DeVaro and Kurtulus (2010). The logic is that the most frequently occurring worker response to the delegation question within an establishment reflects the degree of delegation faced by the typical worker in the workplace. Thus, our delegation measure is defined as follows:

*Delegation* = 1 if the modal worker in the establishment responds "a lot"; (= 0 if the modal worker's response is "none", "a little", or "some").

Later in the section we discuss the potential endogeneity of *Delegation* in our empirical models.

The control variables are defined in Appendix C and include establishment size, main activity of the establishment, industry, whether the firm has a single establishment or multiple establishments, ownership (private versus public, franchise versus non-franchise, publicly traded versus non-publicly traded), single-product or multiple-product, fraction of part-time workers, temporary workers, fixed-term workers under one year, fixed-term workers over one year, number of recognized unions, fraction of the establishment that is unionized, and whether the establishment has been operation for more than five years. Some of the variables in our analysis contain missing values, and we estimate all of our models using listwise deletion. The main source of missing information is *Delegation*, since only 1782 of the 2191 establishments reported any worker responses to the survey question underlying this variable. Models that control for risk in the production environment also have smaller sample sizes, since the underlying survey question was asked only in the trading sector. Descriptive statistics for all variables in our analysis are displayed in Table 1. We use establishment weights in that table and throughout our analysis.

We begin by estimating the standard relationship between incentive pay and authority, neglecting the distinction between complex and simple jobs. The conventional wisdom from the previous literature is that delegation and incentive pay are positively related, and a number of empirical studies have documented this relationship (e.g. DeVaro and Kurtulus (2010), Itoh, Kikutani, and Hayashida (2008), Wulf (2007), Foss and Laursen (2005), Colombo and Delmastro (2004), Nagar (2002), MacLeod and Parent (1999)). This relationship is corroborated in column 1 of Table 2, which reports results from a probit model in which *Incentive Pay* is the dependent variable and *Delegation* is the key independent variable, including the controls defined in Appendix C. The coefficient of *Delegation* is positive and statistically significant. As seen at the bottom of column 1, an increase in *Delegation* from 0 to 1 is associated, on average, with an increase of 0.073 (from 0.170 to 0.243) in the predicted probability that *Incentive Pay* = 1.[10]

Column 2 of Table 2 includes the interaction *Delegation*×*Complex* in the probit model and reveals the main empirical result of the paper. If the coefficient on this interaction were zero, then the relationship between delegation and incentive pay

[10]In Tables 2-5 we report coefficient estimates rather than marginal and incremental effects. This is in part because marginal and incremental effects are cumbersome to compute for every covariate in probit and ordered probit models in STATA when the models include interactions. However, at the bottom of each specification in Tables 2-5 (and also in the text, in some cases) we report the average incremental effect of *Delegation*, which is the effect of interest in this paper. Throughout the paper, we compute incremental effects for every observation in the sample and then average them across observations.

would not differ between the "complex" and "simple" jobs (and would be positive as in the previous literature and our specification in column 1). Instead, this parameter is negative and estimated with high precision. As seen at the bottom of column 2, an increase in *Delegation* from 0 to 1 is associated, on average, with an increase of 0.059 (from 0.173 to 0.232) in the predicted probability that *Incentive Pay* = 1. However, this masks a pronounced difference between complex and simple jobs. For complex jobs, an increase in *Delegation* from 0 to 1 is associated, on average, with a decrease of 0.125 (from 0.233 to 0.107) in the predicted probability that *Incentive Pay* = 1. In contrast, for simple jobs, an increase in *Delegation* from 0 to 1 is associated, on average, with an increase of 0.099 (from 0.160 to 0.259) in the predicted probability that *Incentive Pay* = 1.

Columns 3 and 4 of Table 2 are analogous to columns 1 and 2, respectively, though using our second measure of incentive pay, *Incentive Pay(l.o.g.)*, as the dependent variable. The results are qualitatively the same in this case, based on the average incremental effects of *Delegation*. Table 3 displays ordered probit results, using our third measure of incentive pay, *Incentive Pay%*, as the dependent variable. Since the dependent variable has seven categories, we report seven average incremental effects at the bottom of Table 3. Again, the results are qualitatively the same in this case. In summary, across all three measures the empirical results suggest that the relationship between incentives and delegation is positive only for simple jobs and that it is negative for complex jobs. [11]

A potential concern is that *Delegation* might be endogenous in the empirical model. This problem was addressed in DeVaro and Kurtulus (2010) (using the same data and measures) by estimating a bivariate probit model for incentive pay and delegation. As noted in Heckman (1978), Wilde (2000), and Monfardini and Radice (2008), the parameters of the bivariate probit model are identified even in the absence of exclusion restrictions, except in pathological cases that do not apply here. The main result was that the null hypothesis of a zero correlation in the cross-equation disturbances could not be rejected (i.e. the exogeneity of *Delegation* cannot be rejected).

A potential omitted variable in our three incentive pay models is the degree of risk in the production environment. A well-known prediction from agency theory is that the relationship between these two variables should be negative (Holmstrom (1979); Shavell (1979)). Recent work suggests that identifying this risk-incentives tradeoff empirically requires controlling for delegation in models of incentive pay (Prendergast (2002); DeVaro and Kurtulus (2010)). As a robustness check, to account for this tradeoff, we define the following risk measure from the management survey, following DeVaro and Kurtulus (2010):

[11] In unreported sensitivity analyses, we investigated the possibility that our results are being driven by a particular narrowly-defined occupational group. To explore this possibility, for every two-digit occupation in our "complex" group, we replicated all analyses for the subsample that dropped that two-digit occupation. Across all of these tests, our qualitative results were identical and the quantitative results were similar.

*Risk* = 1 if the current state of the market for the main product or service of the establishment is described as "turbulent" (= 0 otherwise)

Tables 4 and 5 replicate tables 2 and 3, respectively, including *Risk* as a control variable in all models. Our main result is robust to the inclusion of *Risk* as a control. Furthermore, the *Risk* coefficient has the expected sign (negative) and is statistically significant, revealing a risk-incentives tradeoff.

# 3 Model

In this section, we construct a theoretical model to examine the relationship between delegation and incentives. The model highlights features which we believe are central to the example of cardiac surgeons given earlier in the paper. Also, because there are already theoretical explanations for the positive relationship between delegation and incentives (the private benefits approach of Holmstrom and Milgrom (1991) and Prendergast (2002), for example), our focus is only on finding sufficient conditions for a negative relationship.

Our model consists of a principal (the employer) and an agent (the worker). The model has four main parts: a description of how the agent can influence output, the preferences of the principal and agent, contracting assumptions, and the timing of the game along with the information that the players have at various stages of the game.

First consider how an agent can influence output. There are two tasks: a low risk-return task $L$ with a return normalized to 0 and a high risk-return task $H$ where returns, denoted by $R$, are normally distributed with mean $\xi > 0$ and variance $\alpha > 0$. Let $x$ denote the task selected, where $x \in \{L, H\}$. Output, denoted by $y$, consists of two additively separable components. The first component is the return on tasks described above and the second component is the output from effort which is given by $a + \epsilon_a$ where $a$ is the agent's effort and $\epsilon_a$ is a normally distributed variable with mean 0 and variance $\sigma_a^2 > 0$. The variable $\sigma_a^2$ measures the noise with which effort can be measured. Thus

$$y = \begin{cases} a + \epsilon_a & \text{if task L is selected} \\ a + \epsilon_a + R & \text{if task H is selected} \end{cases}$$

Next consider preferences. The principal is risk neutral. The agent's utility function is of the constant absolute risk aversion (CARA) form and is given by

$$U(w, a) = -e^{-\eta(w - \frac{ca^2}{2})}$$

where $\eta > 0$ is the coefficient of absolute risk aversion, $w$ denotes wages and $\frac{ca^2}{2}$ is the agent's effort cost function, with $c > 0$.

Next consider contracts. We assume that contracts can only be written on one performance measure, $y$. That is the individual components of $y$ cannot be contracted on. As in Holmstrom and Milgrom (1991) and Prendergast (2002), we restrict our attention to contracts that are linear for tractability and to allow for a clear interpretation of the strength of incentives based on the slope of the contract. [12] Thus, we assume $w = t + sy$, where $t$ is a fixed transfer from the principal to the agent, and $s$ is the slope of the contract, with $s \leq 1$. Incentives are said to be stronger when $s$ is higher. Because of the CARA-Normal framework, we can write the agent's certainty equivalent, denoted by $CE$, as follows:

$$CE = \begin{cases} t + sa - \dfrac{ca^2}{2} - \dfrac{\eta s^2 \sigma_a^2}{2} & \text{if task L is selected} \\ t + sa + s\xi - \dfrac{ca^2}{2} - \dfrac{\eta s^2 (\sigma_a^2 + \alpha)}{2} & \text{if task H is selected} \end{cases}$$

Finally, the timing and information structure are as follows. The principal offers a contract to the agent that specifies $t$ and $s$ and whether authority is delegated to the agent or not. If the principal retains authority we assume that he can commit to selecting either task $L$ or $H$. The agent then decides whether to participate. If he does participate, he can distinguish task $L$ from task $H$ at no cost. The principal, however, has to pay an information cost $C > 0$ to distinguish between tasks. We assume that the principal can select tasks only if he pays the cost $C$.[13] Tasks are then selected by the party that has authority, and the agent exerts effort. Finally, output is realized and wages paid.

To illustrate how incentives vary with authority, we consider the following two optimization problems. The first considers a setting in which the principal chooses tasks. This is called the "no delegation" problem, and the subscript used for variables in this problem is $n$. In the second problem, the principal delegates authority to an agent to select tasks. The subscript used for variables in this problem is $d$.

In the "no delegation" problem the principal incurs a cost of $C$ to differentiate tasks based on their risk-return attributes.

The principal's problem is

$$\underset{a_n, x_n \in \{L,H\}, s_n \in [0,1], t_n}{Max} \quad \mathbb{E}[y - w] - C$$

subject to the incentive compatibility condition associated with effort

[12] Our empirical work focuses on non-managerial worker groups. The assumption of linear contracts is more reasonable for such workers than for executives, whose incentive compensation plans are comprised more heavily of nonlinear components (e.g. stock options).

[13] This assumption says that the principal cannot select a task randomly when he does not bear the cost $C$. One way to interpret this assumption is that the cost $C$ does not merely provide information about tasks but also gives the principal access to those projects. An alternative way to ensure that the principal never picks tasks when he is not informed is to assume a third task with extremely low payoffs to the principal.

$$a_n = \frac{s_n}{c} \qquad (IC_{an})$$

and subject to the agent's participation constraint

$$CE \geq w_0 \qquad (IR_n)$$

where $w_0$ is the agent's reservation wage.

In the delegation problem, the agent decides the task, and the optimization problem is

$$\underset{a_d, x_d \in \{L,H\}, s_d \in [0,1], t_d}{Max} \quad \mathbb{E}[y - w]$$

subject to the incentive compatibility condition associated with effort

$$a_d = \frac{s_d}{c} \qquad (IC_{ad})$$

the incentive compatibility condition with respect to task selection

$$x_d \ \in \ \ argmax \ \ CE \qquad (IC_{xd})$$

and the agent's participation constraint

$$CE \geq w_0 \qquad (IR_d)$$

Henceforth, let $s_n^*$ and $x_n^*$ denote the optimal levels of incentives and task choice for the no-delegation problem, and let $s_d^*$ and $x_d^*$ denote the optimal levels of incentives and task choice for the delegation problem. The objective of the following analysis is to compare the optimal level of incentives across both of these problems (i.e. to compare $s_n^*$ with $s_d^*$). Also note that since the individual rationality constraint and the incentive compatibility constraint with respect to effort are common to both the "delegation" and "no delegation" problems, we sometimes drop the subscripts, $n$ and $d$, and refer to these constraints as $(IR)$ and $(IC_a)$.

The critical difference between the no-delegation and delegation problem is the following. In the first case, the principal only has to induce effort whereas in the delegation problem the principal has to induce both effort and task selection. To see how a conflict of interest with respect to tasks arises in the delegation problem, substitute the agent's individual rationality constraint into the principal's expected profit function. The principal prefers task H if and only if $\xi - \frac{\eta s^2 \alpha}{2} \geq 0$, whereas the agent prefers task $H$ if and only if $s\xi - \frac{\eta s^2 \alpha}{2} \geq 0$. Because $s \leq 1$, the agent places less weight than the principal on task returns relative to risk and is thus likely to pick task $L$ even though the principal prefers task $H$. To correct this conflict

incentives must be reduced.[14] This creates a tension between inducing effort and higher return tasks when the agent is delegated authority.

To solve the model, start by defining $s_L = \frac{1}{1+\eta c\sigma_a^2}$ and $s_H = \frac{1}{1+\eta c(\sigma_a^2+\alpha)}$. Note that $s_L$ corresponds to the principal's optimal solution in the "no delegation" problem if the task is fixed at $L$. Likewise $s_H$ corresponds to the principal's optimal solution in the "no delegation" problem if the task is fixed at H. Also define $\alpha_d = \frac{2\xi}{\eta}\frac{(1+\eta c\sigma_a^2)}{(1-2\xi c)}$. This cutoff is useful in characterizing the principal's optimal solution.

We now state the two main propositions of the paper. The proofs of the propositions are in Appendix A. The first proposition compares incentive levels across the "no delegation" and "delegation" problems. The second proposition states conditions under which authority is delegated to an agent. We say that the relationship between delegation and incentives is negative if $s_d^* \leq s_n^*$.

**Proposition 1.** *Let* $\xi \geq \frac{1}{2c(1+\eta c\sigma_a^2)}$. *Then*

$$x_n^* = x_d^* = H$$

*and*

$$\begin{cases} s_d^* = s_H = s_n^* \text{ if } \xi \geq \frac{1}{2c} \text{ or } \alpha \leq \alpha_d \\ s_d^* = \frac{2\xi}{\eta\alpha} < s_H = s_n^* \text{ if } \xi < \frac{1}{2c} \text{ and } \alpha > \alpha_d \end{cases}$$

Proposition 1 gives a sufficient condition, $\xi \geq \frac{1}{2c(1+\eta c\sigma_a^2)}$, under which the relationship between delegation and incentives is negative. This sufficient condition holds when tasks vary significantly in their expected return and effort is noisy to measure (i.e. it holds for complex jobs). It ensures that when a principal delegates authority, he always induces task $H$. When the variation in expected returns across tasks is very high relative to the variation in risk (i.e. when $\xi \geq \frac{1}{2c}$ or $\alpha \leq \alpha_d$), there is no conflict of interests with respect to selecting tasks and incentive levels are the same across both problems at $s_H$. However, when $\xi < \frac{1}{2c}$ and $\alpha > \alpha_d$, the agent's preferences diverge and the agent prefers task $L$ when the incentive level is $s_H$. To get the risk averse agent to select the high risk-return task, incentives have to be weakened in the delegation case. Note that as $\alpha$ gets sufficiently large, both

[14] When $s > 0$ the agent finds task $H$ at least as good as task $L$ if and only if $\xi - \frac{\eta s\alpha}{2} \geq 0$. Notice that $\xi - \frac{\eta s\alpha}{2}$ is decreasing in $s$.

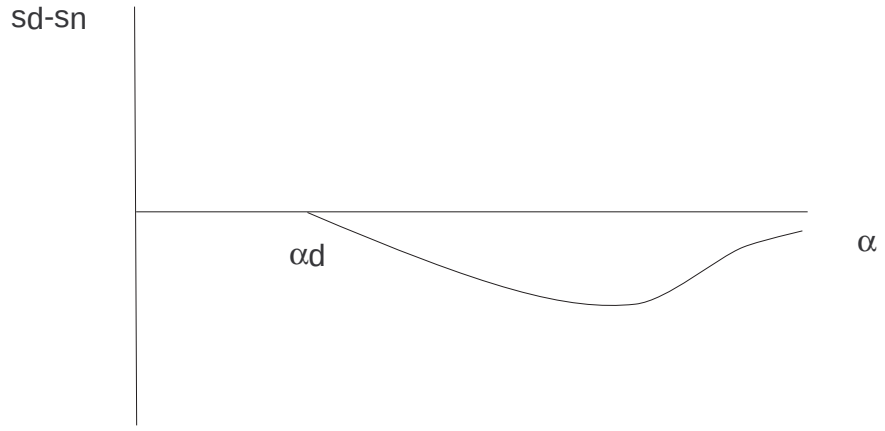


Figure 1: *Relationship between delegation and incentives when* $\frac{1}{2c(1+\eta c\sigma_a^2)} \leq \xi < \frac{1}{2c}$.

$s_d^*$ and $s_n^*$ approach 0, but the negative relationship still holds. Figure 1 shows the relationship between delegation and incentives when there is a conflict of interests with respect to task selection. It is also worth noting that though the condition $\xi \geq \frac{1}{2c(1+\eta c\sigma_a^2)}$ is sufficient for a negative relationship between delegation and incentives, it is not necessary.[15]

Proposition 1 characterizes the tasks selected and the incentive levels across both the delegation and no-delegation problems. It does not tell us when authority is delegated to an agent. The next proposition describes conditions under which authority is delegated to an agent. Define $\bar{C}$ as the critical level of the information cost above which authority is delegated to an agent. A lower $\bar{C}$ indicates that the principal is more likely to delegate authority, and when $\bar{C} = 0$, the principal always delegates authority to the agent.

**Proposition 2.** *Let* $\xi \geq \frac{1}{2c(1+\eta c\sigma_a^2)}$. *Then*

[15] When $\xi < \frac{1}{2c(1+\eta c\sigma_a^2)}$ and $\alpha$ is sufficiently small, we still have a negative relationship between delegation and incentives. As $\alpha$ gets larger, the principal prefers to induce task $L$ and we have $s_d^* \geq s_n^*$. For a complete characterization of the result see a previous working paper version (DeVaro and Prasad (2011)).

$$\bar{C} = \begin{cases} 0 \text{ if } \xi \geq \dfrac{1}{2c} \text{ or } \alpha \leq \alpha_d \\ (s_H - s_d^*)(\dfrac{1}{c} - \dfrac{s_H + s_d^*}{2c} - \dfrac{\eta(\sigma_a^2 + \alpha)(s_H + s_d^*)}{2}) > 0 \text{ if } \xi < \dfrac{1}{2c} \text{ and } \alpha > \alpha_d \end{cases}$$

*Furthermore, $\bar{C}$ is weakly decreasing in $\xi$ and is weakly decreasing in $\sigma_a^2$.*

Proposition 2 says that the principal is more likely to delegate authority when the expected return on task $H$ is high and when effort is more noisy to measure. When the expected return on task $H$ is high the interests of the principal and agent are more closely aligned (i.e both place more weight on task returns relative to risk). Thus, incentives do not have to be weakened as much to get the agent to choose task $H$. This in turn leads to lower distortions in effort in the delegation problem, which makes delegation more likely. Next, consider what happens when effort gets more noisy to measure. In this case, inducing effort is more costly because of the risk premium that has to be paid to the agent. This reduces incentives across both problems (in the limit as the noise gets very large incentives go to 0). Once again, distortions in effort in the delegation problem are not large relative to the no-delegation problem, and the principal is more likely to delegate authority.

Combining Propositions 1 and 2, we can examine the relationship between delegation and incentives as we change three key parameters: $C$, $\xi$, and $\sigma_a^2$. First consider the information cost $C$. Because $C$ is a fixed cost which does not affect optimal incentive levels in either problem, delegation is more likely as $C$ increases. From Proposition 1, we know that delegation and incentives must have a negative relationship. Next, consider the parameter $\xi$. Start with a value of $\xi$ where the principal prefers not to delegate, and consider an increase in $\xi$. From Proposition 2 we know that delegation is more likely. Furthermore, because $s_H$ does not vary with $\xi$, and because $s_d^* \leq s_H$, we know that incentives must be lower if authority is delegated. A similar argument can be applied to the parameter $\sigma_a^2$.

To summarize, Proposition 1 establishes that incentives in the delegation problem are weaker than incentives in the no-delegation problem when tasks vary significantly in their expected return and effort is noisy to measure. Proposition 2 states conditions under which authority is delegated.

# 4 Conclusion

In this paper we document a new empirical finding on the relationship between delegation and incentives. Using data from a large cross section of British establishments, we show that the positive relationship between incentives and delegation that has been consistently documented in the empirical literature masks a stark difference between job types; for simple jobs the relationship is positive, whereas

for complex jobs it is negative. We also construct a theoretical model offering a potential explanation for the negative relationship between delegation and incentive pay for complex jobs. In our model there is one performance measure which performs multiple functions: inducing task selection when authority is delegated and inducing effort. Inducing task selection requires weaker incentives, whereas inducing effort requires stronger incentives. We find that when returns on tasks vary a lot, and when effort is noisy to measure, delegation and incentives are negatively related. We believe that both of these features characterize a number of occupations involving complex jobs.

Our empirical and theoretical analysis shows that the relationship between an employer's decisions about incentive pay and delegation is more nuanced than has been appreciated in the previous literature. While we see the new stylized fact we present as striking, particularly given the breadth of the sample on which it is based, we caution that it is based on an empirical distinction between complex jobs and simple jobs that is (necessarily) arbitrary. The result should therefore be subjected to further scrutiny in future work using other datasets. In particular, narrowing the focus to particular occupations might offer opportunities for sharper distinctions between complex jobs and simple jobs and would also eliminate some of the unobservables that may be inadequately controlled for in our analysis. As noted earlier, the previous literature contains some evidence from studies based on particular occupations, e.g. Nagar (2002) and Wulf (2007). Both of those studies consider managers, as opposed to our analysis which focuses on non-managers, so we see our study and theirs as complementary. It is interesting to note that their studies of managers find a positive relationship between incentives and delegation. Although we do think of management as a complex job, we think that the private benefits story (as opposed to the risk-return tradeoff) may be relatively more important in managerial settings, which could explain those results. We believe a promising direction for future work would be to investigate the role of private benefits versus risk-return tradeoffs across individual occupations to see which effect dominates.

We conclude with two points. First, in addition to contributing to the academic literature, our main result has important managerial implications in that we show why the conventional wisdom (i.e. delegation of authority should go hand in hand with incentive pay) may not hold for a certain important class of jobs. The lesson for managers is not just that the optimal incentive pay and delegation decisions depend crucially on job characteristics. The analysis goes further in illuminating which job characteristics matter and why, and our theoretical result is supported by empirical evidence from a large cross section of employers. Second, we note that our theoretical framework is tractable and could be extended in a number of interesting directions. One particularly fruitful direction might be to allow for endogenous job assignments in a setting with multiple agents as opposed to just one. Some workers would be assigned to complex jobs and others to simple jobs. This allocation of workers to jobs could be expected to reduce the incentive tradeoff between task

selection and effort, though it would result in a higher wage bill. We leave this topic to future research.

## Appendix A

## Proofs

**Proof of Proposition 1:** Consider the "no delegation" problem. Notice that $s_L$ maximizes the principal's expected profit when task $L$ is chosen, and $s_H$ maximizes the principal's expected profit when task $H$ is chosen. Thus the principal's expected profit from choosing task $L$ is

$$\frac{s_L}{c} - \frac{s_L^2}{2c} - \frac{\eta s_L^2 \sigma_a^2}{2} - w_0 - C. \tag{1}$$

Substituting $s_L$ in (1), the principal's expected profit can be rewritten as

$$\frac{1}{2c(1+\eta c\sigma_a^2)} - w_0 - C.$$

Similarly, the principal's expected profit from choosing task $H$ is given by

$$\xi + \frac{s_H}{c} - \frac{s_H^2}{2c} - \frac{\eta s_H^2(\sigma_a^2+\alpha)}{2} - w_0 - C, \tag{2}$$

which can be rewritten as

$$\xi + \frac{1}{2c(1+\eta c(\sigma_a^2+\alpha))} - w_0 - C.$$

We assume that if the principal is indifferent between task $L$ and task $H$, he always chooses task $L$. Thus task $H$ is optimal if and only if

$$\xi + \frac{1}{2c(1+\eta c(\sigma_a^2+\alpha))} > \frac{1}{2c(1+\eta c\sigma_a^2)}. \tag{3}$$

When $\xi \geq \dfrac{1}{2c(1+\eta c\sigma_a^2)}$, the inequality in (3) holds. Thus $x_n^* = H$, and $s_n^* = s_H$.

Next, consider the delegation problem. First, notice that the "no delegation" solution with the incentive-task pair $(s_H, H)$ is implementable in the "delegation" problem if and only if it satisfies $(IC_{xd})$, which is given by the condition

$$s_H\xi - \frac{\eta s_H^2 \alpha}{2} \geq 0.$$

Substituting $s_H$ and rearranging, we get

$$\alpha(1-2\xi c) \leq \frac{2\xi}{\eta}(1+\eta c\sigma_a^2)$$

.

When $\xi \geq \frac{1}{2c}$, the condition above always holds. When $\xi < \frac{1}{2c}$, we can rearrange the expression above to get

$$\alpha \leq \frac{2\xi}{\eta}\frac{(1+\eta c\sigma_a^2)}{(1-2\xi c)} = \alpha_d$$

.

Thus, when $\xi \geq \frac{1}{2c}$ or $\alpha \leq \alpha_d$, we must have $x_d^* = H$ and $s_d^* = s_H$.

Next suppose $\frac{1}{2c(1+\eta c\sigma_a^2)} \leq \xi < \frac{1}{2c}$ and $\alpha > \alpha_d$. We compare two cases, one where the principal implements task $H$ and the other where the principal implements task $L$.

Suppose the principal implements task $H$. Then, the principal's problem after substituting $(IR_d)$ and $(IC_{ad})$ into the expected profit function is

$$\underset{s_d}{Max}\ \frac{s_d}{c} - \frac{s_d^2}{2c} - \frac{\eta s_d^2(\sigma_a^2+\alpha)}{2} + \xi - w_0$$

subject to $(IC_{xd})$ which can be written as

$$s_d \leq \frac{2\xi}{\eta\alpha} \tag{4}$$

The first order necessary conditions imply

$$\frac{1}{c} - \frac{s_d}{c} - \eta s_d(\sigma_a^2+\alpha) = \mu \tag{5}$$

where $\mu$ is the non-negative multiplier associated with (4).

Since $\alpha > \alpha_d$, it follows that $\frac{2\xi}{\eta\alpha} < s_H$. Also, note that the principal's profit after substituting $(IR_d)$ and $(IC_{ad})$ is strictly concave in $s_d$ and that the left-hand side of (5) is equal to 0 when $s_d = s_H$. Thus, for any $s_d$ satisfying (4), the left-hand side of (5) is strictly positive. From the complementary slackness condition, (4) always binds.

Thus, the principal's expected profit if he implements $H$ is

$$\xi + \frac{2\xi}{\eta\alpha c} - \frac{2\xi^2(1+\eta c\sigma_a^2)}{\eta^2\alpha^2 c} - \frac{2\xi^2}{\eta\alpha} - w_0 \tag{6}$$

Next, suppose the principal implements task $L$. Then $(IC_{xd})$ can be written as $s_d \geq \frac{2\xi}{\eta\alpha}$. Since $s_H > \frac{2\xi}{\eta\alpha}$ when $\alpha > \alpha_d$, and since $s_L > s_H$, it follows that the incentive level $s_L$ and task $L$ always satisfy $(IC_{xd})$. Since $s_L$ maximizes the principal's expected profit subject to $(IR_d)$ and $(IC_{ad})$ when $x$ is fixed at $L$, it

follows that the principal always chooses $s_L$ when he implements the task $L$. Thus the principal's expected profit if he implements task $L$ is

$$\frac{1}{2c(1+\eta c\sigma_a^2)} - w_0. \tag{7}$$

At the optimum, the principal implements $H$ if and only if

$$\xi + \frac{2\xi}{\eta\alpha c} - \frac{2\xi^2(1+\eta c\sigma_a^2)}{\eta^2\alpha^2 c} - \frac{2\xi^2}{\eta\alpha} > \frac{1}{2c(1+\eta c\sigma_a^2)}. \tag{8}$$

Since $\xi \geq \frac{1}{2c(1+\eta c\sigma_a^2)}$, the inequality in (8) holds when

$$\frac{2\xi}{\eta\alpha c}(1 - \frac{\xi(1+\eta c\sigma_a^2)}{\eta\alpha} - \xi c) > 0,$$

which can be written as

$$1 - \frac{\xi(1+\eta c\sigma_a^2)}{\eta\alpha} - \xi c > 0.$$

When $\alpha > \alpha_d$, the condition above always holds. Thus the principal always implements $H$ at the optimum in the delegation problem. Thus for $\alpha > \alpha_d$ it follows that $s_d^* = \frac{2\xi}{\eta\alpha} < s_H = s_n^*$.■

**Proof of Proposition 2:** The principal prefers to delegate authority if and only if

$$\xi + \frac{s_H}{c} - \frac{s_H^2}{2c} - \frac{\eta s_H^2(\sigma_a^2+\alpha)}{2} - w_0 - C \leq \xi + \frac{s_d^*}{c} - \frac{s_d^{*^2}}{2c} - \frac{\eta s_d^{*^2}(\sigma_a^2+\alpha)}{2} - w_0.$$

Thus

$$\bar{C} = (s_H - s_d^*)(\frac{1}{c} - \frac{s_H + s_d^*}{2c} - \frac{\eta(\sigma_a^2+\alpha)(s_H+s_d^*)}{2}). \tag{9}$$

Suppose $\xi \geq \frac{1}{2c}$ or $\alpha \leq \alpha_d$. From Proposition 1 we know that $s_d^* = s_H$. Thus $\bar{C} = 0$.

Next, suppose $\frac{1}{2c(1+\eta c\sigma_a^2)} \leq \xi < \frac{1}{2c}$, and $\alpha > \alpha_d$. Since $s_d^* < s_H$ from Proposition 1, it follows that $\bar{C} > 0$.

To see how $\bar{C}$ varies with parameters, first consider the parameter $\xi$. Let $s_n^*(\xi)$ and $s_d^*(\xi)$ denote optimal incentive levels as a function of $\xi$ for the "no delegation"

and "delegation" problems, respectively. Also let $\bar{C}(\xi)$ denote the critical level of the information cost as a function of $\xi$.

Consider $\xi' > \xi$, and define $\alpha'_d = \frac{2\xi'}{\eta}\frac{(1+\eta c\sigma_a^2)}{(1-2\xi' c)}$ as the cutoff level associated with $\xi'$. Notice that $\alpha'_d > \alpha_d$.

We must consider three possible cases. First, suppose $\alpha \leq \alpha_d$. Since $\alpha_d < \alpha'_d$, it follows from Proposition 1 that $s_d^*(\xi') = s_d^*(\xi) = s_H$. From (9) it follows that $\bar{C}(\xi) = \bar{C}(\xi') = 0$.

Second, suppose $\alpha \in (\alpha_d, \alpha'_d]$. Since $\alpha_d < \alpha'_d$, from Proposition 1 we have $s_d^*(\xi') = s_H > s_d^*(\xi)$. Thus from (9) we have $\bar{C}(\xi) > \bar{C}(\xi') = 0$.

Third, suppose $\alpha > \alpha'_d$. Since $\frac{2\xi}{\eta\alpha}$ is strictly increasing in $\xi$, it follows from Proposition 2 that $s_d^*(\xi') > s_d^*(\xi)$. From (9) it also follows that $\bar{C}(\xi) > \bar{C}(\xi')$.

Next, consider the parameter $\sigma_a^2$. Let $s_n^*(\sigma_a^2)$ and $s_d^*(\sigma_a^2)$ denote optimal incentive levels as a function of $\sigma_a^2$ for the "no delegation" and "delegation" problems, respectively. Also let $\bar{C}(\sigma_a^2)$ denote the critical level of the information cost as a function of $\xi$.

Consider $\sigma_a^{2\prime} > \sigma_a^2$, and define $\alpha'_d = \frac{2\xi}{\eta}\frac{(1+\eta c\sigma_a^{2\prime})}{(1-2\xi c)}$ as the cutoff level in Proposition 2 associated with $\sigma_a^{2\prime}$. Notice that $\alpha'_d > \alpha_d$.

We must consider three possible cases. First, suppose $\alpha \leq \alpha_d$. Since $\alpha_d < \alpha'_d$, from Proposition 1 we have $s_d^*(\sigma_a^{2\prime}) = s_H(\sigma_a^{2\prime})$ and $s_d^*(\sigma_a^2) = s_H(\sigma_a^2)$. From (9) it follows that $\bar{C}(\sigma_a^{2\prime}) = \bar{C}(\sigma_a^2) = 0$.

Second, suppose $\alpha \in (\alpha_d, \alpha'_d]$. Since $\alpha_d < \alpha'_d$, from Proposition 1 we have $s_d^*(\sigma_a^{2\prime}) = s_H(\sigma_a^{2\prime})$ and $s_d^*(\sigma_a^2) < s_H(\sigma_a^2)$. Thus from (9) we have $\bar{C}(\sigma_a^2) > \bar{C}(\sigma_a^{2\prime}) = 0$.

Third, suppose $\alpha > \alpha'_d$. Notice that we can rewrite (9) as

$$(\frac{s_H - s_d^*}{2c})(1 - s_d^*(1 + \eta c(\sigma_a^2 + \alpha))), \tag{10}$$

which is strictly decreasing in $\sigma_a^2$.

Thus $\bar{C}(\sigma_a^2) > \bar{C}(\sigma_a^{2\prime})$.

## Appendix B

Panel 1: Two-digit and three-digit SOC codes for Complex Jobs

| CODE | DESCRIPTION |
|---|---|
| 20 | NATURAL SCIENTISTS |
| 200 | Chemists |
| 201 | Biological scientists & biochemists |
| 202 | Physicists, geologists & meteorologists |
| 209 | Other natural scientists nes |
| 21 | ENGINEERS AND TECHNOLOGISTS |
| 210 | Civil, structural, municipal, mining & quarry engineers |
| 211 | Mechanical engineers |
| 212 | Electrical engineers |
| 213 | Electronic engineers |
| 214 | Software engineers |
| 215 | Chemical engineers |
| 216 | Design & development engineers |
| 217 | Process & production engineers |
| 218 | Planning & quality control engineers |
| 219 | Other engineers & technologists nes |
| 22 | HEALTH PROFESSIONALS |
| 220 | Medical practitioners |
| 221 | Pharmacists/pharmacologists |
| 222 | Ophthalmic opticians |
| 223 | Dental practitioners |
| 224 | Veterinarians |
| 23 | TEACHING PROFESSIONALS |
| 230 | University & polytechnic teaching professionals |
| 231 | Higher & further education teaching professionals |
| 232 | Education officers, school inspectors |
| 233 | Secondary (& middle school deemed secondary) education teaching professionals |
| 234 | Primary (& middle school deemed primary) & nursery education teaching professionals |
| 235 | Special education teaching professionals |
| 239 | Other teaching professionals nes |
| 24 | LEGAL PROFESSIONALS |
| 240 | Judges & officers of the court |
| 241 | Barristers & advocates |
| 242 | Solicitors |
| 25 | BUSINESS AND FINANCIAL PROFESSIONALS |
| 250 | Chartered & certified accountants |

| CODE | DESCRIPTION |
|---|---|
| 251 | Management accountants |
| 252 | Actuaries, economists & statisticians |
| 253 | Management consultants, business analysts |
| 26 | ARCHITECTS, TOWN PLANNERS AND SURVEYORS |
| 260 | Architects |
| 261 | Town planners |
| 262 | Building, land, mining & general practice surveyors |
| 27 | LIBRARIANS AND RELATED PROFESSIONALS |
| 270 | Librarians |
| 271 | Archivists & curators |
| 29 | PROFESSIONAL OCCUPATIONS NEC |
| 290 | Psychologists |
| 291 | Other social & behavioural scientists |
| 292 | Clergy |
| 293 | Social workers, probation officers |
| 30 | SCIENTIFIC TECHNICIANS |
| 300 | Laboratory technicians |
| 301 | Engineering technicians |
| 302 | Electrical/electronic technicians |
| 303 | Architectural & town planning technicians |
| 304 | Building & civil engineering technicians |
| 309 | Other scientific technicians nes |
| 31 | DRAUGHTS PERSONS, QUANTITY AND OTHER SURVEYORS |
| 310 | Draughts persons |
| 311 | Building inspectors |
| 312 | Quantity surveyors |
| 313 | Marine, insurance & other surveyors |
| 32 | COMPUTER ANALYSTS/PROGRAMMERS |
| 320 | Computer analyst/programmers |
| 33 | SHIP AND AIRCRAFT OFFICERS, AIR TRAFFIC PLANNERS AND CONTROLLERS |
| 330 | Air traffic planners & controllers |
| 331 | Aircraft flight deck officers |
| 332 | Ship & hovercraft officers |
| 34 | HEALTH ASSOCIATE PROFESSIONALS |
| 340 | Nurses |
| 341 | Midwives |
| 342 | Medical radiographers |
| 343 | Physiotherapists |
| 344 | Chiropodists |
| 345 | Dispensing opticians |

| CODE | DESCRIPTION |
|---|---|
| 346 | Medical technicians, dental auxiliaries |
| 347 | Occupational & speech therapists, psychotherapists, therapists nes |
| 348 | Environmental health officers |
| 349 | Other health associate professionals nes |
| 35 | LEGAL ASSOCIATE PROFESSIONALS |
| 350 | Legal service & related occupations |
| 360 | Estimators, valuers |
| 36 | BUSINESS AND FINANCIAL ASSOCIATE PROFESSIONALS |
| 361 | Underwriters, claims assessors, brokers, investment analysts |
| 362 | Taxation experts |
| 363 | Personnel & industrial relations officers |
| 364 | Organisation & methods & work study officers |
| 37 | SOCIAL WELFARE ASSOCIATE PROFESSIONALS |
| 370 | Matrons, houseparents |
| 371 | Welfare, community & youth workers |
| 38 | LITERARY, ARTISTIC AND SPORTS PROFESSIONALS |
| 380 | Authors, writers, journalists |
| 381 | Artists, commercial artists, graphic designers |
| 382 | Industrial designers |
| 383 | Clothing designers |
| 384 | Actors, entertainers, stage managers, producers & directors |
| 385 | Musicians |
| 386 | Photographers, camera, sound & video operators |
| 387 | Professional athletes, sports officials |
| 39 | ASSOCIATE PROFESSIONAL AND TECHNICAL OCCUPATIONS |
| 390 | Information officers |
| 391 | Vocational & industrial trainers |
| 392 | Careers advisers & vocational guidance specialists |
| 393 | Driving instructors (excluding HGV) |
| 394 | Inspectors of factories, utilities & trading standards |
| 395 | Other statutory & similar inspectors nes |
| 396 | Occupational hygienists & safety officers (health & safety) |
| 399 | Other associate professional & technical occupations nes |

Panel 2: Two-digit SOC codes for Simple Jobs

| CODE | DESCRIPTION |
|---|---|
| 40 | ADMINISTRATIVE/CLERICAL OFFICERS AND ASSISTANTS IN CIVIL SERVICE AND LOCAL GOVERNMENT |
| 41 | NUMERICAL CLERKS AND CASHIERS |
| 42 | FILING AND RECORDS CLERKS |
| 43 | CLERKS (NOT OTHERWISE SPECIFIED) |
| 44 | STORES AND DESPATCH CLERKS, STOREKEEPERS |
| 45 | SECRETARIES, PERSONAL ASSISTANTS, TYPISTS, WORD PROCESSOR OPERATORS |
| 46 | RECEPTIONISTS, TELEPHONISTS AND RELATED OCCUPATIONS |
| 49 | CLERICAL AND SECRETARIAL OCCUPATIONS NES |
| 50 | CONSTRUCTION TRADES |
| 51 | METAL MACHINING, FITTING AND INSTRUMENT MAKING TRADES |
| 52 | ELECTRICAL/ELECTRONIC TRADES |
| 53 | METAL FORMING, WELDING AND RELATED TRADES |
| 54 | VEHICLE TRADES |
| 55 | TEXTILES, GARMENTS AND RELATED TRADES |
| 56 | PRINTING AND RELATED TRADES |
| 57 | WOODWORKING TRADES |
| 58 | FOOD PREPARATION TRADES |
| 59 | OTHER CRAFT AND RELATED OCCUPATIONS |
| 60 | NCOS AND OTHER RANKS, ARMED FORCES |
| 61 | SECURITY AND PROTECTIVE SERVICE OCCUPATIONS |
| 62 | CATERING OCCUPATIONS |
| 63 | TRAVEL ATTENDANTS AND RELATED OCCUPATIONS |
| 64 | HEALTH AND RELATED OCCUPATIONS |
| 65 | CHILDCARE AND RELATED OCCUPATIONS |
| 66 | HAIRDRESSERS, BEAUTICIANS AND RELATED OCCUPATIONS |
| 67 | DOMESTIC STAFF AND RELATED OCCUPATIONS |
| 69 | PERSONAL AND PROTECTIVE SERVICE OCCUPATIONS NES |
| 70 | BUYERS, BROKERS AND RELATED AGENTS |
| 71 | SALES REPRESENTATIVES |
| 72 | SALES ASSISTANTS AND CHECKOUT OPERATORS |
| 73 | MOBILE, MARKET AND DOOR-TO-DOOR SALESPERSONS AND AGENTS |
| 79 | SALES OCCUPATIONS NEC |
| 80 | FOOD, DRINK AND TOBACCO PROCESS OPERATIVES |
| 81 | TEXTILES AND TANNERY PROCESS OPERATIVES |
| 82 | CHEMICALS, PAPER, PLASTICS AND RELATED PROCESS OPERATIVES |
| 83 | METAL MAKING AND TREATING PROCESS OPERATIVES |
| 84 | METAL WORKING PROCESS OPERATIVES |
| 85 | ASSEMBLERS/ LINEWORKERS |

| CODE | DESCRIPTION |
|---|---|
| 86 | OTHER ROUTINE PROCESS OPERATIVES |
| 87 | ROAD TRANSPORT OPERATIVES |
| 88 | OTHER TRANSPORT AND MACHINERY OPERATIVES |
| 89 | PLANT AND MACHINE OPERATIVES NES |
| 90 | OTHER OCCUPATIONS IN AGRICULTURE, FORESTRY AND FISHING |
| 91 | OTHER OCCUPATIONS IN MINING AND MANUFACTURING |
| 92 | OTHER OCCUPATIONS IN CONSTRUCTION |
| 93 | OTHER OCCUPATIONS IN TRANSPORT |
| 94 | OTHER OCCUPATIONS COMMUNICATIONS |
| 95 | OTHER OCCUPATIONS IN SALES AND SERVICES |
| 99 | OTHER OCCUPATIONS NES |

## Appendix C

## FIRM CHARACTERISTICS USED AS CONTROL VARIABLES:

*Single-Establishment Firm* = 1 if the establishment is either a single independent establishment not belonging to another body, or the sole UK establishment of a foreign organization
= 0 if the establishment is one of a number of different establishments within a larger organization

*Establishment Size* = total number of full time, part time, and temporary workers at the establishment (measured in thousands)

*Fraction of Part Time Workers* = number of part time workers at the establishment as a fraction of establishment size

*Temporary Workers* = 1 if there are temporary agency employees working at the establishment at the time of the survey
= 0 otherwise

*Fixed Term Workers Under One Year* = 1 if there are employees who are working on a temporary basis or have fixed-term contracts for less than one year
= 0 otherwise

*Fixed Term Workers Over One Year* = 1 if there are employees who have fixed term contracts for one year or more
= 0 otherwise

*Number of Recognized Unions* = Total number of recognized unions at the workplace

*100% Workers Unionized* = 1 if 100% of all employees, including managers, are covered by collective bargaining either at this workplace or at a higher level (employee-perceived measure)
= 0 otherwise

*80-99% Workers Unionized* = 1 if 80-99% of all employees, including managers, are covered by collective bargaining either at this workplace or at a higher level (employee-perceived measure)
= 0 otherwise

*60-79% Workers Unionized* = 1 if 60-79% of all employees, including managers, are covered by collective bargaining either at this workplace or at a higher level (employee-perceived measure)

= 0 otherwise

*40-59% Workers Unionized* = 1 if 40-59% of all employees, including managers, are covered by collective bargaining either at this workplace or at a higher level (employee-perceived measure)
= 0 otherwise

*20-39% Workers Unionized* = 1 if 20-39% of all employees, including managers, are covered by collective bargaining either at this workplace or at a higher level (employee-perceived measure)
= 0 otherwise

*1-19% Workers Unionized* = 1 if 1-19% of all employees, including managers, are covered by collective bargaining either at this workplace or at a higher level (employee-perceived measure)
= 0 otherwise

*0% Workers Unionized* = 1 if 0% of all employees, including managers, are covered by collective bargaining either at this workplace or at a higher level (employee-perceived measure)
= 0 otherwise

*Main Activity of Establishment* = 1 if the main activity of the establishment is to produce goods or services for consumers = 0 for any of the following other possibilities: supplier of goods or services to other companies; supplier of goods or services to other parts of the organization to which we belong; do not produce goods or provide services for sale in the open market; an administrative office only

*Single Product* = 1 if the establishment is concentrated on one product or service
= 0 if it is concentrated on several different products or services

*Private Sector Franchise* = 1 if the establishment is a private sector company and a franchise
= 0 otherwise

*Private Sector Non-franchise* = 1 if the establishment is a private sector company but not a franchise
= 0 otherwise

*Private Sector Publicly-Traded Franchise* = 1 if the establishment is a publicly-traded private sector unit and a franchise
= 0 otherwise

*Private Sector Publicly-Traded Non-franchise* = 1 if the establishment is a publicly-traded private sector unit but not a franchise
= 0 otherwise

*Operation Over Five Years* = 1 if the workplace has been operating at its present address for 5 years or more
= 0 otherwise

*Industry Controls*: (Manufacturing; Electricity, Gas, and Water; Construction; Wholesale and Retail; Hotels and Restaurants; Transport and Communication; Financial Services; Other Business Services; Public Administration; Education; Health; Other Community Services)

**TABLE 1: Descriptive Statistics**

| | Mean | Standard Error |
|---|---|---|
| Complex | 0.176 | 0.016 |
| Incentive Pay | 0.141 | 0.016 |
| Incentive Pay(l.o.g.) | 0.082 | 0.012 |
| **Incentive Pay%:** | | |
| =1 None 0% | 0.298 | |
| =2 Just a few 1-19% | 0.054 | |
| =3 Some 20-39% | 0.028 | |
| =4 Around half 40-59% | 0.019 | |
| =5 Most 60-79% | 0.012 | |
| =6 Almost all 80-99% | 0.018 | |
| =7 All 100% | 0.571 | |
| Delegation | 0.078 | 0.016 |
| Risk | 0.206 | 0.022 |
| **Largest Occupational Group:** | | |
| Professional Occupations | 0.125 | 0.014 |
| Technical and Scientific Occupations | 0.051 | 0.010 |
| Clerical and Secretarial Occupations | 0.168 | 0.017 |
| Craft and Skilled Service Occupations | 0.118 | 0.016 |
| Personal and Protective Service Occupations | 0.203 | 0.018 |
| Sales Occupations | 0.140 | 0.017 |
| Plant and Machine Operatives | 0.096 | 0.013 |
| Other Occupations | 0.099 | 0.013 |
| **Industry:** | | |
| Manufacturing | 0.129 | 0.017 |
| Electricity, Gas and Water | 0.002 | 0.000 |
| Construction | 0.039 | 0.008 |
| Wholesale and Retail | 0.196 | 0.019 |
| Hotels and Restaurants | 0.066 | 0.011 |
| Transport and Communication | 0.044 | 0.009 |
| Financial Services | 0.031 | 0.006 |
| Other Business Services | 0.104 | 0.014 |
| Public Administration | 0.049 | 0.009 |
| Education | 0.142 | 0.016 |
| Health | 0.147 | 0.016 |
| Other Community Services | 0.050 | 0.009 |
| **Firm Characteristics:** | | |
| Single-Establishment Firm | 0.326 | 0.022 |
| Fixed Term Workers Over One Year | 0.170 | 0.016 |
| Fixed Term Workers Under One Year | 0.253 | 0.018 |
| Operation Over Five Years | 0.898 | 0.013 |

| | | |
|---|---|---|
| Main Activity of Establishment | 0.537 | 0.023 |
| Temporary Workers | 0.190 | 0.016 |
| Establishment Size | 0.060 | 0.003 |
| Fraction of Part Time Workers | 0.328 | 0.014 |
| Number of Recognized Unions | 0.886 | 0.055 |
| 100% Workers Unionized | 0.298 | 0.020 |
| 80-99% Workers Unionized | 0.054 | 0.008 |
| 60-79% Workers Unionized | 0.028 | 0.006 |
| 40-59% Workers Unionized | 0.019 | 0.006 |
| 20-39% Workers Unionized | 0.012 | 0.005 |
| 1-19% Workers Unionized | 0.018 | 0.006 |
| 0% Workers Unionized | 0.571 | 0.022 |
| Private Sector Publicly-Traded Non-franchise | 0.009 | 0.003 |
| Private Sector Publicly-Traded Franchise | 0.273 | 0.019 |
| Private Sector Non-franchise | 0.024 | 0.008 |
| Private Sector Franchise | 0.430 | 0.023 |
| Sample Size = 1766 | | |

Note: Tabulations are for the 1766 establishments for which data on *Incentive Pay*, *Complex*, and *Delegation* are non-missing, excluding those observations for which the largest occupational group is Managers and Administrators. However, some of the above statistics are based on smaller sample sizes due to missing values in individual variables. *Establishment Size* is measured in thousands. All statistics are establishment weighted.

**TABLE 2: Probit Results: Dependent Variable = *Incentive Pay***

| | ***Dependent Variable*** | | | |
|---|---|---|---|---|
| | ***Incentive Pay*** | | ***Incentive Pay(l.o.g.)*** | |
| ***Independent Variables:*** | | | | |
| Delegation | 0.320** | 0.438*** | 0.531*** | 0.608*** |
| | (0.157) | (0.166) | (0.188) | (0.198) |
| Delegation x Complex | | -1.078*** | | -0.926** |
| | | 0.348 | | (0.423) |
| Complex | | 0.331 | | 0.220 |
| | | (0.254) | | (0.271) |
| **Industry Controls** | | | | |
| Manufacturing | -0.850*** | -0.841*** | -0.582 | -0.578 |
| | (0.306) | (0.298) | (0.361) | (0.359) |
| Electricity, Gas and Water | -0.936*** | -0.942*** | -0.776** | -0.789** |
| | (0.345) | (0.337) | (0.373) | (0.368) |
| Construction | -0.825** | -0.836** | -0.830*** | -0.842*** |
| | (0.369) | (0.364) | (0.322) | (0.323) |
| Hotels and Restaurants | -0.680** | -0.680** | -1.934*** | -1.945*** |
| | (0.328) | (0.333) | (0.360) | (0.357) |
| Transport and | | | | |
| Communication | -1.229*** | -1.198*** | -1.360*** | -1.337*** |
| | (0.313) | (0.305) | (0.338) | (0.341) |
| Financial Services | 0.456 | 0.534 | 0.532 | 0.587* |
| | (0.332) | (0.327) | (0.335) | (0.336) |
| Other Business Services | -0.415 | -0.425 | -0.586** | -0.575* |
| | (0.279) | (0.297) | (0.291) | (0.302) |
| Public Administration | -0.782** | -0.805** | -0.754* | -0.785** |
| | (0.352) | (0.355) | (0.386) | (0.385) |
| Education | -1.926*** | -2.055*** | -2.998*** | -3.065*** |
| | (0.441) | (0.444) | (0.446) | (0.440) |
| Health | -1.799*** | -1.820*** | -2.845*** | -2.806*** |
| | (0.268) | (0.275) | (0.394) | (0.384) |
| Other Community Services | -1.171*** | -1.156*** | -1.069*** | -1.067*** |
| | (0.303) | (0.305) | (0.363) | (0.365) |
| **Firm Controls** | | | | |
| Single-Establishment Firm | -0.103 | -0.099 | -0.132 | -0.142 |

| | | | | |
|---|---|---|---|---|
| | (0.201) | (0.199) | (0.237) | (0.236) |
| Fixed Term Workers Over One Year | 0.101 | 0.137 | 0.266 | |
| | (0.190) | (0.189) | (0.214) | (0.210) |
| Fixed Term Workers Under One Year | 0.057 | 0.111 | 0.285* | 0.328* |
| | (0.141) | (0.142) | (0.173) | (0.177) |
| Operation Over Five Years | 0.362** | 0.344** | 0.438** | 0.424** |
| | (0.173) | (0.167) | (0.218) | (0.206) |
| Main Activity of Establishment | 0.084 | 0.053 | 0.221 | 0.198 |
| | (0.158) | (0.157) | (0.192) | (0.191) |
| Temporary Workers | 0.186 | 0.151 | 0.447*** | 0.418*** |
| | (0.148) | (0.147) | (0.160) | (0.159) |
| Establishment Size | 0.118 | 0.108 | -0.006 | -0.014 |
| | (0.090) | (0.088) | (0.124) | (0.125) |
| Fraction of Part Time Workers | -0.579* | -0.509 | -0.629 | -0.584 |
| | (0.336) | (0.322) | (0.424) | (0.427) |
| Number of Recognized Unions | 0.151*** | 0.148*** | 0.010 | 0.011 |
| | (0.047) | (0.047) | (0.078) | (0.079) |
| 100% Workers Unionized | -0.285 | -0.303 | 0.159 | 0.143 |
| | (0.262) | (0.261) | (0.321) | (0.321) |
| 80-99% Workers Unionized | 0.105 | 0.141 | 0.389 | 0.406 |
| | (0.247) | (0.248) | (0.316) | (0.311) |
| 60-79% Workers Unionized | -0.496** | -0.501** | -0.257 | -0.265 |
| | (0.230) | (0.236) | (0.289) | (0.290) |
| 40-59% Workers Unionized | -0.300 | -0.318 | -0.703 | -0.711 |
| | (0.331) | (0.327) | (0.454) | (0.448) |
| 20-39% Workers Unionized | 0.230 | 0.205 | 0.203 | 0.158 |
| | (0.422) | (0.414) | (0.394) | (0.392) |
| 1-19% Workers Unionized | 0.855 | 0.755 | -1.002 | -1.034** |
| | (0.680) | (0.647) | (0.553) | (0.546) |
| Constant | -0.676 | -0.721 | -1.330** | -1.366** |

| | | | | |
|---|---|---|---|---|
| | (0.473) | (0.475) | (0.541) | (0.547) |
| **Incremental Effect of *Delegation*** | | | | |
| Overall (All Jobs) | 0.073 | 0.059 | 0.082 | 0.076 |
| Complex Jobs | | -0.125 | | -0.041 |
| Simple Jobs | | 0.099 | | 0.095 |
| Sample Size | 1712 | 1712 | 1712 | 1712 |

Note 1: Results are probit coefficients, with robust standard errors in parentheses below each estimate. Statistical significance at the 10%, 5%, and 1% levels, respectively, is denoted by *, **, and ***, using two-tailed tests. Reference group for industry dummies is *Wholesale* and *Retail*. Reference group for % unionized dummies is 0% *Workers Unionized*.

Note 2: The overall incremental effect of *Delegation* (for all jobs) is the average value over all sample observations of the predicted values of $Prob(Incentive\ Pay(l.o.g.) = 1 \mid Delegation = 1) - Prob(Incentive\ Pay(l.o.g.) = 1 \mid Delegation = 0)$ evaluating *Complex* at its observed value for each observation. The incremental effect of *Delegation* for "Complex" jobs is the average value over all sample observations of the predicted values of $Prob(Incentive\ Pay(l.o.g) = 1 \mid Complex = 1$ and $Delegation = 1) - Prob(Incentive\ Pay(l.o.g) = 1 \mid Complex = 1$ and $Delegation = 0)$. The incremental effect of *Delegation* for "Simple" is the average value over all sample observations of $Prob(Incentive\ Pay(l.o.g) = 1 \mid Complex = 0$ and $Delegation = 1) - Prob(Incentive\ Pay(l.o.g) = 1 \mid Complex = 0$ and $Delegation = 0)$.

**TABLE 3: Ordered Probit Results: Dep. Var. = *Incentive Pay%***

| | ***Dependent Variable: Incentive Pay%*** | |
|---|---|---|
| ***Independent Variables:*** | | |
| Delegation | 0.258 | 0.395** |
| | (0.167) | (0.178) |
| Delegation x Complex | | -1.255*** |
| | | (0.400) |
| Complex | | 0.400* |
| | | (0.235) |
| **Industry Controls** | | |
| Manufacturing | -0.745** | -0.727** |
| | (0.296) | (0.288) |
| Electricity, Gas and Water | -0.880*** | -0.893*** |
| | (0.338) | (0.326) |
| Construction | -0.987*** | -0.985*** |
| | (0.297) | (0.292) |
| Hotels and Restaurants | -1.214*** | -1.230*** |
| | (0.290) | (0.288) |
| Transport and Communication | -1.234*** | -1.189*** |
| | (0.380) | (0.372) |
| Financial Services | 0.629** | 0.727** |
| | (0.318) | (0.315) |
| Other Business Services | -0.285 | -0.293 |
| | (0.274)) | (0.286) |
| Public Administration | -0.530 | -0.551 |
| | (0.375) | (0.380) |
| Education | -1.665*** | -1.838*** |
| | (0.424) | (0.420) |
| Health | -2.118*** | -2.176*** |
| | (0.380) | (0.382) |
| Other Community Services | -0.831*** | -0.809*** |
| | (0.314) | (0.316) |
| **Firm Controls** | | |
| Single-Establishment Firm | -0.020 | -0.021 |
| | (0.186) | (0.183) |
| Fixed Term Workers Over One Year | 0.080 | 0.136 |

| | | |
|---|---|---|
| | (0.195) | (0.188) |
| Fixed Term Workers Under One Year | 0.273* | 0.341** |
| | (0.160) | (0.164) |
| Operation Over Five Years | 0.217 | 0.206 |
| | (0.190) | (0.180) |
| Main Activity of Establishment | 0.000 | -0.035 |
| | (0.160) | (0.159) |
| Temporary Workers | 0.118 | 0.080 |
| | (0.155) | (0.153) |
| Establishment Size | 0.007 | -0.004 |
| | (0.091) | (0.093) |
| Fraction of Part Time Workers | -0.566 | -0.468 |
| | (0.353) | (0.340) |
| Number of Recognized Unions | 0.122** | 0.121** |
| | (0.055) | (0.055) |
| 100% Workers Unionized | 0.033 | 0.019 |
| | (0.238) | (0.237) |
| 80-99% Workers Unionized | 0.270 | 0.311 |
| | (0.331) | (0.333) |
| 60-79% Workers Unionized | -0.322 | -0.323 |
| | (0.255) | (0.258) |
| 40-59% Workers Unionized | -0.269 | -0.281 |
| | (0.391) | (0.384) |
| 20-39% Workers Unionized | 0.463 | 0.446 |
| | (0.514) | (0.506) |
| 1-19% Workers Unionized | 0.876 | 0.762 |
| | (0.634) | (0.604) |
| Cutoff 1 | 1.083** | 1.178** |
| | (0.457) | (0.464) |
| Cutoff 2 | 1.240*** | 1.336*** |
| | (0.463) | (0.473) |
| Cutoff 3 | 1.324*** | 1.421*** |
| | (0.485) | (0.495) |
| Cutoff 4 | 1.447*** | 1.544*** |
| | (0.479) | (0.489) |

| | | |
|---|---|---|
| Cutoff 5 | 1.500*** | 1.598*** |
| | (0.480) | (0.490) |
| Cutoff 6 | 1.786*** | 1.886*** |
| | (0.488) | (0.499) |
| **Incremental Effect of *Delegation*** | | |
| **Overall (All Jobs)** | | |
| =1 (None 0%) | -0.050 | -0.040 |
| =2 (Just a few 1-19%) | 0.006 | 0.004 |
| =3 (Some 20-39%) | 0.003 | 0.002 |
| =4 (Around half 40-59%) | 0.004 | 0.003 |
| =5 (Most 60-79%) | 0.002 | 0.001 |
| =6 (Almost all 80-99%) | 0.009 | 0.007 |
| =7 (All 100%) | 0.025 | 0.023 |
| **Complex Jobs** | | |
| =1 (None 0%) | | 0.137 |
| =2 (Just a few 1-19%) | | -0.018 |
| =3 (Some 20-39%) | | -0.009 |
| =4 (Around half 40-59%) | | -0.013 |
| =5 (Most 60-79%) | | -0.005 |
| =6 (Almost all 80-99%) | | -0.026 |
| =7 (All 100%) | | -0.065 |
| **Simple Jobs** | | |
| =1 (None 0%) | | -0.075 |
| =2 (Just a few 1-19%) | | 0.009 |
| =3 (Some 20-39%) | | 0.005 |
| =4 (Around half 40-59%) | | 0.007 |
| =5 (Most 60-79%) | | 0.003 |
| =6 (Almost all 80-99%) | | 0.014 |
| =7 (All 100%) | | 0.038 |
| Sample Size | 1632 | 1632 |

Note 1: Results are ordered probit coefficients, with robust standard errors in parentheses below

each estimate. Statistical significance at the 10%, 5%, and 1% levels, respectively, is denoted by *, **, and ***, using two-tailed tests. Reference group for industry dummies is *Wholesale* and *Retail*. Reference group for % unionized dummies is 0% *Workers Unionized*.

Note 2: The overall incremental effect of *Delegation* (for all jobs) is the average value over all sample observations of the predicted values of $Prob(Incentive\ Pay\% = j \mid Delegation = 1) - Prob(Incentive\ Pay\% = j \mid Delegation = 0)$, for j = 1, 2, ..., 7, evaluating *Complex* at its observed value for each observation. The incremental effect of *Delegation* for "Complex" jobs is the average value over all sample observations of the predicted values of $Prob(Incentive\ Pay\% = j \mid Complex = 1$ and $Delegation = 1) - Prob(Incentive\ Pay\% = j \mid Complex = 1$ and $Delegation = 0)$, for j = 1, 2, ..., 7. The incremental effect of *Delegation* for "Simple" is the average value over all sample observations of $Prob(Incentive\ Pay\% = j \mid Complex = 0$ and $Delegation = 1) - Prob(Incentive\ Pay\% = j \mid Complex = 0$ and $Delegation = 0), for j = 1, 2, ..., 7.$

**TABLE 4: Probit Results: Dependent Variable = *Incentive Pay(l.o.g.)***

| | *Dependent Variable* | | | |
|---|---|---|---|---|
| | ***Incentive Pay*** | | ***Incentive Pay(l.o.g.)*** | |
| ***Independent Variables:*** | | | | |
| Delegation | 0.589*** | 0.727*** | 0.729*** | 0.800*** |
| | (0.191) | (0.195) | (0.204) | (0.218) |
| Delegation x Complex | | -1.409*** | | -0.917* |
| | | (0.527) | | (0.542) |
| Complex | | 0.528 | | 0.189 |
| | | (0.400) | | (0.370) |
| **Industry Controls** | | | | |
| Manufacturing | -0.857*** | -0.835*** | -0.562 | -0.566 |
| | (0.319) | (0.307) | (0.358) | (0.357) |
| Electricity, Gas and Water | -1.384*** | -1.305*** | -0.996** | -0.954** |
| | (0.455) | (0.443) | (0.477) | (0.473) |
| Construction | -0.838** | -0.835** | -0.639* | -0.648* |
| | (0.423) | (0.410) | (0.362) | (0.360) |
| Hotels and Restaurants | -0.861*** | -0.874*** | -2.102*** | -2.123*** |
| | (0.330) | (0.340) | (0.364) | (0.363) |
| Transport and | | | | |
| Communication | -1.108*** | -1.077*** | -1.240*** | -1.214*** |
| | (0.307) | (0.303) | (0.385) | (0.384) |
| Financial Services | 0.550 | 0.689 | 0.661* | 0.725** |
| | (0.372) | (0.360) | (0.354) | (0.357) |
| Other Business Services | -0.704** | -0.768** | -0.586* | -0.593 |
| | (0.290) | (0.330) | (0.338) | (0.363) |
| Public Administration | -1.965*** | -2.001*** | -1.109 | -1.144** |
| | (0.497) | (0.501) | (0.451) | (0.448) |
| Education | -3.031*** | -3.353*** | -2.473** | -2.532*** |
| | (0.522) | (0.587) | (0.401) | (0.427) |
| Health | -2.176*** | -2.266*** | -2.473** | -2.461*** |
| | (0.361) | (0.404) | (0.369) | (0.376) |
| Other Community Services | -1.106*** | -1.070*** | -0.730*** | -0.718** |
| | (0.366) | (0.367) | (0.367) | (0.368) |
| **Firm Controls** | | | | |
| Single-Establishment Firm | 0.018 | 0.021 | -0.216 | -0.216 |

| | | | | |
|---|---|---|---|---|
| | (0.210) | (0.207) | (0.260) | (0.259) |
| Fixed Term Workers Over One Year | 0.301 | 0.408 | 0.275 | 0.361 |
| | (0.266) | (0.270) | (0.305) | (0.296) |
| Fixed Term Workers Under One Year | 0.055 | 0.136 | 0.078 | 0.138 |
| | (0.173) | (0.172) | (0.192) | (0.197) |
| Operation Over Five Years | 0.513** | 0.474** | 0.639** | 0.612** |
| | (0.231) | (0.227) | (0.300) | (0.287) |
| Main Activity of Establishment | 0.278 | 0.234 | 0.347 | 0.312 |
| | (0.211) | (0.212) | (0.242) | (0.240) |
| Temporary Workers | 0.149 | 0.094 | 0.455** | 0.424** |
| | (0.179) | (0.179) | (0.182) | (0.183) |
| Establishment Size | 0.188 | 0.188 | 0.124 | 0.124 |
| | (0.136) | (0.131) | (0.107) | (0.106) |
| Fraction of Part Time Workers | -0.618 | -0.505 | -0.514 | -0.468 |
| | (0.403) | (0.384) | (0.445) | (0.443) |
| Number of Recognized Unions | 0.176*** | 0.163** | 0.045 | 0.042 |
| | (0.068) | (0.069) | (0.105) | (0.105) |
| 100% Workers Unionized | -0.428 | -0.462 | 0.016 | 0.000 |
| | (0.293) | (0.295) | (0.325) | (0.322) |
| 80-99% Workers Unionized | -0.145 | -0.108 | -0.146 | -0.128 |
| | (0.252) | (0.263) | (0.305) | (0.311) |
| 60-79% Workers Unionized | -0.697*** | -0.709*** | -0.477 | -0.491 |
| | (0.266) | (0.273) | (0.318) | (0.320) |
| 40-59% Workers Unionized | -0.462 | -0.471 | -0.709 | -0.717 |
| | (0.378) | (0.374) | (0.483) | (0.480) |
| 20-39% Workers Unionized | 0.446 | 0.509 | -0.285 | -0.263 |
| | (0.549) | (0.529) | (0.419) | (0.449) |
| 1-19% Workers Unionized | -1.364** | -1.396*** | | |
| | (0.550) | 0.536 | | |
| Risk | 0.427* | 0.488 | -0.732*** | -0.756 |
| | (0.241) | (0.229) | (0.245) | (0.542) |

| | | | | |
|---|---|---|---|---|
| Constant | -0.630<br>(0.623) | -0.663<br>(0.634) | -1.893***<br>(0.639) | -1.898***<br>(0.623) |
| **Incremental Effect of *Delegation*** | | | | |
| Overall (All Jobs) | 0.126 | 0.116 | 0.111 | 0.108 |
| Complex Jobs | | -0.129 | | -0.014 |
| Simple Jobs | | 0.153 | | 0.123 |
| Sample Size | 1214 | 1214 | 1214 | 1214 |

Note 1: This table is the same as Table 2 except that it includes the variable *Risk* as a control. Results are probit coefficients, with robust standard errors in parentheses below each estimate. Statistical significance at the 10%, 5%, and 1% levels, respectively, is denoted by *, **, and ***, using two-tailed tests. Reference group for industry dummies is *Wholesale* and *Retail*. Reference group for % unionized dummies is 0% *Workers Unionized*.

Note 2: The overall incremental effect of *Delegation* (for all jobs) is the average value over all sample observations of the predicted values of $Prob(Incentive\ Pay(l.o.g.) = 1 \mid Delegation = 1) - Prob(Incentive\ Pay(l.o.g.) = 1 \mid Delegation = 0)$ evaluating *Complex* at its observed value for each observation. The incremental effect of *Delegation* for "Complex" jobs is the average value over all sample observations of the predicted values of $Prob(Incentive\ Pay(l.o.g) = 1 \mid Complex = 1$ and $Delegation = 1) - Prob(Incentive\ Pay(l.o.g) = 1 \mid Complex = 1$ and $Delegation = 0)$. The incremental effect of *Delegation* for "Simple" is the average value over all sample observations of $Prob(Incentive\ Pay(l.o.g) = 1 \mid Complex = 0$ and $Delegation = 1) - Prob(Incentive\ Pay(l.o.g) = 1 \mid Complex = 0$ and $Delegation = 0)$.

**TABLE 5: Ordered Probit Results: Dep. Var. = *Incentive Pay%***

| | ***Dependent Variable: Incentive Pay%*** | |
|---|---|---|
| ***Independent Variables:*** | | |
| Delegation | 0.460** | 0.622*** |
| | (0.193) | (0.198) |
| Delegation x Complex | | -1.601*** |
| | | (0.539) |
| Complex | | 0.614* |
| | | (0.352) |
| **Industry Controls** | | |
| Manufacturing | -0.785** | -0.753** |
| | (0.310) | (0.296) |
| Electricity, Gas and Water | -1.023** | -0.916** |
| | (0.454) | (0.420) |
| Construction | -0.948** | -0.918*** |
| | (0.371) | (0.353) |
| Hotels and Restaurants | -1.444*** | -1.488*** |
| | (0.312) | (0.315) |
| Transport and Communication | -0.973*** | -0.928*** |
| | (0.295) | (0.289) |
| Financial Services | 0.704** | 0.865** |
| | (0.347) | (0.338) |
| Other Business Services | -0.584** | -0.671** |
| | (0.289) | (0.320) |
| Public Administration | -1.314*** | -1.351 |
| | (0.406) | (0.410) |
| Education | -2.457*** | -2.817*** |
| | (0.447) | (0.515) |
| Health | -1.993*** | -2.102*** |
| | (0.389) | (0.424) |
| Other Community Services | -0.559 | -0.505 |
| | (0.350) | (0.347) |
| **Firm Controls** | | |
| Single-Establishment Firm | 0.097 | 0.093 |
| | (0.184) | (0.183) |
| Fixed Term Workers Over One Year | 0.151 | 0.289 |

| | | |
|---|---|---|
| | (0.259) | (0.252) |
| Fixed Term Workers Under One Year | 0.277 | 0.375** |
| | (0.185) | (0.189) |
| Operation Over Five Years | 0.290 | 0.251 |
| | (0.234) | (0.227) |
| Main Activity of Establishment | 0.085 | 0.027 |
| | (0.214) | (0.214) |
| Temporary Workers | 0.130 | 0.072 |
| | (0.186) | (0.186) |
| Establishment Size | 0.099 | 0.100 |
| | (0.097) | (0.095) |
| Fraction of Part Time Workers | -0.497 | -0.355 |
| | (0.402) | (0.376) |
| Number of Recognized Unions | 0.167** | 0.155* |
| | (0.078) | (0.078) |
| 100% Workers Unionized | -0.062 | -0.085 |
| | (0.254) | (0.253) |
| 80-99% Workers Unionized | -0.254 | -0.225 |
| | (0.269) | (0.288) |
| 60-79% Workers Unionized | -0.483* | -0.492* |
| | (0.282) | (0.288) |
| 40-59% Workers Unionized | -0.351 | -0.361 |
| | (0.427) | (0.421) |
| 20-39% Workers Unionized | 0.820 | 0.896 |
| | (0.623) | (0.582) |
| 1-19% Workers Unionized | -1.435** | -1.481*** |
| | 0.579 | 0.573 |
| Risk | -0.482** | -0.571*** |
| | (0.241) | (0.212) |
| Cutoff 1 | 1.197** | 1.294** |
| | (0.522) | (0.520) |
| Cutoff 2 | 1.323** | 1.421*** |
| | (0.522) | (0.524) |
| Cutoff 3 | 1.429*** | 1.527*** |
| | (0.552) | (0.554) |

| | | |
|---|---|---|
| Cutoff 4 | 1.586*** | 1.685*** |
| | (0.546) | (0.547) |
| Cutoff 5 | 1.653*** | 1.753*** |
| | (0.545) | (0.547) |
| Cutoff 6 | 1.984*** | 2.087*** |
| | (0.554) | (0.556) |
| **Incremental Effect of *Delegation*** | | |
| **Overall (All Jobs)** | | |
| =1 (None 0%) | -0.084 | -0.080 |
| =2 (Just a few 1-19%) | 0.007 | 0.006 |
| =3 (Some 20-39%) | 0.006 | 0.005 |
| =4 (Around half 40-59%) | 0.009 | 0.008 |
| =5 (Most 60-79%) | 0.004 | 0.003 |
| =6 (Almost all 80-99%) | 0.017 | 0.015 |
| =7 (All 100%) | 0.042 | 0.043 |
| **Complex Jobs** | | |
| =1 (None 0%) | | -0.015 |
| =2 (Just a few 1-19%) | | -0.014 |
| =3 (Some 20-39%) | | -0.012 |
| =4 (Around half 40-59%) | | -0.017 |
| =5 (Most 60-79%) | | -0.007 |
| =6 (Almost all 80-99%) | | -0.030 |
| =7 (All 100%) | | -0.074 |
| **Simple Jobs** | | |
| =1 (None 0%) | | 0.111 |
| =2 (Just a few 1-19%) | | 0.009 |
| =3 (Some 20-39%) | | 0.008 |
| =4 (Around half 40-59%) | | 0.011 |
| =5 (Most 60-79%) | | 0.005 |
| =6 (Almost all 80-99%) | | 0.021 |
| =7 (All 100%) | | 0.056 |

| | | |
|---|---|---|
| Sample Size | 1187 | 1187 |

Note 1: This table is the same as Table 3 except that it includes the variable *Risk* as a control. Results are ordered probit coefficients, with robust standard errors in parentheses below each estimate. Statistical significance at the 10%, 5%, and 1% levels, respectively, is denoted by *, **, and ***, using two-tailed tests. Reference group for industry dummies is *Wholesale* and *Retail*. Reference group for % unionized dummies is 0% *Workers Unionized*.

Note 2: The overall incremental effect of *Delegation* (for all jobs) is the average value over all sample observations of the predicted values of $Prob(Incentive\ Pay\% = j \mid Delegation = 1) - Prob(Incentive\ Pay\% = j \mid Delegation = 0)$, for j = 1, 2, ..., 7, evaluating *Complex* at its observed value for each observation. The incremental effect of *Delegation* for "Complex" jobs is the average value over all sample observations of the predicted values of $Prob(Incentive\ Pay\% = j \mid Complex = 1$ and $Delegation = 1) - Prob(Incentive\ Pay\% = j \mid Complex = 1$ and $Delegation = 0)$, for j = 1, 2, ..., 7. The incremental effect of *Delegation* for "Simple" is the average value over all sample observations of $Prob(Incentive\ Pay\% = j \mid Complex = 0$ and $Delegation = 1) - Prob(Incentive\ Pay\% = j \mid Complex = 0$ and $Delegation = 0), for j = 1, 2, ..., 7$.

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