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DISCUSSION PAPER SERIES

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Performance Pay and Applicant Screening

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ABSTRACT

Performance Pay and Applicant Screening*

Using German establishment data, we show that the relationship between intensity of performance pay and intensity of applicant screening depends on the nature of production. In establishments with increased multitasking, performance pay is positively associated with applicant screening. By contrast, in establishments without increased multitasking, performance pay is negatively associated with applicant screening. The findings fit the hypothesis that performance pay induces a positive self-sorting of employees if jobs are less multifaceted. In this case, employers with a high intensity of performance pay do not need intensive applicant screening to ensure a high quality of matches between workers and jobs. However, if jobs are more multifaceted, performance pay can entail problems of adverse self-sorting. In order to mitigate or overcome these problems, employers making intensive use of performance pay also screen applicants more intensively.

JEL Classification: J33, J60, M51, M52

Keywords: performance pay, multitasking, self-sorting, applicant screening, non-managerial employees, managerial employees

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1. Introduction

Since its emergence, personnel economics has made great progress in analyzing the incentives created within firms. Much less attention has been paid to the hiring strategies of firms. As Oyer and Schaefer (2011: p. 1770) put it:

> 'The literature has been less successful at explaining how firms can find the right employees in the first place. Economists understand the broad economic forces – matching with costly search and bilateral asymmetric information – that firms face in trying to hire. But the main models in this area treat firms as simple black-box production functions. Less work has been done to understand how different firms approach the hiring problem, what determines the firm-level heterogeneity in hiring strategies, and whether these patterns conform to theory.'

This lack of knowledge is surprising given that improving the quality of matches between workers and jobs can substantially raise productivity (Autor and Scarborough 2008, Bartling et al. 2012). Usually, a careful selection of employees is viewed as a fundamental part of human resource management in order to improve the quality of matches (Huang and Capelli 2010, Ichniowski et al. 1997). However, the quality of matches not only depends on applicant screening. A firm's personnel policy in general and the use of performance pay in particular may also have an influence on the quality of matches by inducing a self-sorting of applicants.

Our study contributes to the literature by examining the relationship between performance pay and applicant screening. Lazear (1986, 2000) has shown that performance pay can induce a self-sorting of high-ability employees.[1] Against this background one may expect that performance pay and applicant screening should be substitutes. Employers using

performance pay can attract high-ability employees without extensive screening of applicants. Only those employers who do not make intensive use of performance pay may need extensive applicant screening to ensure a sufficiently high ability of their employees.

This prediction presupposes a comprehensive measurement of performance so that performance pay in the end adequately rewards every worker characteristic that is relevant for production. In this case, performance pay can attract workers whose skills and abilities match the various job requirements. However, if the measurement of worker performance is only available for a limited set of dimensions, performance pay may induce a distorted sorting process, as it does not reward all the worker attributes needed for production. Whether or not a comprehensive measurement of performance is available depends on the nature of production. As a consequence, potential distortions in the self-sorting process induced by performance pay should depend on the nature of production.

Against this background, we hypothesize that the nature of production plays a moderating role in the relationship between performance pay and applicant screening. A substitutive relationship should hold if production is characterized by a lower degree of multitasking. A low degree of multitasking implies that worker performance can be more easily and comprehensively measured. In this case, performance pay rewards the worker characteristics needed for production and, hence, attracts the right workers reducing the necessity of an intensive applicant screening. By contrast, a complementary relationship should hold if production entails a higher degree of multitasking. A high degree of multitasking implies that performance pay can entail problems of adverse self-sorting. If performance measures are not available for all relevant tasks, performance pay may attract employees who are only strong in the measured performance

dimensions, but are weak in the non-measured dimensions. In order to mitigate or avoid the problem of adverse self-sorting, the employer has to screen applicants more intensively.

Our empirical analysis uses unique data from German establishments. The data are based on an additional survey of a representative subsample of establishments participating in the IAB Establishment Panel. Importantly, the survey provides information on the intensity of performance pay and the intensity of applicant screening for both managerial and non-managerial employees. We use the establishment's focus on high quality, innovativeness or customer-specific solutions as an indication of a production that requires increased multitasking.

Our estimates confirm that the nature of production indeed plays a moderating role in the relationship between performance pay and applicant screening. The average share of individual performance pay in employees' earnings and the time taken for the screening of applicants are negatively associated if production is characterized by less multitasking. They are positively associated if production is characterized by increased multitasking. Thus, the findings suggest a substitutive relationship between intensity of performance pay and intensity of applicant screening in a less multifaceted work setting and a complementary relationship in a more multifaceted work setting. This holds for managerial and for non-managerial employees.

We also account for the use of performance appraisal systems in order to examine if the relationship between performance pay and applicant screening depends on how individual worker performance is measured. Our estimates show that the key pattern of results holds for both establishments using and establishments not using performance appraisals. However, the pattern of results is unique to individual performance pay. We do not find a similar pattern of results for group-based performance pay or profit sharing.

Our study is related to recent research on performance pay and multidimensional sorting (Bandiera et al. 2015, Cornelissen et al. 2011, Curme and Stefanec 2007, Dohmen and Falk 2011, Geddes and Heywood 2003, Grund and Sliwka 2010, Heywood et al. 2016). This research has used employee data to show that the self-sorting into performance pay jobs can take place along multiple dimensions of the employees' personal characteristics. Our study indicates that the self-sorting process induced by performance pay is even more complex. Ability itself can be multi-dimensional and the self-sorting process is moderated by the nature of production.

The rest of the paper is organized as follows. The second section sets the stage by providing a non-technical background discussion on individual performance pay, applicant screening and multitasking. In the third section, we develop a formal theoretical model to analyze the relationship between performance pay and applicant screening. In the fourth section, we proceed with a discussion on the role of subjective performance appraisals to take into account that the relationship between performance pay and applicant screening can also depend on how individual worker performance is measured. Moreover, we contrast individual performance pay with collective incentive schemes. The fifth section presents the data and variables while the sixth section provides the estimation results. The seventh section concludes.

2. Background Discussion

The classical sorting model by Lazear (1986) lends itself as a useful starting point for our discussion. Lazear models performance pay as a self-sorting process by workers who differ in their ability level. He divides the economy into a time rate sector and a performance pay sector. Employers in the time rate sector cannot observe individual worker performance. Thus, the wage of an individual worker does not depend on his or her ability. Each worker receives the same time rate. By contrast, employers in the performance pay sector are able to monitor individual

worker performance so that they can reward workers according to their individual performance. This implies that workers with a higher ability receive a higher performance-related payment. However, performance pay is coupled with a lower base payment. Workers prefer the performance pay sector only if the performance-related pay they can earn dominates the disadvantage of the lower base payment. This condition is met by workers with sufficiently high ability. Hence, high-ability workers sort themselves into performance-pay firms while low-ability workers choose jobs in time-rate firms. The model has received empirical support in Lazear's (2000) well known case study of the Safelite Glass Corporation. The auto glass company moved 3,000 workers from hourly wages to piece rates resulting in a 44 percent increase in output per worker. Half of the productivity gain came from more able workers being attracted into the piece rate scheme.[2]

While Lazear does not explicitly analyze employers' investments in the selection of new employees, the idea of performance pay as a self-sorting device suggests that performance pay and applicant screening may be substitutes. Employers using performance pay can attract high-ability workers even without being proactive in screening job applicants for their ability. By contrast, those employers in the time rate sector who are interested in recruiting high-ability workers must rely on screening methods such as evaluations of résumés, reference and background checks, applicant testing, and extensive job interviews for selecting appropriate applicants. They offer high fixed wages to attract the applicants being successful in the screening process.

In our stylized model, we take applicant screening explicitly into account. Specifically, we consider high-powered performance pay, low-powered performance pay, and time rates coupled with applicant screening. In the basic version of the model, we assume a one-

dimensional task and imagine workers who have either a low or a high ability in the task.[3] An employer offering a time rate sets the fixed wage equal to the reservation utility of high-ability workers to ensure that these workers are willing to work for the firm. However, if low-ability workers have a smaller reservation utility than high-ability workers, they have an incentive also to apply for the job. One way to discourage low-ability workers from applying for the job is to couple the time rate with applicant screening. Performance pay stands as an alternative to avoid an adverse selection problem. On the one hand, it prevents low-ability workers from applying for the job, as their ability does not enable them to earn a sufficiently high performance-related wage. On the other hand, it attracts high-ability workers, as it rewards their ability. While low-powered performance pay and high-powered performance pay both induce a positive self-sorting of high-ability workers, only high-powered performance pay provides an additional incentive to exert high effort.

Altogether, the basic version of our illustrative model predicts a substitutive relationship between performance pay and applicant screening. However, to attract workers whose skills and abilities match the various job requirements, performance pay must adequately reward every worker characteristic that is relevant for production. Thus, the prediction of a substitutive relationship between performance pay and applicant screening should rather hold for less multifaceted tasks that allow a comprehensive measurement of worker performance. In an extension of our model, we show that the relationship between performance pay and applicant screening may be different if production is characterized by multitasking.

Multitasking can be associated with dimensions of worker performance for which individual performance measures are not available. The literature on multitasking usually focuses on the implications for the effort of workers. The inability to reward every type of productive

worker activity can cause workers to cut back on productive behaviors for which they are not rewarded (Baker 2002, Holmstrom and Milgrom 1991, 1994, Itoh 1994).[4] For example, piece rates induce workers to exert effort increasing quantity while they provide no incentives to engage in activities such as helping colleagues, maintaining equipment, cultivating customer goodwill, and reducing chances of workplace injury (Artz and Heywood 2015, Bender et al. 2012, Bender and Theodossiou 2014, Brown 1990, Drago and Garvey 1998, Drago and Heywood 1995, Freeman and Kleiner 2005, Heywood et al. 2013).

However, an emphasis on performance as measured by one or a few narrow performance indicators may not only distort the allocation of effort across tasks but may also entail problems of adverse self-sorting.[5] Performance pay may attract workers who have high abilities in the measured performance dimensions and have low abilities in the non-measured performance dimensions. Thus, taking up our example again, piece rates may induce a self-sorting of workers who are strong in producing a high quantity of output but weak in maintaining equipment or cooperating with colleagues. Those workers increase their individual output at the expense of equipment maintenance and helping on the job. In order to avoid such adverse self-sorting, employers using performance pay may to a larger extent invest in applicant screening. While performance pay causes a self-sorting of high-ability workers along the measured performance dimensions, applicant screening ensures sufficiently high abilities in the non-measured performance dimensions. Hence, in case of increased multitasking, combining performance pay with a more careful and in-depth applicant screening can help the employer to find the right employees.

In the extension of our model, we consider the case that ability and performance are two-dimensional. Only the first dimension of performance can be measured so that performance pay

can only reward that dimension. We show that specifically high-powered performance pay aggravates the adverse selection problem. Workers that have a high ability in the first performance dimension receive a utility greater than their reservation utility if they are on high-powered performance pay. Thus, they have an incentive to apply for a job with high-powered performance pay even if their ability in the second performance dimension is low. In order to avoid such adverse selection, the employer must screen applicants with respect to the second dimension of ability.

From a practical viewpoint, one may raise the question as to what measures employers can take to screen applicants for multitask jobs. The use of personality tests may be one way to intensify applicant screening. A series of psychological studies show that general personality traits such as the Big Five can predict various dimensions of job performance closely related to multitasking. These dimensions include team-related behavior, service orientation, creative problem solving, innovativeness, and dealing with uncertain work situations (see Hough and Oswald 2008, Judge et al. 2008, Penney et al. 2011 and Rothstein and Goffin 2006 for surveys). Personality traits are even related to counter-productive work behavior such as performing tasks incorrectly or unsafe behavior. Moreover, personality test may not only identify general personality traits but also specific personality characteristics that are directly linked to multitasking. Polychronicity (the preference to multitask) has been shown as an important indicator of multitasking performance (Conte and Gintoft 2005, Koenig et al. 2010).

All in all, the relationship between performance pay and applicant screening should depend on the nature of production. If production is characterized by a lower degree of multitasking, we anticipate a substitutive relationship. Employers using performance pay can induce a self-sorting of high-ability workers and, hence, do not need to rely on extensive

applicant screening.[6] By contrast, if production is characterized by a higher degree of multitasking, we anticipate a complementary relationship. Employers with an intensive use of performance pay should engage in more extensive applicant screening in order to avoid an adverse self-sorting of workers who have low abilities in the non-measured performance dimensions.

Examining these predictions empirically requires variation across firms in the intensity of performance pay. Such variation exists if firms differ in the cost of implementation or managers do not have perfect information on the potential advantages and disadvantages of performance pay (Bresnahan et al. 2002, Caroli and van Reenen 2001). Imperfect information on the advantages and disadvantages of performance pay implies that managers are subject to some optimization errors leading to experimentation with performance pay. Indeed, empirical studies provide evidence that there is substantial trial and error in the use of performance pay (Brown and Heywood 2002).

3. A Model of Individual Performance Pay and Applicant Screening

In what follows, we develop a stylized formal model to analyze the relationship between performance pay and applicant screening. While Lazear's (1986) analysis of performance pay focuses on an economy-wide self-sorting equilibrium under the assumption of a zero-profit condition, we consider a single profit-maximizing principal choosing the optimal hiring strategy. Our analysis is based on a limited-liability principal-agent model with both moral hazard and adverse selection (see Laffont and Martimort 2002: chapter 7 for an introduction into this type of model).

3.1 The Basic Model

A principal wants to hire one agent for a project. The pool of agents consists of two types. Let $\theta \in \{\underline{\theta}, \overline{\theta}\}$ denote an agent's type where a low-ability agent is characterized by $\underline{\theta}$ and a high-ability agent by $\overline{\theta}$. While the agents know of which type they are, the principal cannot immediately observe an agent's type. However, the principal can invest in applicant screening. For the sake of simplicity, we assume that screening is perfect and unambiguously reveals the true type of an applicant. The fixed screening cost is given by $z > 0$. The reservation utilities of low-ability and high-ability agents are $\underline{U}$ and $\overline{U}$ with $\overline{U} > \underline{U} > 0$. This reflects that high-ability agents have better outside options than low-ability agents. The project can either succeed or fail. An agent's output is

$$Q = \begin{cases} q > 0 \text{ with probability } \rho(e, \theta), \\ 0 \text{ with probability } 1 - \rho(e, \theta), \end{cases} \tag{1}$$

where the success probability ρ is a function of the agent's type θ and the agent's additional effort e. Effort is dichotomous with $e \in \{0, 1\}$. We assume that

$$\rho(0, \underline{\theta}) = 0 < \rho(1, \underline{\theta}) < 1, \tag{2a}$$

$$0 < \rho(0, \overline{\theta}) < \rho(1, \overline{\theta}) < 1, \tag{2b}$$

$$\rho(1, \underline{\theta}) - \rho(0, \underline{\theta}) < \rho(1, \overline{\theta}) - \rho(0, \overline{\theta}). \tag{2c}$$

Additional effort increases the probability of success. Assuming complementarity of effort and ability, the increase is stronger for a high-ability agent than for a low-ability agent. If no additional effort is exerted, a high-ability agent has still a positive probability of success while the success probability of a low-ability agent is normalized to zero.

Building from Laffont and Martimort (2002: chapter 9), we assume that the value of the agent's output for the principal depends also directly on the agent's type:

$$S(\theta, Q) = \begin{cases} \gamma Q \text{ if } \theta = \bar{\theta}, \\ 0 \text{ if } \theta = \underline{\theta}, \end{cases} \tag{3}$$

with $\gamma > 0$. The parameter γ is assumed to be sufficiently large so that it is profitable for the employer to hire a high-ability agent. One possible interpretation of equation (3) is that some minimum quality is required to make the output valuable to the principal. The output of a high-ability agent meets this quality standard while the output of a low-ability agent does not meet it. Thus, it has no value to the principal to hire a low-ability agent. Agents are risk-neutral and their utility functions are given by

$$U(W, e) = W - C(e), \tag{4}$$

where W is the wage and $C(e)$ the disutility of effort with $C(0) = 0$ and $C(1) = c > 0$. The principal can either pay a time rate $W = \overline{W}$ or a performance-related wage. We assume that the agent's effort e is not observable to the principal and that the value S of the output for the principal is not verifiable. Thus, performance pay can only be based on the agent's output Q. Furthermore, agents are assumed to be protected by limited liability implying that they must receive a non-negative wage regardless of whether the project is successful or not: $W \geq 0$. As a consequence, a performance pay contract specifies a payment $W = \alpha Q$ where α is the agent's share in produced output.[7] Designing performance pay and verifying produced output is costly to the principal. Thus, performance pay entails a cost $m > 0$.

The timing of the model is as follows: The principal chooses a hiring strategy and announces the contract. Agents decide whether or not they apply for the position. The principal hires an agent. The agent chooses his or her effort and output is realized.

3.2 The Principal's Hiring Strategies

We assume that the principal can choose among three different hiring strategies, namely

applicant screening, high-powered performance pay, and low-powered performance pay.

Applicant screening. The principal offers a time rate. The time rate provides no incentives to exert effort. Thus, there is no disutility of effort an agent must be compensated for. To attract $\bar{\theta}$-agents, the principal sets the time rate equal to their reservation utility: $\overline{W} = \overline{U}$. However, this wage alone entails an adverse selection problem. Agents with low ability $\underline{\theta}$ have also an incentive to apply for the job, as their reservation utility $\underline{U}$ is smaller than the reservation utility $\overline{U}$ of $\bar{\theta}$-agents.

To avoid such adverse selection, the principal combines the wage offer with the announcement that applicants will be screened. Screening discourages $\underline{\theta}$-agents from applying for the job. They anticipate that they have no chance of being hired, as their true type will be revealed. Hence, the pool of applicants only consists of $\bar{\theta}$-agents. Even though the principal has rational expectation about the type of the applicants, the credibility of the announcement requires that she screens applicants. As all of the applicants are $\bar{\theta}$-agents, the principal has to screen only one applicant. She hires the first applicant who is screened. The principal's expected profit is:

$$E\Pi_1 = E[S] - \overline{W} - z = \rho(0, \overline{\theta})\gamma q - \overline{U} - z. \quad (5)$$

Applicant screening ensures that the vacant position is filled with an agent of type $\bar{\theta}$. The $\bar{\theta}$-agent produces output q with probability $\rho(0, \overline{\theta})$. This output has a value γq for the principal. However, the principal not only incurs wage cost $\overline{W}$, but also the additional screening cost z.

High-powered performance pay. High-powered performance pay not only induces a self-sorting of agents, but also provides incentives to exert additional effort. An agent exerts additional effort if the expected utility from exerting effort is at least as large as the expected utility from exerting no effort:

$$\rho(1, \theta)\alpha q - c \geq \rho(0, \theta)\alpha q. \quad (6)$$

The minimum share α that induces an agent of type $\bar{\theta}$ to exert effort is:

$$\alpha^* = \frac{c}{(\rho(1,\bar{\theta}) - \rho(0,\bar{\theta}))q}. \tag{7}$$

The resulting expected utility of the $\bar{\theta}$-agent is equal to the expected wage minus the disutility of effort:

$$EU^* = \rho(1,\overline{\theta})\alpha^* q - c = \frac{\rho(0,\bar{\theta})c}{\rho(1,\bar{\theta}) - \rho(0,\bar{\theta})}. \tag{8}$$

High-powered performance pay attracts $\bar{\theta}$-agents if

$$EU^* \geq \overline{U}. \tag{9}$$

In what follows we assume that EU^* is sufficiently large so that performance pay yields a utility greater than the reservation utility and, hence, inequality (9) holds. This is in line with previous research showing that workers on performance pay receive a substantial rent in terms of higher job satisfaction (Cornelissen et al. 2011, Green and Heywood 2008).[8]

For $\underline{\theta}$-agents, the share α^* is too small to induce effort. Taking (2c) and (7) into account, we obtain $(\rho(1,\underline{\theta}) - \rho(0,\underline{\theta}))\alpha^* q < c = (\rho(1,\overline{\theta}) - \rho(0,\overline{\theta}))\alpha^* q$. As the effort of $\underline{\theta}$-agents increases the success probability to a smaller amount than the effort of $\bar{\theta}$-agents, the increase in the expected earnings of $\underline{\theta}$-agents is not large enough to offset their disutility of effort. The $\underline{\theta}$-agents' expected utility from exerting effort is smaller than their expected utility from exerting no effort.

Taking into account that $\underline{\theta}$-agents exerting no effort have zero success probability, their expected utility from high-powered performance pay is equal to zero. This utility is smaller than their reservation utility $\underline{U}$. Thus, $\underline{\theta}$-agents are discouraged by high-powered performance pay from applying for the job. This implies that the principal hires a $\bar{\theta}$-agent for sure. The principal's

expected profit is $E\Pi_2 = \rho(1,\overline{\theta})\gamma q - \alpha^*\rho(1,\overline{\theta})q - m$. Taking (8) into account, the expected profit can be rewritten:

$$E\Pi_2 = \rho(1,\overline{\theta})\gamma q - (EU^* + c) - m. \tag{10}$$

High-powered performance pay not only attracts $\bar{\theta}$-agents, but also provides incentives to exert additional effort. Thus, compared to applicant screening, high-powered performance pay has the advantage that it implies a higher success probability $\rho(1,\overline{\theta})$. The disadvantage is that it entails a higher expected wage $E[W] = (EU^* + c)$ and the monitoring cost m.

Low-powered performance pay. In contrast to high-powered performance pay, low-powered performance pay is only used to attract $\bar{\theta}$-agents, but not to induce additional effort. The principal sets the share α in such a way that, for $\bar{\theta}$-agents, the expected utility is equal to their reservation utility: $\alpha\rho(0,\overline{\theta})q = \overline{U}$. This yields

$$\alpha^{**} = \frac{\overline{U}}{\rho(0,\overline{\theta})q}. \tag{11}$$

Taking (8) and (9) into account, it is straightforward to show that $\alpha^{**} < \alpha^*$.[9] As α^* is the minimum share providing an incentive for high-ability agents, this means that α^{**} is too low to induce effort. If α^{**} does not provide an incentive for $\bar{\theta}$-agents, it also does not provide an incentive for $\underline{\theta}$-agents. As $\underline{\theta}$-agents have zero success probability when exerting no effort, they would receive zero expected utility if they were on low-powered performance pay. That utility is smaller than their reservation utility $\underline{U}$. Thus, $\underline{\theta}$-agents are discouraged by low-powered performance pay from applying for the job. The principal's expected profit is:

$$E\Pi_3 = \rho(0,\overline{\theta})\gamma q - \alpha^{**}\rho(0,\overline{\theta})q - m = \rho(0,\overline{\theta})\gamma q - \overline{U} - m. \tag{12}$$

The principal hires a high-ability agent who exerts no effort. This implies a success probability of $\rho(0,\overline{\theta})$. The principal pays an expected wage equal to the high-ability agent's reservation

utility $\overline{U}$ and incurs the monitoring cost m.

Comparing the hiring strategies. The principal chooses the hiring strategy that yields the highest expected profit. The choice depends on the wage costs, the monitoring cost, the screening cost, and the success probabilities with and without additional effort.

The basic point for our analysis is that, in our stylized model with one-dimensional ability of the agents, screening and performance pay are substitutes. Applicant screening is only required if the principal pays a time rate. It is not required if the principal uses performance pay. This applies to both high-powered and low-powered performance pay. High-powered performance pay solves both the moral hazard and the adverse selection problem. It provides incentives for high-ability agents to exert effort and discourages low-ability agents from applying for the job. Low-powered performance pay only solves the adverse selection problem. It discourages low-ability agents from applying for the job, but provides no incentive for high-ability agents to exert effort.

3.3 Model Extension: Multitasking

To capture multitasking, we now assume that ability is two-dimensional. Let $\eta \in \{\underline{\eta}, \overline{\eta}\}$ denote an agent's second ability where a low-ability agent is characterized by $\underline{\eta}$ and a high-ability agent by $\overline{\eta}$. The share of $\overline{\eta}$-agents in the population is given by μ. Ability η may, for example, reflect innovativeness, flexibility, customer service skills, or specific quality skills. The second ability is also not immediately observable to the principal. But the principal can invest in screening to unambiguously identify this ability. Identifying an agent's second ability entails a fixed cost $k > 0$. The two abilities θ and η may be correlated, but are not perfectly correlated.

If production is characterized by multitasking, the principal values both the first and the second ability. For the sake of simplicity, we assume that both dimensions are additively

separable: $S(\theta, Q) + V(\eta)$, where $S(\theta, Q)$ is given by equation (3) and $V(\eta)$ is the value of the agent's second ability for the principal:

$$V(\eta) = \begin{cases} v > 0 \text{ if } \eta = \bar{\eta}, \\ 0 \text{ if } \eta = \underline{\eta} \end{cases} \tag{13}$$

The value $V(\eta)$ for the principal is also not verifiable. Thus, as to the second dimension of ability, we focus on the adverse selection problem and abstract from moral hazard. All of our previous assumptions still hold. Specifically, we assume that reservation utilities only depend on the agents' first ability θ.

Applicant screening and low-powered performance pay. If the principal screens applicants with respect to θ or uses low-powered performance pay for output Q, $\underline{\theta}$-agents are still discouraged from applying for the job regardless of whether they are of type $\bar{\eta}$ or type $\underline{\eta}$. The $\overline{\theta}$-agents are still willing to apply for the job. They receive a utility equal to their reservation utility when they work for the principal. The second ability η has no influence on that utility. Thus, applicants have no incentive to mask their true ability η. They realize their reservation utility regardless of whether or not they are hired by the principal. Thus, the principal can simply ask applicants to reveal their true ability η.[10] She then chooses an applicant with ability $\bar{\eta}$. If the principal screens applicants with respect to θ, her expected profit is

$$E\Pi_4 = E\Pi_1 + v. \tag{14}$$

The principal's expected profit from low-powered performance pay is

$$E\Pi_5 = E\Pi_3 + v. \tag{15}$$

Even though the principal screens applicants only with respect to the first ability θ or provides low-powered rewards only for the output associated with θ, she is able to hire an agent with a high ability $\overline{\eta}$ and to realize the full value of multitasking. No additional screening with respect

to the second ability η is required.

High-powered performance pay. Agents with ability $\overline{\theta}$ receive an expected utility EU^* greater than their reservation utility $\overline{U}$ if they are on high-powered performance pay. Thus, they apply for the job regardless of whether they are $\bar{\eta}$-types or $\underline{\eta}$-types. Or put differently, high-powered rewards for the output associated with the first ability involve an adverse selection problem with the respect to the second ability, as even $\underline{\eta}$-types apply for the job. If the principal does not screen applicants with respect to η, her expected profit is

$$E\Pi_6 = E\Pi_2 + \mu(\bar{\eta}|\overline{\theta})v, \tag{16}$$

where $\mu(\bar{\eta}|\overline{\theta})$ is the conditional probability that an agent is of type $\bar{\eta}$ given that the agent is a $\overline{\theta}$-type. The principal realizes the value v of multitasking only with probability $\mu(\bar{\eta}|\overline{\theta})$. In contrast, if the principal screens applicants with respect to η, her expected profit is

$$E\Pi_7 = E\Pi_2 + v - k, \tag{17}$$

The principal can now hire an agent of type $\bar{\eta}$ for sure. However, this entails the screening cost k. The principal combines high-powered performance pay with screening if $1 - \mu(\bar{\eta}|\overline{\theta})v \geq k$.

Comparing the hiring strategies. Applicant screening with respect to the first ability and low-powered performance pay for the output associated with the first ability have the advantage that they entail no adverse selection with respect to the agents' second ability. Both hiring strategies allow realizing the full value of multitasking without incurring further cost. By contrast, high-powered performance pay for the output associated with first ability involves an adverse selection with respect to the second ability. Agents whose first ability is high can realize a utility greater than their reservation utility. Thus, they have an incentive to apply for the job regardless of whether their second ability is high or low. This is costly to the principal, as she either has a lower (expected) value from the agent's multitasking or has to screen applicants with

respect to the second ability. Thus, if production is characterized by multitasking, the principal's propensity to use high-powered performance pay is reduced. She chooses high-powered performance pay only if the additional effort induced by this pay scheme yields a sufficiently large increase in expected output that also outweighs the additional disadvantages resulting from an aggravated adverse selection problem.

Most importantly in our context, the aggravated adverse selection problem can imply that a principal using high-powered performance pay additionally invests in applicant screening. Thus, high-powered performance pay and applicant screening may be complements if production is characterized by multitasking. This should specifically hold true if the screening cost k is low, the value v of the agent's multitasking is high, and the principal faces a high probability $1 - \mu(\bar{\eta}|\overline{\theta})$ that agents with low multitasking ability apply for the job. Finally, our model implies that high-powered performance pay involves a greater level of applicant screening than the time rate if $k > z$.

4. Alternative Methods of Performance Measurement

4.1 Performance Appraisals

We recognize that the relationship between performance pay and applicant screening may not only depend on the nature of production, but also on how individual worker performance is measured. Performance measures can be either objective or subjective (Baker et al. 1988). Objective measures such as sales or the quantity of produced output involve a relatively low degree of discretion and can be easily verified. In contrast, subjective performance measures such as performance appraisals by superiors are based on judgments and opinions that are often not verifiable and involve a high degree of discretion (Jackson and Schuler 2003, Lewin and Mitchell 1995, Milkovic and Newman 2002, Murphy and Cleveland 1995).

A potential drawback of objective performance measures is that they capture only a very limited set of performance dimensions. Many dimensions of individual worker performance such as cooperativeness, customer orientation, leadership behavior, flexibility, and creativity are difficult to verify objectively. However, these performance dimensions can be assessed by subjective performance appraisals. Thus, a measurement of individual worker performance that not only involves objective indicators, but also subjective appraisals provides a more comprehensive approach of performance measurement.

Such comprehensive measurement of worker performance appears to be specifically important in a multitask setting that involves complex performance dimensions (Brown and Heywood 2005, Gibbons 1998, Jirjahn and Poutsma 2013, Prendergast 1999). The potential comprehensiveness of performance appraisals may also have implications for the relationship between performance pay and applicant screening. It reduces the need for intensive applicant screening so that, in a multitask setting, the complementary relationship between performance pay and applicant screening may be less strong for firms using performance appraisals. In the extreme, if subjective appraisals capture all relevant performance dimensions, a substitutive relationship between performance pay and applicant screening might even hold for a high degree of multitasking. In that case, multitasking would only lead to a complementary relationship if narrow objective performance measures are used.

However, there is a second effect of performance appraisals that works in the opposite direction. Performance appraisals entail a high degree of discretion and subjectivity (Prendergast and Topel 1993). This allows workers to strategically engage in influence activities that result in a positive evaluation, but not necessarily in increased performance (Acemoglu et al. 2008, Milgrom and Roberts 1988). For example, workers may conform to the opinion of their superiors

or provide flattery and private services to the superiors (Laffont 1990, Prendergast 1993). If workers are heterogeneous in their ability to engage in such influence activities, performance appraisal systems may attract those workers who have a special talent for manipulating their superiors' evaluations. Thus, employers using performance appraisal systems have an incentive to carefully screen applicants in order to avoid such adverse self-sorting.[11]

Altogether, from a theoretical point of view, the use of a performance appraisal system can influence the relationship between performance pay and applicant screening in two opposite ways. On the one hand, performance appraisals provide a more comprehensive measurement of worker performance so that the employer's need for applicant screening is reduced even if production is characterized by a high degree of multitasking. On the other hand, performance pay based on subjective performance measures can entail an adverse self-sorting of workers who have a high talent for engaging in unproductive influence activities. In order to mitigate this problem, the employer has to screen applicants more intensively.

4.2 Collective Incentive Schemes

Performance cannot only be measured at the individual level, but also at the group level or firm level. Thus, collective incentive schemes such as group performance pay or profit sharing may stand as alternatives to provide incentives for multitasking (Baker 2002, Drago and Turnbull 1988, Jirjahn 2001). Specifically, profit sharing rewards all worker activities and worker characteristics that are relevant for the firm's profit. Thus, profit sharing may not only provide incentives to adequately allocate effort across all tasks needed for production. It may also attract those workers whose skills and abilities match the various job requirements. This would reduce the need for intensive applicant screening.

However, profit sharing, like other collective incentive schemes, potentially suffers from

a free rider problem among workers. The incentive to exert effort dissipates as the returns to that effort are distributed among all workers participating in the profit sharing scheme. Under certain circumstances, mutual monitoring and peer pressure may help mitigate the free rider problem (Carpenter et al. 2009, Freeman et al. 2010, Kandel and Lazear 1992). This solution particularly requires that the employer hires the right types of workers (Cornelissen et al. 2014). There appear to be two specific types of workers who may not have the appropriate personality traits to overcome the disincentives associated with profit sharing. On the one hand, profit sharing may attract talented free riders who are not responsive to social pressure. On the other hand, workers with too strong negative reciprocal inclinations may exert excessive peer pressure resulting in reduced cooperation and unproductive conflicts (Barron and Gjerde 1997). Thus, the employer has to invest in increased applicant screening in order select workers who are responsive to social pressure and are willing to exert peer pressure without having an excessively high degree of negative reciprocal inclination.

To summarize, the relationship between profit sharing and applicant screening is ambiguous from a theoretical point of view. On the one hand, profit sharing provides a comprehensive reward for the skills needed for production. This may induce a positive self-sorting of workers whose skills and abilities match the various job requirements. If this effects dominates, there will be a substitutive relationship between profit sharing and applicant screening even in a multitask setting. On the other hand, profit sharing entails a potential free rider problem that can only be mitigated if the employer invests in applicant screening in order to hire workers with the appropriate team skills. If that effect dominates, we will observe a complementary relationship between profit sharing and applicant screening.

5. Data and Variables

5.1 Data Set

The data used in our empirical analysis are based on an additional survey of a subsample of establishments participating in the IAB Establishment Panel. The IAB Establishment Panel is a representative sample of establishments from all sectors in the German economy (Fischer et al. 2009). Infratest Sozialforschung, a professional survey and opinion research institute, conducts the interviews on behalf of the Institute for Employment Research (IAB) which belongs to the Federal Employment Agency. The data are collected on the basis of a questionnaire and follow-up personal interviews with the owner or top manager of the establishment. Each year since 1993 (1996), the IAB Establishment Panel has surveyed establishments in Western (Eastern) Germany.

The additional survey was conducted in the 2012 wave (Kampkoetter et al. 2016). This add-on survey, the Linked Personnel Panel (LPP), consists of a questionnaire for the employer and a questionnaire for the employees. The employer questionnaire, answered by the owner or top managers of the establishment, has a specific focus on topics related to HRM including hiring and performance management. The employee questionnaire asks about job characteristics and the interviewee's socio-demographic background.

For our analysis, we use the employer survey of the LPP. The survey is representative of private sector establishments with 50 or more employees in manufacturing and service industries. The sample is stratified according to four establishment size classes (50-99, 100-249, 250-499, and 500 and more employees), five industries (metalworking and electronic industries, further manufacturing industries, retail and transport, services for firms, and information and communication services) and four regions (North, East, South, and West Germany). Note that we

include variables for the stratification characteristics in the estimations so that we do not use weighted regressions (Winship and Radbill 1994).

While the IAB Establishment Panel comprises interviews with 15,556 establishments, the LPP data are based on a subsample of 1,219 establishments. After eliminating observations for which full information is not available, the analysis on the screening of non-managerial applicants is based on data from 1,036 establishments. For the analysis on the screening of managerial applicants, information is available from 915 establishments.

5.2 Key Variables

The definitions of the variables and their descriptive statistics are provided in Table 1. Our dependent variable is the intensity of applicant screening, measured as the time usually taken for the screening of an applicant.[12] This information is provided for both managerial and non-managerial applicants. On average, the establishments in our sample spend 320 minutes of screening per managerial applicant and 166 minutes per non-managerial applicant.

The key explanatory variable is the average percentage share of individual-based performance pay in relation to the employees' base pay.[13] While studies on performance pay are often based on simple dummy variables, this variable provides a more nuanced measurement as it captures differences in the intensity of performance pay across establishments. Information on performance pay is also available for managerial and non-managerial employees. Considering all establishments, the mean is 3.7 percent for managerial employees and 3.2 percent for non-managerial employees. Considering only establishments with individual performance pay, the means are 8.6 and 9.1 percent. Note that 43 percent of the establishments use performance pay for managerial employees while 35 percent use performance pay for non-managerial employees.

Our theoretical considerations suggest that the relationship between performance pay and

applicant screening depends on the degree of multitasking. In order to capture increased multitasking in the empirical analysis, we use information on the establishment's business model. Interviewees had to choose one item from a list of possible strategies to characterize the establishment's primary business model. We define a dummy variable equal to 1 if the establishment's business model is primarily characterized by high quality, innovativeness or customer-specific solutions. The reference group consists of establishments with a price strategy or 'other' strategies.

The literature on multitasking has identified quality orientation, innovativeness and customer-specific production as involving an increased degree of multitasking. The allocation of effort and talent across the quantitative and qualitative dimension of performance is the classic example in the multitasking literature (Holmstrom and Milgrom 1991). If the market strategy has a focus on high quality, the employer must ensure that workers do not increase individual output at the expense of product quality. Innovativeness should entail increased multitasking as workers do not only have to perform their standard tasks but also have to engage in innovative activities (Hellmann and Thiele 2011, Morita 2005). Innovativeness requires that workers are flexible to switch form one task to another. Askildsen et al. (2006), Jirjahn and Kraft (2011) and Laursen and Foss (2003) confirm that innovativeness is associated with indicators of multitasking such as flexible production, further training, and the use of production teams with expanded involvement in decision making and increased responsibilities. These findings suggest that innovativeness involves multifaceted tasks not only for R&D employees, but also for a broader group of employees within the establishment. Similarly, a market strategy focusing on the varying and specific needs of customers entails that workers have to perform a wider spectra of tasks (Griffith and Neely 2009, Lindbeck and Snower 2000). This also involves greater interaction

with customers in order to build reputation and customer goodwill.

A potential limitation of our establishment-level indicator of increased multitasking may be that it provides no information on multitasking for the various jobs within the establishment. This can make it more difficult to empirically identify the relationships predicted by our theoretical considerations. If, for example, not all jobs within innovative establishments are characterized by a high degree of multitasking, our estimates may fail to find a positive link between performance pay and applicant screening for these establishments. And vice versa, if some jobs within non-innovative establishments are characterized by a higher degree of multitasking, the estimates may fail to show a negative link between performance pay and screening for these establishments. Thus, if the empirical findings conform to the theoretical predictions despite these possible attenuation biases, our confidence in the estimates is even strengthened.

A related issue is whether the establishment's business model moderates the relationship between performance pay and screening only for non-managerial employees or also for managerial employees. On the one hand, managerial jobs may involve complex and multifaceted tasks regardless of the establishment's strategy. In that case, we would find that the link between managerial performance pay and screening is independent of the business model. On the other hand, even the complexity of managerial jobs may well depend on the business model so that the establishment's strategy should also play a moderating role in the link between managerial performance pay and applicant screening. Empirical evidence indicates that managers' tasks are indeed influenced by the business model. For example, Baldwin and Johnson (1995) show that the importance of management is greater for innovative than for non-innovative firms. Innovative firms place greater emphasis on managing human resources, financing, marketing,

and production economics. Specifically, collaborative networks play an important role in a firm's innovation activities (Nieto and Santamaria 2007). This requires increased social skills and networking abilities (Voudouris et al. 2015).

In order to provide a first impression of the patterns in our data, Table 2 provides simple correlations between individual performance pay and applicant screening. The correlations are based on bivariate estimations that regress the log of the time taken for applicant screening on the intensity of performance pay. For both managerial and non-managerial employees, the table shows the same pattern of results. If we consider all establishment (without distinguishing by the degree of multitasking), we obtain a positive correlation between the intensity of performance pay and the intensity of applicant screening. However, the combined sample of establishments hides a far richer pattern. Taking the degree of multitasking into account, we find a positive correlation for establishments with increased multitasking and a negative correlation for establishments without increased multitasking. Thus, the simple correlations provide first explorative evidence for the hypothesis that the relationship between performance pay and applicant screening depends on the nature of production. At issue is now, whether this finding also holds in a multivariate regression analysis that controls for further establishment characteristics.

5.3 Control Variables

In the regressions, we account for performance appraisals. Performance appraisals have multiple functions (Heywood et al. 2016). They may not only be used in allocating financial rewards, but also in providing feedback to workers, in making job assignment, and in determining training need. Thus performance appraisal use does not perfectly overlap with the use of performance pay. We include a dummy equal to 1 if the firm uses performance appraisals and recommends a

predetermined distribution of ratings that evaluators have to follow. Recommended distributions are adopted to ensure more differentiation among employees (Kampkoetter and Sliwka 2016). The variable for performance appraisals is available for both managerial and non-managerial employees. In the course of the empirical analysis, we will interact the performance appraisal variable with the variables for individual performance pay and multitasking. This enables us to examine if the moderating role of multitasking differs between firms with and without performance appraisal systems.

Furthermore, in order to contrast individual performance pay with collective performance pay, we include variables for the average percentage shares of group performance pay and profit sharing in relation to the employees' base pay. In the course of the analysis, we will not only examine interactions of the various payment schemes with the multitasking indicator, but also interactions of the payment schemes among each other. Some recent studies have addressed the question of whether or not multiple incentive schemes should be combined (Barnes et al. 2011, Jirjahn 2017, Pendleton 1997, 2006, Pendleton and Robinson 2015, Wageman 1995). We examine the interaction effect of combined incentive schemes on applicant screening.

We also take into account that the quality of matches between workers and jobs is more important to establishments with higher skill requirements (DeVaro 2005). Thus, these establishments should be characterized by a higher screening intensity. Several variables capture the skill requirements of an establishment. A dummy variable for a modern production technology is included. Moreover, the share of employees with completed apprenticeship training and the share of employees with university degree are controlled for.

Variables for industrial relations are also included in the regressions. Industrial relations in Germany are characterized by a dual structure of worker representation with both unions and

works councils (Huebler and Jirjahn 2003). Unions usually negotiate collective bargaining contracts on an industrial level. Employers are covered by those contracts if they are members of an employers' association. Works councils provide a highly developed mechanism for codetermination at the establishment level (Freeman and Lazear 1995). The incidence of a works council depends on the initiative of the establishment's workforce. Most importantly in our context, both collective bargaining coverage and works councils have been shown to encourage internal labor markets resulting in higher tenure with the employer (Gerlach and Stephan 2008, Heywood et al. 2010, Zwick 2011). Establishments should screen applicants more intensively if they foster long-term employment relationships. Thus, we expect a positive influence of works councils and collective bargaining coverage on applicant screening.

Furthermore, establishment size should play a role in applicant screening. Larger establishments are more able to implement internal labor markets. Moreover, they may be more likely to have a professional personnel management that can help adopt effective screening procedures. We also include a dummy equal to 1 if personnel management is embedded at the top management level. This variable indicates the importance the establishment places on personnel issues. General establishment characteristics are controlled for by variables for the share of female employees, foreign owners, owner-managers and the legal form of the establishment. Finally, we include four industry dummies and three region dummies.

6. Estimation Results

6.1 Screening of Non-Managerial Applicants

Table 3 shows the results on the determinants of the screening intensity for non-managerial applicants. The dependent variable is the logarithm of the time usually taken for the screening of a non-managerial applicant. Regression (1) does not account for the interaction of non-

managerial performance pay and multitasking while regressions (2) and (3) include an interaction term.

Several of the control variables emerge with significant coefficients. The share of university graduates is positively associated with screening intensity. This conforms to the hypothesis that employers with higher skill requirements screen applicants more intensively. The works council variable takes also a significantly positive coefficient. Works councils foster long-term employment relationships and internal labor markets leading to a more careful screening of applicants for entry-level positions. Furthermore, profit sharing and the use of performance appraisals are positively associated with the intensity of applicant screening.

Turning to the explanatory variable of primary interest, non-managerial performance pay takes a significantly positive coefficient in regression (1). This would suggest that performance pay and screening intensity are complements. However, as shown by regression (2), the relationship between performance pay and the intensity of screening crucially depends on the extent of multitasking. When including the interaction variable of performance pay and multitasking, performance pay takes a significantly negative coefficient while the interaction term emerges with a significantly positive coefficient. Using regression (2), the estimated coefficients imply that the intensity of performance pay is a negative determinant of the intensity of applicant screening if there is no increased multitasking ($-0.021 + 0.027 \times 0 = -0.021$). By contrast, the intensity of performance pay is positively associated with the intensity of applicant screening if production is characterized by increased multitasking ($-0.021 + 0.027 \times 1 = 0.006$). As a check of robustness, we do not control for industry and region in regression (3). This check confirms the basic pattern of results.

For a quantitative assessment of the results, let us consider an 8 percentage point increase

in the share of individual performance pay. This is roughly an increase by one standard deviation. The one standard deviation increase in the share of performance pay implies a decrease in the intensity of applicant screening by 17 percent in a firm without increased multitasking (-0.021 x 8 = -0.168). It implies an increase by 5 percent in a firm with increased multitasking (0.006 x 8 = 0.048).

Thus, our estimates confirm that the relationship between performance pay and screening of non-managerial applicants is moderated by the nature of production. If production is characterized by a low degree of multitasking, performance pay and applicant screening are substitutes. An employer tying pay tightly to individual performance does not need extensive applicant screening. Performance pay attracts workers who have high abilities in the rather simple tasks. However, if production is characterized by a higher degree of multitasking, performance pay and applicant screening are complements. The self-sorting process induced by performance pay does not necessarily guarantee a high quality of matches between workers and jobs. In a multitask setting, performance measures are often not available for all of the relevant tasks so that performance pay may attract workers who are only strong in the measured performance dimensions, but are weak in the non-measured dimensions. Hence, employers tying performance tightly to individual performance in a multitask setting screen applicants more extensively to mitigate such problems. While performance pay induces a self-sorting of high-ability workers along the measured dimensions of performance, a high intensity of applicant screening ensures productive abilities in the non-measured dimensions.[14] Hence, combining performance pay with applicant screening can help find the right employees for jobs characterized by increased multitasking.

6.2 Screening of Managerial Applicants

Table 4 presents results on the determinants of the screening intensity for managerial employees. Screening intensity is measured by the logarithm of the time usually taken for the screening of a managerial applicant. The key explanatory variable is now the intensity of managerial performance pay.

In contrast to the estimates for non-managerial employees, profit sharing, the use of performance appraisals and the share of university graduates do not emerge with significant coefficients. However, the incidence of a works council plays also a significant role in the screening intensity for managerial employees. Moreover, establishment size and collective bargaining coverage now take significantly positive coefficients.

Turning to our variable of primary interest, the coefficient on individual-based performance pay is insignificant in the initial regression (1) that does not account for the interaction with multitasking. However, taking the interaction into account, the estimations for managerial employees repeat the crucial pattern of results found for non-managerial employees. In regression (2), performance pay emerges with a significantly negative coefficient while the interaction term takes a significantly positive coefficient. The negative coefficient of the performance pay variable is dominated by the positive coefficient of the interaction term. Thus, the intensity of performance pay is associated with a reduced intensity of applicant screening only if there is no increased multitasking (-0.025 + 0.032 x 0 = -0.025). It is associated with a greater intensity of applicant screening if production is characterized by increased multitasking (-0.025 + 0.032 x 1 = 0.007). Hence, also the estimates for managerial employees confirm that the relationship between performance pay and applicant screening crucially depends on the nature of production. As shown by regression (3), the pattern of results also holds when region and

industry are not controlled for.

For a quantitative assessment, we again consider an 8 percentage point increase in the share of performance pay. Using estimation (2), the increase in the share of performance pay is associated with a decrease in intensity of screening managerial applicants by 20 percent if there is no increased multitasking (-0.025 x 8 = -0.200). It implies an increase in the screening intensity by 6 percent if there is increased multitasking (0.007 x 8 = 0.056). All in all, the pattern of key results is very similar for the screening of managerial and non-managerial applicants with the effects being somewhat stronger for the managerial applicants.

6.3 Separate Estimates

As a check of robustness, we also ran separate estimates for establishments with and without increased multitasking. Table 5 provides the results on our key explanatory variables. The results on the control variables are suppressed to save space. Our separate estimates confirm the basic pattern of results. They show a significantly positive association between performance pay and applicant screening for establishments with increased multitasking and a significantly negative association for establishments without increased multitasking. This holds for both managerial and non-managerial employees.

6.4 Interactions with Collective Incentive Schemes

In a further step, we return to the combined sample of establishments and additionally consider interactions of multitasking with profit sharing and group-based performance pay in order to examine if a similar pattern of results can also be found for collective incentive schemes. Moreover, we account for various combinations of incentive schemes to analyse if collective incentive schemes complement individual-based performance pay especially in a multitask

environment.

Table 6 provides the results on the key variables. While the estimates confirm the basic pattern of results for individual-based performance pay, virtually all of the coefficients on the other interaction variables are insignificant. As discussed, collective incentive schemes involve two opposing effects on the need for applicant screening. On the one hand, these schemes reduce the need for intensive applicant screening, as they provide a more comprehensive reward for the worker characteristics that are relevant to firm's production. On the other hand, collective incentive schemes can entail an increased need for applicant screening, as firms must invest in finding workers with appropriate team skills in order to mitigate the free rider problem. The results indicate that the two opposing effects largely offset each other. The estimates provide only some evidence that, in a multitask environment, a combination of group-based performance pay and profit sharing reduces the intensity of applicant screening for managers.

Altogether, the key results on individual-based performance pay are confirmed when additionally taking interactions with collective schemes into account. Moreover, we find no evidence that collective incentive schemes moderate the relationship between individual-based performance pay and applicant screening.

6.5 Interactions with Performance Appraisals

Next we examine if the relationship between individual-based performance pay and applicant screening depends on how individual worker performance is measured. We include additional interactions with the performance appraisal dummy. As discussed, performance appraisals provide a more comprehensive measurement of worker performance. This may reduce the need for intensive applicant screening. However, performance appraisal systems can generate their own problems if they attract workers who are talented in manipulating the process of appraisal to

their advantage. This increases the need for an intensive applicant screening in order to mitigate the problem of adverse self-sorting. Thus, performance appraisals can influence the relationship between performance pay and applicant screening in opposite ways.

Table 7 shows the results on the key variables. The positive coefficient on the performance appraisal dummy is now also significant in the regression for managerial employees. However, the additional interaction effects do not emerge with significant coefficients in that regression. Most importantly, the regression confirms our key results. The association between individual-based performance pay and screening intensity is negative in establishments without increased multitasking and positive in establishments with increased multitasking.

In the regression for non-managerial employees, the additional interaction variables take significant coefficients. Thus, the relationship between performance pay and the screening of non-managerial employees is influenced by the employer's use of performance appraisals. In a setting without increased multitasking, the negative link between performance pay and screening is stronger for establishments using performance appraisals (-0.019 + 0.027 x 0 - 0.383 x 1 + 0.376 x 1 x 0 = -0.402) than for establishments not using performance appraisals (-0.019 + 0.027 x 0 - 0.383 x 0 + 0.376 x 0 x 0 = -0.019). In a setting with increased multitasking, the positive link between performance pay and screening is less strong for establishments with a performance appraisal system (-0.019 + 0.027 x 1 - 0.383 x 1 + 0.376 x 1 x 1 = 0.006) than for establishments without such a system (-0.019 + 0.027 x 1 - 0.383 x 0 + 0.376 x 0 x 1 = 0.008). These findings suggest that a comprehensive measurement of worker performance reduce the need for intensive screening of applicants. However, we note that the base effect of performance appraisal use on screening intensity is positive in both the setting without increased multitasking (0.820 – 0.590 x

0 = 0.820) and the setting with increased multitasking (0.820 – 0.590 x 1 = 0.230). This indicates that establishments using performance appraisals undertake some base investment in applicant screening in order to mitigate the adverse self-selection of workers who have a high talent for unproductive influence activities.

To summarize, our key results are confirmed even when taking potential interactions with the employer's use of performance appraisals into account. There is a negative association between individual-based performance pay and screening intensity in establishments without increased multitasking and a positive one in establishments with increased multitasking. For managerial employees, the estimates provide no evidence that the use of performance appraisals plays a moderating role. For non-managerial employees, the estimates suggest that performance appraisals influence the strength of the association, but without reversing its sign.

6.6 Robustness Checks

Finally, we present a series of robustness checks that increase confidence in the basic pattern of results. The results of the robustness checks can be found in the Appendix.

So far we have used the log of applicant screening as the dependent variable. In Appendix Table A.1 we show the results of regressions using the level as the dependent variable. Increased multitasking now emerges with a significantly positive coefficient. However, most importantly, the regressions confirm a negative relationship between performance pay and applicant screening for establishments without increased multitasking and a positive relationship for establishments with increased multitasking.

Furthermore, we check if our results indeed reflect the influence of the intensity of performance pay and not simply the influence of performance pay incidence. The estimations shown in Table A.2 additionally include a dummy variable for performance pay incidence and a

variable for the interaction of this dummy with the multitasking variable. While the two variables do not take significant coefficients, the role of performance pay intensity and its interaction with multitasking are confirmed. This suggests that the results are not simply driven by the incidence but rather by the intensity of performance pay.

Our dummy variable for multitasking captures three different business models. As a check of robustness, we divide this combined variable into three separate dummies with each dummy capturing one of the three business models. As shown in Table A.3, we find for each business model a significantly positive interaction with performance pay. This underscores that innovativeness, quality orientation and customer orientation, in a similar way, reflect increased multitasking.

One might wonder if the interaction between performance pay and multitasking masks an interaction with firm size or industry. Thus, we include additional interaction terms with firm size and industry. Table A.4 provides the results. Most of these interaction terms do not emerge with significant coefficients. Importantly, including the additional interaction terms does not change our basic pattern of results.

Finally, we run median regressions to address the possibility that our estimates might be influenced by outliers. Median regressions are more robust to outliers than OLS regressions. As shown in Table A.5, the median regressions also confirm our key results.

7. Conclusions

Classical self-sorting models of performance pay predict that employers tying pay to individual performance attract high-ability workers. This suggests that employers need no intensive applicant screening if they make substantial use of performance pay. Our study shows that such negative relationship between performance pay and applicant screening only holds for work

arrangements with a lower degree of multitasking. If production is, however, characterized by a higher degree of multitasking, we find a positive relationship. This finding fits the hypothesis that, in case of increased multitasking, performance pay can entail problems of an adverse self-selection of workers. Only by combining performance pay with applicant screening employers can ensure that they attract the right employees to the more complex jobs.

On a broader scale, our study contributes to the debate over the best practices in human resource management. Specifically, proponents of the high-performance paradigm have searched for a bundle of best practices that is of virtually universal benefit to employers (see Godard 2004 and Godard and Delaney 2000 for a critical assessment). Our findings support the view that a universal bundle of best practices does not exist. The relationship between performance pay and applicant screening crucially depends on the nature of production. If production is more complex, performance pay and applicant screening are complements. Yet, if production is less complex, they are substitutes.

We conclude this paper with suggestions for future research. Now that the relationship between performance pay and applicant screening has been studied, it would be interesting to examine their interaction effect on firm performance and the success of hiring decisions. Specifically, future research could fruitfully examine if the interaction effect also depends on the nature of production.

Table 1: Variable Definitions and Descriptive Statistics

Variable	Description	Mean	Std. Dev.
Time taken for the screening of a non-managerial applicant	Number of minutes taken on average for the screening of a non-managerial applicant.	166	163
Time taken for the screening of a managerial applicant	Number of minutes taken on average for the screening of a managerial applicant.	330	280
Individual-based performance pay for non-managerial employees	Average percentage share of individual performance pay for non-managerial employees in relation to their base pay.	3.176	8.247
Individual-based performance pay for non-managerial employees (dummy)	Dummy equals 1 if the firm uses individual-based performance pay for non-managerial employees.	0.349	0.477
Individual-based performance pay for managerial employees	Average percentage share of individual performance for managerial employees in relation to their base pay.	3.717	7.453
Individual-based performance pay for managerial employees (dummy)	Dummy equals 1 if the firm uses individual-based performance pay for non-managerial employees.	0.434	0.496
Increased multitasking	Dummy equals 1 if the establishment's business model aims at high quality, innovativeness, or customer-specific solutions.	0.936	0.244
High quality	Dummy equals 1 if the establishment's business model aims at high quality.	0.434	0.496
Innovativeness	Dummy equals 1 if the establishment's business model aims at innovations.	0.143	0.350
Customer-specific solutions	Dummy equals 1 if the establishment's business model aims at customer-specific solutions.	0.359	0.480
Group-based performance pay for non-managerial employees	Average percentage share of group-based performance pay for non-managerial employees in relation to their base pay.	1.112	3.622
Group-based performance pay for managerial employees	Average percentage share of group-based performance pay for managerial employees in relation to their base pay.	1.955	5.279
Profit sharing for non-managerial employees	Average percentage share of profit sharing pay for non-managerial employees in relation to their base pay.	1.547	4.293
Profit sharing for managerial employees	Average percentage share of individual performance for managerial employees in relation to their base pay.	5.330	9.619
Performance appraisals for non-managerial employees	Dummy equals 1 if the firm uses performance appraisals for non-managerial employees and recommends a predetermined distribution of ratings.	0.069	0.254
Performance appraisals for managerial employees	Dummy equals 1 if the firm uses performance appraisals for managerial employees and recommends a predetermined distribution of ratings.	0.031	0.172
Number of employees	Number of employees in the establishment.	394	1,792
Personnel management	Dummy equals 1 if personnel management is embedded at the top management level.	0.446	0.497
Owner manager	Dummy equals 1 if the establishment is managed by its	0.289	0.453

	owner.		
Limited company	Dummy equals 1 if the establishment is a private limited company.	0.909	0.287
Foreign owner	Dummy equals 1 if the establishment has a dominant foreign owner.	0.172	0.377
Collective bargaining	Dummy equals 1 if the firm is covered by a collective bargaining agreement.	0.611	0.488
Works council	Dummy equals 1 if the establishment has a works council.	0.643	0.479
Modern technology	Dummy equals 1 if the establishment has a modern or very modern production technology.	0.716	0.451
Proportion of women	The share of the establishment's workforce that is female.	0.317	0.240
Proportion of university graduates	The share of the workforce with university degrees.	0.106	0.148
Proportion of skilled employees	The share of the workforce with completed apprenticeship training.	0.638	0.248
Industry dummies	Four dummies for metalworking and electronic industries, other manufacturing industries, retail and transport, and information and communication services are included. The reference group is services for firms.	---	---
Region dummies	Three dummies for North, East and West Germany are included. The reference group consists of establishments located in South Germany.	---	---

N = 1,036. For the time taken for the screening of managerial employees and managerial performance pay, the number of observations is equal to 915.

Table 2: Bivariate regressions

	All establishments	Establishments with increased multitasking	Establishments without increased multitasking
Individual-based performance pay for non-managerial employees correlated with the logarithm of the time taken for the screening of a non-managerial applicant	0.007 (2.94)***	0.009 (3.62)***	-0.021 (3.38)***
N	1,036	970	66
R squared	0.006	0.008	0.004
Individual-based performance pay for managerial employees correlated with the logarithm of the time taken for the screening of a managerial applicant	0.008 (2.51)**	0.010 (3.50)***	-0.022 (3.45)***
N	915	858	57
R squared	0.005	0.009	0.008

The table shows the coefficients of bivariate estimations that regress the log of screening intensity on the intensity of individual-based performance pay. Method: OLS. *t*-statistics are in parentheses. *** Statistically significant at the 1% level; ** at the 5% level.

Table 3: Determinants of the Time Taken for the Screening of a Non-Managerial Applicant

	(1)	(2)	(3)
Increased multitasking	0.138 (1.42)	0.070 (0.69)	0.092 (0.91)
Individual-based performance pay for non-managerial employees	0.005 (1.91)*	-0.021 (3.13)***	-0.020 (3.28)***
Individual-based performance pay for non-managerial employees x increased multitasking	----	0.027 (3.84)***	0.026 (3.92)***
Group-based performance pay for non-managerial employees	0.009 (1.49)	0.009 (1.39)	0.007 (1.08)
Profit sharing for non-managerial employees	0.010 (1.90)*	0.011 (1.98)**	0.010 (1.92)*
Performance appraisals for non-managerial employees	0.222 (2.29)**	0.217 (2.24)**	0.229 (2.41)**
Number of employees / 1,000	0.018 (1.46)	0.018 (1.45)	0.018 (1.51)
Personnel management	-0.043 (0.83)	-0.041 (0.78)	-0.040 (0.78)
Owner manager	-0.108 (1.63)	-0.110 (1.65)	-0.113 (1.71)*
Limited company	0.012 (0.13)	0.015 (0.16)	0.031 (0.35)
Foreign owner	0.036 (0.56)	0.034 (0.53)	0.036 (0.57)
Collective bargaining	0.062 (1.01)	0.065 (0.53)	0.043 (0.74)
Works council	0.150 (2.30)**	0.145 (2.24)**	0.185 (2.97)***
Modern technology	0.063 (1.12)	0.062 (1.11)	0.058 (1.04)
Proportion of women	0.048 (0.35)	0.049 (0.36)	0.052 (0.43)
Proportion of university graduates	0.387 (2.13)**	0.381 (2.10)**	0.354 (1.97)**
Proportion of skilled workers	0.026 (0.21)	0.028 (0.23)	0.009 (0.08)
Constant	4.545 (22.70)***	4.461 (20.34)***	4.385 (23.65)***
Industry and region dummies	Included	Included	Not included
N	1,036	1,036	1,036
R squared	0.080	0.083	0.070

Dependent variable: Log of number of minutes taken on average for the screening of a non-managerial applicant. Method: OLS. The table shows the estimated coefficients. *t*-statistics in parentheses are based on robust standard errors. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Table 4: Determinants of the Time Taken for the Screening of a Managerial Applicant

	(1)	(2)	(3)
Increased multitasking	0.195 (1.97)**	0.069 (0.68)	0.085 (0.87)
Individual-based performance pay for managerial employees	0.004 (1.40)	-0.025 (4.08)***	-0.025 (4.42)***
Individual-based performance pay for managerial employees x increased multitasking	----	0.032 (4.70)***	0.031 (4.88)***
Group-based performance pay for managerial employees	0.006 (1.41)	0.005 (1.26)	0.004 (1.04)
Profit sharing for managerial employees	0.005 (1.57)	0.005 (1.58)	0.004 (1.50)
Performance appraisals for managerial employees	0.252 (1.56)	0.252 (1.57)	0.278 (1.72)*
Number of employees / 1,000	0.022 (2.17)**	0.022 (2.19)**	0.0227 (2.39)**
Personnel management	0.018 (0.32)	0.026 (0.48)	0.021 (0.39)
Owner manager	-0.093 (1.40)	-0.095 (1.43)	-0.096 (1.43)
Limited company	0.030 (0.31)	0.022 (0.23)	0.022 (0.23)
Foreign owner	0.010 (0.15)	0.010 (0.14)	0.006 (0.09)
Collective bargaining	0.113 (1.85)*	0.114 (1.87)*	0.109 (1.85)**
Works council	0.126 (1.84)*	0.123 (1.81)*	0.151 (2.30)**
Modern technology	0.011 (0.19)	0.011 (0.19)	0.003 (0.05)
Proportion of women	0.077 (0.50)	0.057 (0.37)	-0.021 (0.16)
Proportion of university graduates	0.070 (0.39)	0.069 (0.38)	0.059 (0.33)
Proportion of skilled workers	-0.047 (0.35)	-0.040 (0.30)	-0.085 (0.66)
Constant	5.281 (25.26)***	5.407 (25.75)***	5.232 (26.12)***
Industry and region dummies	Included	Included	Not included
N	915	915	915
R squared	0.066	0.072	0.059

Dependent variable: Log of number of minutes taken on average for the screening of a managerial applicant. Method: OLS. The table shows the estimated coefficients. *t*-statistics in parentheses are based on robust standard errors. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Table 5: Separate Estimates

	Dependent variable: Log of number of minutes taken on average for the screening of non-managerial applicants		Dependent variable: Log of number of minutes taken on average for the screening of managerial applicants	
	Establishments with increased multitasking	Establishments without increased multitasking	Establishments with increased multitasking	Establishments without increased multitasking
	(1)	(2)	(3)	(4)
Individual-based performance pay	0.007 (2.61)**	-0.028 (2.36)**	0.007 (2.32)***	-0.017 (1.78)*
N	970	66	858	57
R squared	0.076	0.311	0.069	0.389

In regressions (1) and (2), the variable for individual-based performance pay refers to non-managerial employees. In regressions (3) and (4), the variable for individual-based performance pay refers to managerial employees. Method: OLS. The table shows the estimated coefficients. *t*-statistics in parentheses are based on robust standard errors. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level. Note that all of the other control variables are included but are suppressed to save space.

Table 6: Interactions with Group-Based Performance Pay and Profit Sharing

	Dependent variable: Log of number of minutes taken on average for the screening of non-managerial applicants	Dependent variable: Log of number of minutes taken on average for the screening of managerial applicants
	(1)	(2)
Increased multitasking	0.021 (0.17)	0.075 (0.60)
Individual-based performance pay	-0.022 (3.92)***	-0.027 (3.25)***
Individual performance pay x increased multitasking	0.029 (4.81)***	0.036 (3.94)***
Group-based performance pay	-0.002 (0.03)	0.033 (0.97)
Group-based performance pay x increased multitasking	0.016 (0.24)	-0.029 (0.83)
Profit sharing	-0.066 (0.92)	-0.024 (1.14)
Profit sharing x increased multitasking	0.079 (1.10)	0.032 (1.51)
Individual-based performance pay x group-based performance pay	-0.011 (0.73)	0.004 (0.32)
Individual-based performance pay x group-based performance pay x increased multitasking	0.011 (0.71)	0.003 (0.30)
Individual-based performance pay x profit sharing	0.006 (1.33)	0.001 (1.03)
Individual-based performance pay x profit sharing x increased multitasking	-0.006 (1.36)	-0.001 (1.28)
Group-based performance pay x profit sharing	0.038 (0.91)	0.018 (1.64)
Group-based performance pay x profit sharing x increased multitasking	-0.038 (0.92)	-0.018 (1.68)*
Individual-based performance pay x group-based performance pay x profit sharing	-0.0001 (0.18)	-0.0001 (0.75)
Observations	1036	915
R squared	0.085	0.079

In regression (1), the variables for individual-based performance pay, group-based performance pay and profit sharing refer to non-managerial employees. In regression (2), these variables refer to managerial employees. Method: OLS. The table shows the estimated coefficients. *t*-statistics in parentheses are based on robust standard errors. *** Statistically significant at the 1% level; * at the 10% level. Note that all of the other control variables are included but are suppressed to save space.

Table 7: Interactions with Performance Appraisals

	Dependent variable: Log of number of minutes taken on average for the screening of non-managerial applicants	Dependent variable: Log of number of minutes taken on average for the screening of managerial applicants
	(1)	(2)
Increased multitasking	0.092 (0.88)	0.069 (0.66)
Individual-based performance pay	-0.019 (2.85)***	-0.025 (4.00)***
Individual-based performance pay x increased multitasking	0.027 (3.72)***	0.031 (4.56)***
Performance appraisals	0.820 (4.97)***	0.305 (2.32)**
Performance appraisals x increased multitasking	-0.590 (3.06)***	0.222 (0.84)
Individual performance pay x performance appraisals	-0.383 (2.86)***	-0.016 (0.85)
Individual-based performance pay x performance appraisals x increased multitasking	0.376 (2.81)***	0.054 (1.42)
Observations	1,036	915
R squared	0.085	0.074

In regression (1), the variables for individual-based performance pay and performance appraisals refer to non-managerial employees. In regression (2), these variables refer to managerial employees. Method: OLS. The table shows the estimated coefficients. *t*-statistics in parentheses are based on robust standard errors. *** Statistically significant at the 1% level; ** at the 5% level. Note that all of the other control variables are included but are suppressed to save space.

Appendix

Table A.1: Estimates with the Level of Screening Intensity

	Dependent variable: Number of minutes taken on average for the screening of non-managerial applicants	Dependent variable: Number of minutes taken on average for the screening of managerial applicants
	(1)	(2)
Increased multitasking	28.56 (1.90)*	68.32 (2.52)**
Individual-based performance pay	-2.596 (3.29)***	-4.38 (2.69) ***
Individual-based performance pay x increased multitasking	3.154 (3.47)***	5.45 (2.90) ***
Observations	1,036	915
R squared	0.046	0.053

In regression (1), the variable for individual-based performance pay refers to non-managerial employees. In regression (2), the variable refers to managerial employees. Method: OLS. The table shows the estimated coefficients. *t*-statistics in parentheses are based on robust standard errors. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level. Note that all of the other control variables are included but are suppressed to save space.

Table A.2: Performance Pay Intensity vs. Performance Pay Incidence

	Dependent variable: Log of number of minutes taken on average for the screening of non-managerial applicants	Dependent variable: Log of number of minutes taken on average for the screening of managerial applicants
	(1)	(2)
Increased multitasking	0.063 (0.54)	0.062 (0.53)
Individual-based performance pay	-0.023 (4.10)***	-0.027 (4.38)***
Individual-based performance pay x increased multitasking	0.027 (4.23)***	0.030 (4.37)***
Individual-based performance pay (dummy)	0.080 (0.41)	0.063 (0.28)
Individual-based performance pay (dummy) x increased multitasking	0.026 (0.13)	0.029 (0.12)
Observations	1,036	915
R squared	0.086	0.074

In regression (1), the variables for individual-based performance pay refer to non-managerial employees. In regression (2), the variables refer to managerial employees. Method: OLS. The table shows the estimated coefficients. *t*-statistics in parentheses are based on robust standard errors. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level. Note that all of the other control variables are included but are suppressed to save space.

Table A.3: The Business Models in Detail

	Dependent variable: Log of number of minutes taken on average for the screening of non-managerial applicants	Dependent variable: Log of number of minutes taken on average for the screening of managerial applicants
	(1)	(2)
High quality	0.035 (0.32)	0.011 (0.11)
Customer-specific solutions	0.097 (0.92)	0.149 (1.35)
Innovativeness	0.108 (0.90)	0.018 (0.14)
Individual-based performance pay	-0.021 (3.12)***	-0.025 (4.05)***
Individual-based performance pay x high quality	0.029 (3.99)***	0.035 (4.85) ***
Individual-based performance pay x customer-specific solutions	0.023 (2.64)***	0.022 (2.84)***
Individual-based performance pay x innovativeness	0.025 (2.95)***	0.047 (3.88)***
Observations	1,036	915
R squared	0.085	0.079

In regression (1), the variable for individual-based performance pay refers to non-managerial employees. In regression (2), the variable refers to managerial employees. Method: OLS. The table shows the estimated coefficients. *t*-statistics in parentheses are based on robust standard errors. *** Statistically significant at the 1% level. Note that all of the other control variables are included but are suppressed to save space.

Table A.4: Interactions with Firm Size and Industry

	Dependent variable: Log of number of minutes taken on average for the screening of non-managerial applicants	Dependent variable: Log of number of minutes taken on average for the screening of managerial applicants
	Interaction with firm size	
	(1)	(2)
Increased multitasking	0.068 (0.68)	0.071 (0.70)
Individual-based performance pay	-0.020 (3.07)***	-0.025 (4.16)***
Individual-based performance pay x increased multitasking	0.027 (3.89)***	0.031 (4.58)***
Firm size/ 1000	0.037 (1.40)	0.019 (2.40)**
Individual-based performance pay x firm size/ 1000	0.00025 (0.88)	0.00029 (1.84)*
Observations	1,036	915
R squared	0.084	0.073
	Interactions with industries	
	(3)	(4)
Increased multitasking	0.067 (0.67)	0.066 (0.64)
Individual-based performance pay	-0.019 (1.95)*	-0.024 (4.07)***
Individual-based performance pay x increased multitasking	0.030 (3.81)***	0.033 (4.05)***
Metal and electronic industry	0.191 (2.18)**	0.130 (1.26)
Individual-based performance pay x metal and electronic industry	-0.013 (1.08)	-0.010 (1.08)
Other manufacturers	0.193 (2.05)**	0.134 (1.20)
Individual-based performance pay x other manufacturers	-0.126 (1.54)	-0.006 (0.67)
Retail and transport	0.118 (1.17)	-0.060 (0.52)
Individual-based performance pay x retail and transport	-0.003 (0.55)	0.004 (0.50)
Information and communication services	0.233 (1.68)*	-0.025 (0.16)
Individual-based performance pay x information and communication services	0.001 (0.05)	0.011 (0.91)
Observations	1,036	915
R squared	0.086	0.076

In regressions (1) and (3), the variable for individual-based performance pay refers to non-managerial employees. In regressions (2) and (4), the variable refers to managerial employees. Method: OLS. The table shows the estimated coefficients. *t*-statistics in parentheses are based on robust standard errors. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level. Note that all of the other control variables are included but are suppressed to save space.

Table A.5: Median Regressions

	Dependent variable: Log of number of minutes taken on average for the screening of non-managerial applicants	Dependent variable: Log of number of minutes taken on average for the screening of managerial applicants
	(1)	(2)
Increased multitasking	-0.044 (0.31)	0.004 (0.03)
Individual-based performance pay	-0.029 (2.71)**	-0.027 (4.20)***
Individual-based performance pay x increased multitasking	0.036 (3.32)***	0.032 (3.94)***
Observations	1,036	915
R squared	0.042	0.046

In regression (1), the variable for individual-based performance pay refers to non-managerial employees. In regression (2), the variable refers to managerial employees. Method: LAD. The table shows the estimated coefficients. *t*-statistics in parentheses are based on robust standard errors. *** Statistically significant at the 1% level; ** at the 5% level. Note that all of the other control variables are included but are suppressed to save space.

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Endnotes

[1] In what follows we use the term 'ability' in a very broad sense. It refers to all worker characteristics that are relevant for a worker's productivity. Depending on the respective job, ability can involve professional qualification, cognitive and non-cognitive skills, manual skills, or physical and mental fitness.

[2] The other half was attributable to higher effort.

[3] Of course in reality even simple task may involve some degree of multitasking. Thus, the assumption of a single-dimensional task can be seen as a theoretical simplification. It is a metaphor for a low degree of multitasking. In the extension of our model, we contrast the single-dimensional task with a two-dimensional task. The two-dimensional task can be seen as a metaphor for a high degree of multitasking.

[4] MacDonald and Marx (2001) even take a step further. Even if the principal were able to observe and reward every relevant performance dimension, she could not set accurate performance pay without information about the effort cost of each task to the workers. If the principal has no complete information about the workers' preferences over tasks, she cannot provide stronger incentives for tasks workers find more costly. This results in an adverse specialization of workers in tasks that are less costly to them.

[5] While models on multitasking usually examine moral hazard, some recent theoretical advances consider multitasking also within models of adverse selection. Benabou and Tirole (2016) and Moen and Rosen (2005) present models showing that performance pay attracts high-ability workers only in the measurable performance dimension and distorts the allocation of effort across tasks. Increased competition for high-ability workers leads firm to rely heavily on performance pay and results in an increased distortion of the allocation of effort. In a model by Kosfeld and von Siemens (2011), workers can exert individual effort and cooperative effort. Workers differ in their cooperativeness with cooperation being non-verifiable. The model implies a separating equilibrium in which less cooperative workers sort themselves in firms with performance pay and cooperative workers sort themselves in firms with low-powered incentives.

[6] Of course, this only means a reduced screening intensity and does not necessarily imply that the need for screening is completely eliminated. In our theoretical model we assume just for the sake of simplicity that the employer's screening decision is a dichotomous yes-or-no decision.

[7] If agents were not protected by limited liability, the principal may not only specify a variable payment, but also a negative fixed wage component. The limited liability constraint does not allow such negative fixed wage component.

[8] In our model, the agent's rent cannot be reduced, as he or she is protected by limited liability. If the agent were not protected by limited liability, the principal could specify a performance payment $W = \alpha^* Q + \beta$ with a negative fixed component $\beta = -(EU^* - \overline{U})$. That payment scheme would yield an expected utility equal to the reservation utility: $EU = \rho(1, \overline{\theta})\alpha^* q + \beta - c = \overline{U}$. This would imply a negative wage in case of a failure of the project: $W = -(EU^* - \overline{U})$ if $q = 0$. Such negative wage is not feasible with the limited liability constraint $W \geq 0$.

[9] $\alpha^{**} < \alpha^* \Leftrightarrow \overline{U}/\rho(0, \overline{\theta}) < c/(\rho(1, \bar{\theta}) - \rho(0, \bar{\theta})) \Leftrightarrow \overline{U} < EU^*$.

[10] This is similar the Holmstrom and Milgrom's (1991) model of multitasking and moral hazard. In that model the agent exerts voluntarily some minimum level of effort and follows the principal's instructions in allocating the effort across tasks.

[11] Of course, applicants may try to strategically fake their responses to personality tests by deliberately increasing their scores on desirable personality traits and decreasing their scores on undesirable traits. However, a series of psychological studies have shown that even though faking to some extent attenuates the accuracy of personality tests it does not completely neutralize the usefulness of the tests (Rothstein and Goffin 2006 or Tett and Christiansen 2007). There remains enough validity to be useful for predicting job performance. Moreover, the stylized setting of personality tests allows reducing the opportunities for faking. E.g., the forced-choice approach is a common method to limit faking. The effect of perceived desirability on response choices is reduced by presenting statements in pairs, triplets or quartets that assess different traits, but have been equated with respect to the level of perceived desirability. Applicants are instructed to choose the statement that best describes themselves. Because the desirability levels of the choices are equal, applicants are presumed to respond in a more honest and self-descriptive manner.

[12] The dependent variable is based on the question 'How many hours do you on average spend on job

interviews, tests and so on to screen a successful applicant? We mean the total time an applicant spends in the screening process.'

[13] The survey first asks employers if the establishment provides variable pay for its employees. For those employers answering in affirmative, there is a second and a third question. The second question asks about the average share of variable pay for managerial and non-managerial employees in relation to their base pay. The third question asks about the shares of individual-based performance pay, group-based performance pay and profit sharing in total variable pay for managerial and non-managerial employees. By multiplying the share of variable pay in relation to base pay with the share of individual-based pay in total variable pay, we obtain our key variables for managerial and non-managerial performance pay. The variables are set equal to zero if the establishment does not provide variable pay to its employees. Accordingly, we construct the control variables for group-based performance pay and profit sharing.

[14] While our explanation emphasizes the role of self-sorting processes, one might ask if there could also be a pure moral hazard explanation for the empirical result. If production is characterized by multitasking, the employer could combine performance pay and applicant screening to induce effort in the observable performance dimensions and to find intrinsically motivated workers who voluntarily provide effort in the unobservable dimensions. This alternative explanation would suggest a complementary relationship between performance pay and applicant screening even in the absence of workers' self-sorting. However, while we cannot completely rule out this alternative explanation, we view it as rather unlikely for two reasons. First, as shown by our theoretical model, moral hazard and adverse selection are intertwined. In our theoretical model, solving the moral hazard problem aggravates the adverse selection problem with respect to the unobservable performance dimension. Second, as shown by empirical studies, performance pay sets a substantial self-sorting process in motion (Bandiera et al. 2015, Curme and Stefanec 2007, Dohmen and Falk 2011, Geddes and Heywood 2003, Grund and Sliwka 2010, Heywood et al. 2016, Lazear 2000). Against this background, a pure moral hazard explanation does not appear to be convincing.