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## Asymmetric information in external versus internal promotions

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# Asymmetric information in external versus internal promotions

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## Abstract

Individuals have two possible channels through which to obtain a managerial position: external and internal promotions. Employing the revised German Employment Register, we compare external and internal promotions by using multinomial logit regressions while accounting for workplace heterogeneity. Individual characteristics are hypothesized to exert differential effects because of their observability within and across workplaces. We find that actual working hours are a more important source of information for internal versus external promotions. By contrast, formal vocational degrees and initial job task complexity, which are also externally observed, are a relatively more important signal for external promotions. Consistent with statistical discrimination, women and foreigners face a more pronounced disadvantage in external promotions. For women, this differential effect is fully driven by promotions to executive positions characterized by high task complexity. Moreover, actual working hours show a strong positive interaction effect on women's prospects of promotion.

## Zusammenfassung

Für Beschäftigte existieren zwei Kanäle um eine Führungsposition zu erreichen: die externe und die interne Beförderung. Anhand der neu aufgelegten deutschen Beschäftigtenstatistik vergleichen wir externe und interne Beförderungen mithilfe eines multinomialen Logit-Modells und unter Kontrolle für die Heterogenität zwischen Arbeitgebern. Wir nehmen an, dass die Charakteristika von Beschäftigten abhängig von ihrer Sichtbarkeit innerhalb von Betrieben und über Betriebe hinweg abweichende Einflüsse ausüben. Wir zeigen, dass die Realarbeitszeit für interne Beförderungen eine bedeutsamere Informationsquelle darstellt als für externe. Demgegenüber spielen formale Ausbildungsabschlüsse und die ursprüngliche Aufgabenkomplexität, welche beide auch über Betriebe hinweg sichtbar sind, eine größere Rolle bei externen Beförderungen. Übereinstimmend mit dem Konzept statistischer Diskriminierung unterliegen Frauen und Ausländer bei externen Beförderungen einem stärker ausgeprägten Nachteil. Bei Frauen ist dieses Ergebnis vollständig auf Beförderungen zu Managern bzw. leitenden Angestellten zurückzuführen, welche durch hohe Aufgabenkomplexität gekennzeichnet sind. Darüber hinaus zeigt die Realarbeitszeit einen starken positiven Interaktionseffekt auf die Beförderungsaussichten von Frauen.

**JEL classification:** J41, J70, M12, M51

**Keywords:** Promotions, asymmetric information, signaling, statistical discrimination

# 1 Introduction

Previous research has shown that promotions to managerial positions are important to both employers and employees. Considering establishments' viewpoint, Bertrand and Schoar (2003) find that managers have a large impact on firm performance. Furthermore, as employers provide the prospect for promotions, they induce an incentive for high levels of effort by potential candidates, which in turn raises firms' productivity (Lazear/Rosen 1981). From individuals' perspective, promotions to managerial positions are associated with increased wages (McCue 1996; Lima/Pereira 2003) and job satisfaction (Kosteas 2011).

Famous promotion theories explain how firms should execute promotion decisions. In tournament theory proposed by Lazear and Rosen (1981), employees compete for a promotion, and the most productive employee wins the tournament, which is a promotion to the next rank. The tournament induces an incentive to provide a high level of effort, which is desired by the employer. Tournament theory has been extended by allowing for the possibility of external promotions. While Chan (1996, 2006) proposes a handicap for external candidates to preserve the incentives for effort provision in the internal tournament, Chen (2003, 2005) argues that increased competition from the outside could foster the internals' incentives.

In the early work of Waldman (1984), employers seek the most efficient assignment of employees to job positions. Hence, as in tournament theory, the most productive employees are assigned to management positions. However, Waldman (1984) imposes a restriction that the true ability of employees is not revealed externally and that external employers base their hiring decisions on information revealed by employees' prior job position. Correspondingly, we assume that managerial positions are filled with the most promising candidates and allow for competition from the outside. But different types of information that is available about external candidates may influence promotion decisions. If relevant information is available only for internal candidates, we suggest that such signals are more important for promotions of internal candidates. By contrast, other sources of information, such as formal vocational degrees, are available for both internal and external candidates. As information on external candidates is scarce, we hypothesize that these surrogate productivity signals are relatively more important for the chances of external candidates.

Most of the empirical literature examines the effects of employee characteristics on promotions solely within firms. The findings show positive effects of contractual working time (Pfeifer 2010) and actual working hours (Bell/Freeman 2001) and negative effects from absenteeism (Pfeifer 2010) on internal promotions. Among the studies comparing internal and external promotions, Chan (2006) presents evidence that external hires are superior in quality because they have a higher probability of obtaining subsequent promotions. Similarly, Cassidy, DeVaro, and Kauhanen (2012) and Pfeifer (2011) find that externally promoted employees are more likely to have a university degree. These studies support the handicap hypothesis originally proposed by Chan (1996) that external candidates face a handicap when hired to managerial positions, but they also support the mechanism of an efficient assignment of employees to managerial positions, as suggested by Gibbons and Waldman (1999, 2006).

Looking at the firm level, Agrawal, Knoeber, and Tsoulouhas (2006) and DeVaro and Morita (2013) analyze whether the composition of internal candidates affects the likelihood that an internal candidate is chosen. Their findings suggest that a larger and more comparable pool of internal candidates enhances the probability of internal promotions. A differing approach is presented by Bayo-Moriones and Ortín-Ángel (2006), who use firm-level survey data to provide a comparison of internal versus external promotions. They find substantial firm-level heterogeneity regarding the choice between internal and external promotions and present weak evidence regarding large firms' tendency to prefer internal promotions.

We contribute to this literature by presenting evidence regarding the impact of individual-level characteristics on internal versus external promotions based on multinomial logit estimations. In this study, internal promotions are defined as promotions of incumbent employees, whereas external promotions refer to (non-manager) employees hired for a managerial position. Our analysis is the first to control for establishment-level heterogeneity at both the initial and the destination establishment. This allows us to determine the extent to which differences in promotion decisions and previous findings concerning differences in internal versus external promotions can be ascribed to individual characteristics, which we hypothesize to vary in their observability across employers.

We also enrich the literature with an assessment of females' and foreigners' chances of promotion within and across workplaces. Females are well documented to face lower average promotion probabilities than their male colleagues, which might be due to stereotypic views (Schein 1973), economic state dependencies (Bossler/Mosthaf/Schank 2015), or a lower readiness for competition (Niederle/Vesterlund 2007). However, their lower prospects for promotion might also result from statistical discrimination (Bjerk 2008). As we will find based on the data, both females and foreigners are less likely to be promoted than males, especially when they move across workplaces. This result may be due to statistical discrimination, as females and foreigners are very often perceived to have a lower average productivity and as their true productivity is unobserved across firms. However, females also face disadvantages in the labor market because of child bearing and employment disruptions (Kunze 2014; Schönberg/Ludsteck 2014). Using the same line of argumentation, we analyze whether females face a disadvantage in their career progression because of their lower actual working hours.

Finally, we contribute to the existing literature by using administratively collected data on promotions. While the existing literature primarily uses individual surveys (Anger 2005, 2008; Bell/Freeman 2001), plant-level surveys (Bayo-Moriones/Ortín-Ángel 2006), or personnel data from a single firm (Pfeifer 2010, 2011), we exploit information from the German Employment Register, which includes information on managerial positions since 2012. The employment register is a highly valid administrative data source, since the reports are mandatory for all employers in Germany. Furthermore, we are able to draw conclusions from a sample comprising the entire population of employer-reported promotions between April 2012 and December 2013, which strengthens the external validity of our results, as promotions to managerial positions depict a rare event.

## 2 Asymmetric information in internal versus external promotions

The well-established tournament theory by Lazear and Rosen (1981) proposes differential pay depending on relative productivity rather than absolute productivity. Thus, employees are paid according to their relative rank in the establishment, and a steep hierarchical ranking then creates an incentive for employees to invest in their productivity. The most productive candidate in the tournament for a higher rank position wins the prize, which is a promotion to a higher level position. The underlying idea of this theory is that employers should provide prospects for internal promotions and that the most productive candidate should be promoted to a vacant managerial position.

Chan (1996, 2006) proposes an extension to tournament theory by allowing for external promotions. He argues that the possibility of filling a vacant manager position from the outside decreases the likelihood of promotion for insiders. Consequently, insiders reduce their level of work effort. Hence, Chan (1996) proposes that employers impose a promotion handicap on external candidates, mitigating competition from the outside. By contrast, Chen (2003, 2005) argues that increasing competition from the outside can be desirable because it reduces the marginal returns of negative activities such as sabotage or collusion among insiders. By reducing these negative externalities in the internal tournament, competition from the outside can actually restore the internal incentives for effort provision without the need for a handicap.

Chan (1996) also states that the true productivity of internal candidates is observed with less noise than the productivity of external candidates. For a risk-averse employer, preference would be given to the less uncertain internal candidate. This conjecture is in line with the general theoretical consideration of Greenwald (1986), who argues that asymmetric information inhibits mobility across employers. We build on the theoretical consideration that asymmetric information about external and internal candidates is prevalent and test whether productivity signals and statistical discrimination are relevant for comparisons of internal and external promotions.

Another theoretical approach starts with the idea that firms aim for the most efficient assignment of employees to job positions (Waldman 1984). Based on this underlying assumption, employers should promote the most able and productive employee to a vacant managerial position. Hence, variables closely associated with productivity should explain future promotions. One example is employee attendance, which captures employees' willingness to provide effort and demonstrates workers' dedication. Employee attendance has been tested previously, operationalized by absenteeism, overtime work, unpaid overtime work, actual working hours, and contractual working hours (Anger 2005; Bell/Freeman 2001; Booth/Francesconi/Frank 2003; Bratti/Staffolani 2007; Flabbi/Ichino 2001; Francesconi 2001; Pfeifer 2010). Another example is provided by studies testing the relation between performance ratings and future promotions. Performance ratings should directly capture employer-perceived productivity ratings and hence correlate with future promotions (Dohmen 2004; Gibbs 1995; Medoff/Abraham 1981).

## **2.1 Hours, educational degrees and initial job assignment**

We assume that individual ability is the most relevant factor for promotions. However, as suggested by Waldman (1984), information about true ability is unevenly distributed across internal and external candidates. Waldman (1984) assumes that promotion decisions regarding external employees are based on the prior job assignment, while the ability of internal employees is fully revealed. By contrast, we believe that employers observe different signals for which we expect differential impacts on internal versus external promotions. First, we believe that actual working hours are an important signal as long working hours are perceived as a general requirement for managers and may also signal effort and dedication.

Based on historical data on munition workers during World War I, John Pencavel (2015) presents evidence that productivity decreases with increasing working hours. However, this decline in productivity does not start before weekly working hours exceed 49 and even after that, output continues to increase to a relatively high threshold at which additional working hours do not lead to a marginal increase in output. Additionally, Bell and Freeman (2001) provide evidence that extended working hours are associated with higher productivity. However, even if actual working hours are not directly linked to effort, they can still signal a willingness to work long hours, which may constitute a temporary strategic signal to seek promotion. Therefore, such strategic shirking may still lead to promotion (DeVaro/Gürtler 2015), even if it is inefficient.

While the actual working hours are observed for internal candidates, they cannot be observed for external candidates. In our analysis, only the part of actual working hours that represents a discretionary choice of the worker is relevant. In this way, by controlling for establishment heterogeneity, we try to purge our estimation results from the impact of employer-induced changes in actual working hours.

Second, we look at formal vocational degrees, which signal general human capital. Formal vocational degrees are outlined in every application; therefore, they can be observed by both internal and external employers. Since information is scarce for other potential employers, we believe that formal vocational degrees serve as a surrogate signal when employers evaluate external candidates.

As suggested by Waldman (1984), we also examine external employees' prior job assignment as an ability signal, which is also available to external employers. Using a measure of the task complexity of employees' prior job, we assess whether task complexity is a more important source of information for external than for internal promotion decisions.

## **2.2 Statistical discrimination in external promotions**

In line with asymmetrically distributed productivity information, we believe that female and foreign employees face a relatively greater disadvantage in external promotions. Statistical discrimination theory predicts that the productivity of individuals, if unknown, is evaluated at observable group averages (Altonji/Pierret 2001). For example due to different expectations concerning market participation (Mincer/Polachek 1974), employers may ascribe lower levels



of productivity to women and foreigners. This statistical discrimination should be relatively more pronounced in external promotions, for which productivity information is assumed to be less accessible.

Women could also face statistical discrimination because of their lower average working hours. As women are perceived to work fewer hours than men on average (Blundell/Bozio/Laroque 2011), they may face a disadvantage in promotion decisions. We therefore hypothesize that actual working hours are a stronger signal for women than for men, i.e., long actual working hours for women signal an emphasized career dedication, which in turn affects their prospects for promotion.

### 3 Empirical specification

To estimate the impact of different variables on the likelihood of internal and external promotions, we estimate a multinomial choice model. The latent propensity for destination in one of the  $J=4$  outcome states (remaining non-promoted at the same workplace, hired by another employer without promotion, promoted within the workplace, or promoted across employers) is specified as

$$y_{ij}^* = x_i' * \beta_j + \varepsilon_{ij} \quad (1),$$

where  $i=1, \dots, N$  and  $j=1, \dots, 4=J$ .  $x_i$  is a vector of explanatory variables, which vary across individuals and potentially correlate with the outcome categories reflected by the coefficient vector  $\beta_j$ .

To control for establishment heterogeneity, we add establishment-specific components for the initial establishment,  $\varphi_{k(i)j}$ , and for the destination establishment,  $\theta_{l(i)j}$ ,

$$y_{ij}^* = x_i * \beta_j + \varphi_{k(i)j} + \theta_{l(i)j} + \varepsilon_{ij} \quad (2)$$

where the initial establishment is assigned the subscript  $k=1, \dots, K < N$  and the destination establishment, the subscript  $l=1, \dots, L < N$ . The establishment-specific heterogeneity is a constant effect for all employees observed in the same establishment, which enables an interpretation of coefficients  $\beta_j$  within establishments. Thus, we interpret the effect of the individual characteristic among potential candidates within the initial establishment and the destination establishment.

We want to control for the heterogeneity of the initial establishment, where the respective individuals were in regular non-managerial positions, and of the destination establishment, which ultimately conducts the promotion decision. By construction, for employees without mobility in our observation period, the initial and destination establishments effectively depict the same establishment at different points in time. However, the model is identified as we observe mobility between establishments of both promoted and non-promoted individuals.

When capturing the heterogeneity of the initial establishment, i.e., by including  $\varphi_{k(i)j}$ , we control for initial sorting into workplaces. Initial sorting is important because some workplaces

offer decent prospects for promotions, while others are characterized by so-called dead-end jobs with only few career development prospects (Mosthaf/Schnabel/Stephani 2011). Since this initial sorting may correlate with individual characteristics of interest, we want to control for these differences. Furthermore, the initial workplace may exert a quality signal itself for which we want to control. For example, if the initial employer is highly productive or known for a productive work force, this likely induces a positive signal that affects external promotion prospects. Moreover, the hypothesized effects may correlate with firm-level decisions. For example, the actual hours worked may be codetermined by a firm's decision to run overtime hours. After we control for these sources of establishment heterogeneity, we can interpret the effects of interest as a comparison among employees at the same initial establishment.

Second, we additionally want to control for heterogeneity at the destination establishment by inserting  $\theta_{l(i)j}$ , as this variable captures differences between employers, which ultimately execute promotion decisions. Employers may have a preference for one of the two promotion channels, which has shown to be correlated with plant-level characteristics (Agrawal/Knoeber/Tsoulouhas 2006; Bayo-Moriones/Ortín-Ángel 2006). Moreover, the destination employer, who conducts the promotion decision, may be restricted to one of the channels because of an internal personnel policy or a public regulation. If such a firm-level restriction drives the choice for internal or external promotions, we want to control for it so that the individual variables of interest are the ultimate reason for promotions within or across workplaces. After we control for this second source of establishment-specific heterogeneity, our estimates provide a comparison not only among colleagues of the initial workplace but also among employees at the destination establishment.

Technically, controlling for establishment-level heterogeneity rules out the possibility that  $\beta_j$  captures effects that are due to a correlation between  $x_i$  and  $\varphi_{k(i)j}$  or between  $x_i$  and  $\theta_{k(i)j}$ . We follow the approach by Mundlak (1978) and Chamberlain (1984) and model the establishment-specific effects as linear functions of the establishment-level means of the individual covariates  $x_i$ :

$$\varphi_{k(i)j} = \bar{x}_k * \rho_j + \mu_{kj} \quad (3)$$

$$\theta_{l(i)j} = \bar{x}_l * \gamma_j + \mu_{lj} \quad (4)$$

where  $\mu_{kj}$  is assumed to be uncorrelated with  $\bar{x}_k$  and  $\varepsilon_{ij}$  and where  $\mu_{lj}$  is assumed to be uncorrelated with  $\bar{x}_l$  and  $\varepsilon_{ij}$ . Combining equations (2), (3), and (4) yields the following empirical specification:

$$y_{ij}^* = x_i * \beta_j + \bar{x}_k * \rho_j + \bar{x}_l * \gamma_j + \mu_{kj} + \mu_{lj} + \varepsilon_{ij}, \quad (5)$$

which can be estimated consistently by using pooled maximum likelihood applied to a multinomial logit specification (Wooldridge 2010):

$$\Pr(y_i = j | x_i, \bar{x}_k, \bar{x}_l) = \frac{\exp(x_i \beta_j + \bar{x}_k * \rho_j + \bar{x}_l * \gamma_j)}{1 + \left[ \sum_{h=1}^J \exp(x_i \beta_h + \bar{x}_k * \rho_h + \bar{x}_l * \gamma_h) \right]} \quad (6)$$

However, to estimate equation (6), we must define a base outcome—in our case, remaining regularly non-promoted and employed at the same workplace,<sup>1</sup> for which the coefficients  $\beta$ ,  $\rho$ , and  $\gamma$  are defined as zero. Additionally, inference is adjusted to allow arbitrary correlation within establishments (Wooldridge 2010).

We calculate and report relative risk ratios (henceforth rrrs) for each of the explanatory variables. Compared with partial effects, rrrs have the advantage of being comparable in size across outcome categories even if the respective outcomes' constants  $\beta_{0j}$  differ in size. For example, the rrr for women to end up in category  $j$  is defined as follows:

$$rrr^{\text{females}}(y_i = j \mid x_i, \bar{x}_k, \bar{x}_l) = \frac{\frac{Pr(y=j \mid \text{female}=1, x_i, \bar{x}_k, \bar{x}_l)}{Pr(y=\text{base} \mid \text{female}=1, x_i, \bar{x}_k, \bar{x}_l)}}{\frac{Pr(y=j \mid \text{female}=0, x_i, \bar{x}_k, \bar{x}_l)}{Pr(y=\text{base} \mid \text{female}=0, x_i, \bar{x}_k, \bar{x}_l)}} \quad (7)$$

Equivalently, we calculate rrrs for the actual working time, foreign citizenship, and formal vocational degrees. However, the interpretation of rrrs differs from that of marginal effects as rrrs represent multiplicative effects (Buis 2010), i.e., a rrr of 2 for females implies that the females' chance for being in category  $j$  is twice that of men.

## 4 Data

We use the new and revised German employment register (“Beschäftigtenstatistik”), which consists of administratively collected data from employers' mandatory social security reports for each of their employees. While the number of variables is limited, these types of data provide three substantial advantages over survey-based data. First, the data are employer reported. Hence, we do not face over-reporting in promotions by individuals (Pergamit/Veum 1999) or bias from socially desirable responses by individuals. Second, the data contain the full information since the reports are mandatory,<sup>2</sup> which is particularly relevant because promotions are rare events. In contrast to surveys, we therefore do not encounter the issue of selective participation. Avoiding this issue might be particularly advantageous in research on managerial positions since these individuals face higher opportunity costs when participating in surveys. Third, administratively collected datasets are large in scale, allowing us to draw reliable statistical inferences.

Because the occupational classification scheme was revised in the new KIdB 2010, which has been constructed in accordance to the international standard classification of occupations (ISCO 2008), the employment register includes reliable information on managerial positions for each employee since April 2012. The new variable contains a digit defining whether the individual is in a managerial position irrespective of the original occupational compe-

<sup>1</sup> We choose being non-promoted at the same workplace as the base outcome because in this case, no change is observed for the individual.

<sup>2</sup> We observe the population of employed individuals liable to social security contributions; thus, we exclude individuals in the black market, the self-employed, and civil servants. However, promotions might be rather limited on the black market, and they are irrelevant for self-employment.

tence. These positions require both supervisory competence and budgetary responsibility such as those of heads of departments or divisions.

As we compare promotions of individuals by their individual characteristics, promotions are defined by changes in the occupational classification. Thus, a promoted individual is classified as a regular non-managerial employee on 15 April 2012 but is classified as a manager on 15 December 2013. Using the establishment identifiers of these two points in time, we define promotions within establishments if the establishment identifier does not change and across establishments if the identifier changes.

In the data, a promotion requires a reclassification according to the 5-digit occupational code. Since reclassifications are more likely when an individual changes employers, simply because a new classification has to be chosen, the total number of promotions across establishments should be overstated (Table 1). However, this approach should not cause bias in our estimates if the choice for a new classifier is not systematically correlated with the variables of interest. Furthermore, the rrrs, which we use for our interpretation, cancel out any unsystematic over-representation of a specific outcome category by construction.<sup>3</sup>

[Table 1 about here]

The data further allow us to distinguish between leading positions by their level of task complexity. The information on task complexity is represented by the fifth digit of the occupational code reported by the employer and is measured on four levels: unskilled tasks, skilled tasks, specialized skilled tasks, and highly specialized expert tasks, where only the last two apply to managerial positions. Accordingly, some of the leading positions are defined as executive, whereas others are defined as supervisory positions, where executive positions involve a higher complexity than supervisory positions. Finally, we do not look at promotions to top management positions such as in the board of directors since these types of positions are recorded differently, and we expect different mechanisms to be at play with these types of promotions.

The data also include a unique establishment identifier. Thus, we can control for establishment heterogeneity as specified in equation (2) and distinguish between promotions within and across establishments, which is the main scope of this article.<sup>4</sup> Additionally, as of January 2010, employers are obliged to report each employee’s actual working hours to the com-

<sup>3</sup> Suppose that for a specific characteristic  $z=1$ , we are interested in the relative risk of being promoted ( $y=j$ ) in comparison with staying in the base category ( $y=base$ ), where category  $y=j$  is over-represented by the factor  $F_j(z, x)$ ,

$$\text{i.e., } rrr^{z=1}(y_i = j | x_i) = \frac{\frac{\Pr(y=j | z_i=1, x_i) \cdot F_j(z, x)}{\Pr(y=base | z_i=1, x_i)}}{\frac{\Pr(y=j | z_i=0, x_i) \cdot F_j(z, x)}{\Pr(y=base | z_i=0, x_i)}}.$$

As long as the over-representation is not structurally correlated with the covariates, i.e.,  $F_j(z, x)=F_j$ , the baseline probability of each outcome category it cancels out of the relative risk ratio and does not influence the promotion probabilities of interest.

<sup>4</sup> While most of the theoretical considerations build on a firm-level argumentation, we use an establishment-level distinction in the data. If the hypothesized information is available across establishments but not across firms, the establishment-level distinction might be rather imprecise, leading to an under-estimation of the difference between internal and external promotions.

pulsory industrial injury insurance. This information on actual working hours is an essential explanatory variable for our analyses. A brief description of the information on actual working hours is provided in Online Appendix A.<sup>5</sup>

As promotions to managerial positions among all employees in the work force depict rarely occurring events, our analyses draw on the full sample of all individuals who are promoted to managerial positions between April 2012 and December 2013. In addition to the full sample of promoted individuals, we draw a 2 percent random sample from the population of all non-promoted employees working in the same establishments as the promoted workers during that time (Table 1). This sample depicts the promotion processes into managerial positions most genuinely since only employees who are working at the same establishments and who hence are provided the same initial opportunity to get promoted are considered.<sup>6</sup> As non-random sampling leads to an analysis sample, in which the absolute probability to receive a promotion is upward biased because of sample stratification, we report rrrs instead of partial effects.

All individual covariates are calculated to the date of 15 April 2012 and are hence determined before the period of potential promotions. For a summary description of these variables, see Table 2. Individual covariates include the log of gross daily wages; a dummy indicating censored wage information (wages are top coded in the employment register); tenure; tenure squared; job mobility and regional mobility within the last 10 years; age dummies (45 categories), which also capture cohort effects;<sup>7</sup> occupational main groups (37 categories); and an indicator for fixed-term contracts. We also add establishment-level information calculated from the entire population of employees for both points in time, 15 April 2012 and 15 December 2013. The establishment-level variables include the shares of managers and promotions, the establishment size (total number of employees in logs), the industry (18 categories), and the churning rate. Finally, the analysis sample is restricted to employees with a full-time contract and an age between 18 and 63 years.

[Table 2 about here]

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<sup>5</sup> A more comprehensive but after these revisions slightly outdated overview on the administrative employment register and its collection process is provided in Oberschachtsiek et al. (2009).

<sup>6</sup> For a robustness check, we utilize a 2 percent random sample of all non-promoted employees of the entire workforce, i.e., employees working at any establishment during that time. While this sub-sample does not allow us to control for establishment heterogeneity, the results remain unchanged from those in panel A of Table 3.

<sup>7</sup> Since we use a cross-section, the detailed controls for age also capture cohort effects, which are relevant for promotions (Kwon/Milgrom/Hwang 2010).

## 5 Regression results

Our estimation results are presented as rrrs for the hypothesized explanatory variables, i.e., actual daily working hours, apprenticeship training certificate, master craftsman certificate (“Meister”), university or college degree, doctoral degree, gender, and foreign citizenship. Table 3 provides rrrs from three different specifications: In panel A, we present rather descriptive estimates by omitting the establishment-level averages of the individual variables and hence neglecting potential establishment heterogeneities. In panel B, we present the results from the full specification as derived in Section 3. The estimated equation includes establishment-level averages of each control variable to capture the heterogeneity of both the initial and the destination establishment. Both of the presented specifications control for establishment-level variables, such as establishment size, industry, and churning rate, as well as the number of managers and promotions, at both the initial and destination establishments, which capture differences in hierarchical levels and job-turnover in managerial positions.

[Table 3 about here]

### 5.1 The signal of hours, initial job assignment, and formal educational degrees

Looking at the actual daily working hours, we observe positive effects across all specifications and for both channels of promotions. This result confirms the general findings of an extensive body of literature (e.g., Anger 2008; Pfeifer 2010) showing that promotions are positively associated with working time. The rrrs of *1.14* and *1.17* (Table 3, panel A) seem quite large, but since we examine working hours on a daily basis, an increase by one additional hour of working time is a fairly large treatment.

Regarding the differential effect of working time on promotions within versus across establishments, all three panels show that the impact of working time is significantly larger on promotions within establishments than on promotions across establishments. This result is in line with the corresponding hypothesis, which states that actual working time provides a meaningful signal for the current employer, but it is usually not observed by other potential employers. A plausible explanation for our finding of a more substantial difference when we control for establishment heterogeneity (panel B) is that working time is strongly influenced by firm-level policies, i.e., firm-level decisions that influence heterogeneity in working time.<sup>8</sup> Examples of such firm-level policies are over-time work, short-time working schemes, or changes in contracted working time at the firm level, which may all influence the working time of the establishment’s entire work force. Accordingly, we observe a much stronger impact on internal promotions when we draw on variation within establishments, suggesting that relative working time within establishments is more important than working time across the entire

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<sup>8</sup> See also Appendix A for the difference in actual working hours across and within workplaces.

population. The relative working time within the establishment is determined more by individuals' level of effort or dedication before promotion than by firm-level policies.

We also observe that working hours are lower when an individual moves across workplaces without being promoted (column 6). However, this effect, which is  $1-0.885=0.115$ , falls short of the differential effect between an internal and external promotion, which is  $0.209$ . This result suggests that mobility differences by hours of work cannot explain the entire differential of the two channels of promotion.

Since we find evidence that signals such as actual working time are more important internally, external employers have to rely on surrogate observable signals. Formal education is an obvious externally observable signal, as vocational degrees are presented in all applications to potential employers.

Looking at the results in Table 3, we can confirm this hypothesis. Across all three specifications, the effects of a *Meister*, a *university/college*, and a *doctoral degree* are much more emphasized for promotions across establishments.<sup>9</sup> However, we also observe significant and positive effects from education on promotions within establishments, which is in line with the idea that better educated individuals are more productive and therefore more likely to be promoted.<sup>10</sup>

When controlling for establishment heterogeneity (panel B), we find that the differential effect on external versus internal promotions shrinks but remains of substantial size. The difference may shrink because employers may induce a productivity signal, which might be correlated with education. The productivity of an employer is most likely correlated with the educational level of its employees, and a highly productive employer itself may also cast a signal to potential employers. However, the rrrs in panel B remain economically significant. The rrr of a university/college graduate is still 0.92 points larger for external promotions compared with internal promotions. Again, the relatively smaller effects in column 6 indicate that the differential effects are not explained by differences in the general tendency toward mobility.

Moreover, we observe the same pattern for job assignments. The level of task complexity appears to be more important for external promotions than for internal promotions, implying that other potential employers rely on this surrogate measure to evaluate individual ability. While the rrrs for external promotion increase with task complexity, the connection seems to be more complex for promotions within establishments. As expected, the relative risk of promotion is lowest for workers in jobs with unskilled tasks. However, surprisingly, those in jobs with skilled tasks have the highest likelihood of internal promotion. We argue that this result

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<sup>9</sup> In Table B1 of Appendix B, we can show that the differential effect on external versus internal promotions is fully robust to the use of secondary schooling degrees instead of tertiary vocational certificates.

<sup>10</sup> An alternative theoretical explanation suggesting the same outcome is provided by a large stream of theoretical contributions addressing promotions as a signal (e.g., DeVaro/Waldman 2012; Cassidy/DeVaro/Kauhanen 2012; Bernhardt 1995), where employers have an incentive to promote educated workers before their uneducated but equally or even more capable counterparts.

may point to highly specialized expert tasks that are excluded from the main hierarchical structure within the establishment, e.g., a software engineer in an automotive manufacturer. Such experts are more likely to achieve promotions by changing employers.

## 5.2 Statistical discrimination

The coefficients indicate that women and foreigners are severely disadvantaged in promotions to managerial positions. Across all three specifications presented in Table 3, the rrr is strictly below 1, indicating a lower likelihood of promotion. Moreover, we observe lower probabilities of promotion across establishments for both women and foreigners, which corresponds to the theory of statistical discrimination. Since the true productivity of women and foreigners is initially unknown across establishments, they are evaluated at their employer-estimated group means, which are below average. By contrast, when the present employer observes the true productivity of these employees, s/he does not rely on the negative average productivity signal of these groups, and promotions thus become more likely.

The general disadvantage of women in promotions within establishments is widely debated. Some fraction of the difference might be due to the employer's preferences and therefore considered discrimination (Becker 1971). However, other reasons are suggested by Gneezy, Niederle, and Rustichini (2003) or Niederle and Vesterlund (2007), who present experimental evidence showing that women have an aversion to competition and are less productive in tournaments. Moreover, Lazear and Rosen (1990) argue that women have a comparative advantage in the non-market sector, as they have to compensate for their higher probability of leaving the labor force on an interim basis in order to be promoted. This would explain different promotion prospects even when men and women are assumed to share the same productivity distribution. However, others allow for "ability" distributions to deviate, as long as such deviation results from different investments due to different expectations by men and women of market participation (Mincer/Polachek 1974). While we cannot present conclusive evidence concerning the general disadvantage of women, the large difference in the disadvantage in external versus internal promotions, which we estimate to be about 10 percentage points, indicates statistical discrimination in the decision to promote an individual from the outside. Somewhat surprisingly, column 6 shows no gender difference in the tendency toward mobility across workplaces, which in turn emphasizes the magnitude of the difference between internal and external promotions.

## 5.3 Increased hours as a signal for women

We have shown that working hours have a positive impact on promotions when we compare individuals of the same establishment, i.e., when we control for average working hours. This positive effect on promotions is stronger for internal candidates compared with external candidates. However, hours of work may also serve as a supplementary signal for women. Women are known to work shorter hours than men (e.g., Blundell/Bozio/Laroque (2011) or Olivetti (2006)). Combined with the positive effect of working hours, this difference explains some of the female disadvantage in the labor market (e.g., Olivetti (2006)). In addition, we believe that women are perceived to work relatively shorter hours, and accordingly, they may



face a statistical discrimination. Relatively longer working hours can mitigate this disadvantage, i.e., females have to work longer hours to obtain promotions. This result points to the possibility that women face a statistical stigma of low career orientation because they work lower average working hours. A second more positive interpretation is that females strongly improve their prospects of promotion by increasing their actual hours of work.

To show whether longer actual working hours are a stronger signal for females, we use our baseline multinomial regression framework and estimate additional interactions between our target groups (i.e., females and foreigners) and actual working hours. Using rrrs, we can directly interpret the interaction effects in the multinomial model. However, these interaction effects should be interpreted multiplicative to the respective baseline effects (Buis 2010). That is, the coefficient on the female–hours interaction is multiplied on the baseline hours effect to yield the multiplicative impact of hours for females. Since the rrrs in Table 4 show a baseline hours effect and an interaction effect that both exceed one, longer hours are a more influential signal for women. The magnitude of the impact of hours on promotions increases by a factor ranging between 1.06 and 1.08 once we examine only women. By contrast, hours of work are a less important signal for foreign citizens, which is statistically significant for external promotions.

[Table 4 about here]

#### **5.4 Executive versus supervisory positions**

In the occupational classification used in this paper, managerial positions can be further differentiated by the level of task complexity associated with these positions. While both executive and supervisory positions require budgetary responsibility and supervisory competence, executive positions entail more complex tasks and hence tend to demand higher qualification than supervisory positions. As promotion decisions may differ between executive and supervisory positions, particularly since many occupations provide only the possibility of promotion to either a supervisory or an executive position, we perform two separate estimations. The corresponding results are displayed in Table 5.

[Table 5 about here]

For women, the differences between external and internal promotions are significant only for promotions to executive positions, implying that our results for women from Table 2 are exclusively driven by this type of promotion. We argue that the deviating results can mainly be explained by two circumstances: First, as we can show descriptively (Figure 1), women tend to sort into occupations in which most promotions lead to executive positions. In these occupations, we observe a relatively larger share of women among both the promoted and the non-promoted employees. This occupational sorting might be one reason why women are more likely promoted to executive positions. Second, with higher task complexity, screening for the suitability of external job candidates should become more difficult. Hence, as executive positions are associated with a higher level of task complexity than supervisory positions, this may explain why, despite their higher likelihood of getting promoted in general, women

are significantly less likely to get promoted to an executive position when changing employers, i.e., when their ability is observed with noise.

[Figure 1 about here]

Looking at the effects of formal educational degrees, we find that the Meister certificate, which is the highest degree in manual jobs and mostly observed in craftsman trades, is more important for promotions to supervisory positions, irrespective of the promotion channel. In contrast, those degrees acquired in academic education (university/college degree and doctoral degree) seem to play a larger role in promotions to executive positions. These findings are in line with the observation that occupations that usually require practical training tend to provide supervisory positions, whereas those that require academic education tend to provide executive positions.

## 6 Robustness

A crucial assumption of the multinomial logit estimation, which we apply here, is the independence of irrelevant alternatives (IIA) assumption. For validation of this assumption, we propose two robustness checks by changing the number of outcome categories.<sup>11</sup>

First, we merge the base category of employees who do not receive a promotion but stay at the same establishment with those employees who also do not receive a promotion but leave the initial employer. Panel A of Table 6 presents the rrrs of a multinomial logit regression in which we control for establishment-level heterogeneity of both the initial and the destination establishment. The absolute sizes of the rrrs as well as the differences between internal and external promotions are very similar to those in Table 3.

[Table 6 about here]

Second, we add an outcome category comprising employees who leave the sample, i.e., who are no longer employed full time (panel B). This second robustness check is important if a selective group of employees leaves our analysis sample. As a prominent example of selective attrition, women without chances for promotions may endogenously leave the sample for child bearing. The rrrs when we include this category are presented in panel B of Table 6. Compared with those in Table 3, the differential effects on external promotions versus internal promotions remain by and large unchanged.

## 7 Conclusions

This paper addresses the prevalence of information asymmetries in promotions within and across establishments. The true ability, on which firms base promotion decisions, is revealed only to the present employer. This information asymmetry implies several differential effects

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<sup>11</sup> We further check the robustness of the IIA assumption by replicating our estimations with a multinomial probit specification that does not rely on the IIA assumption; see Online Appendix C. When comparing the marginal effects of the multinomial logit and probit specifications, we do not find any meaningful differences between these two estimation methods.

on external versus internal promotions, which are confirmed in the empirical part of this paper.

We argue that asymmetric information can appear in two different manifestations. First, individuals' actual working hours provide a signal to their present employer but not to other potential employers. Therefore, external employers have to rely on surrogate ability signals, such as formal educational degrees. The multinomial estimations confirm these effects. Formal educational degrees appear to be more important for external promotions across all specifications. Although actual working time increases the differential effect only in the specification in which we control for workplace heterogeneity, this specification in particular accounts for the relative rank within firms, as implied by theory.

Second, as other potential employers cannot observe workers' true ability, the theoretical concept of statistical discrimination suggests that they evaluate job applicants at their corresponding group means. Since employers may perceive women and foreigners to be less productive, their disadvantages should be more pronounced in external promotions than in internal promotions, as their true individual productivity is revealed only to the current employer. These differences are also observed across all our specifications. Moreover, the differential effect for women is more pronounced for promotions to executive positions, which are characterized by higher task complexity and thus relatively more strenuous candidate screening.

Overall, we find large differences in the effects on external and internal promotions. For women and foreigners, a career within establishments appears to be beneficial since they face a greater disadvantage across establishments. By contrast, highly educated individuals have better chances across establishments, as their education provides a meaningful signal in their application.

To employers, information is important, as it limits decisions to externally promote suitable candidates. Moreover, as suggested by Chen (2003, 2005), competition from the outside can be important to employees' effort provision, which increases the importance of screening potential candidates, i.e., by using headhunters or other ways to gather information.

For women, hours of work are a highly important factor for promotion. By contrast, relatively shorter working hours seem to be a crucial restriction to female career advancement. A counteractive measure to further exploit the potential of women could be firm policies such as part-time careers.

A final implication of our study is that specialists very often leave to seek promotion at another workplace. All else equal, their initial task complexity is a signal to external employers (see also Waldman 1984). Therefore, as we observe an increasing scarcity of specialists in Western societies, employers should provide sufficient prospects for internal promotions in order to preserve this potential.

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## Tables and Figures

**Table 1**  
**Descriptive overview of the analysis sample**

	Promoted individuals		Control samples
	promotion across	promotion within	initially within same establishment
Promotion	100%	100%	0%
Employer change	100%	0%	11.3%
Number of individuals (observations)	72,182	28,968	95,506

*Data source:* German Administrative Employment Histories, 15 April 2012, analysis sample.

**Table 2**  
**Summary table (excluding establishment-level means of individual characteristics)**

Variable	Obs.	Mean	Std. Dev.	Min	Max
<b>Outcome</b>					
Not promoted, same establishment (D)	196,658	0.431	0.495	0	1
Promoted, different establishment (D)	196,658	0.367	0.482	0	1
Promoted, same establishment (D)	196,658	0.147	0.354	0	1
Not promoted, different establishment (D)	196,658	0.055	0.228	0	1
<b>Establishment-level information</b>					
Churning rate (initial establishment)	196,658	0.319	0.286	0	2
Churning rate (destination establishment)	196,658	0.296	0.263	0	2
Share of promotions (initial)	196,658	0.039	0.079	0	1
Share of promotions (destination)	196,658	0.046	0.091	0	1
Share of managers (destination)	196,658	0.086	0.089	0	1
Managers (initial) (D)	196,658	0.15	0.357	0	1
Share of managers (initial)	196,658	11.389	12.669	0	100
Number of employees (log) (initial)	196,658	5.394	2.108	0.693	10.811
Number of employees (log) (destination)	196,658	5.397	2.15	0.693	10.888
<b>Individual-level information</b>					
Regional mobility in the past	196,658	0.109	0.188	0	1
Job mobility in the past	196,658	0.194	0.241	0	1
Initial wage (log)	196,658	3.192	0.527	-2.803	11.028
Censored wage? (D)	196,658	0.186	0.389	0	1
Gender (D; 1=female)	196,658	0.26	0.439	0	1
Nationality (D; 1=foreign)	196,658	0.066	0.248	0	1
Age	196,658	39.798	10.167	18.156	62.995
Age squared	196,658	1,687.24	825.972	329.646	3,968.31
Tenure	196,658	7.371	7.939	0	37.312
Tenure squared	196,658	117.356	224.771	0	1,392.21
Work experience	196,658	17.143	10.028	0	37.312
Work experience squared	196,658	394.45	380.746	0	1,392.21
Actual daily working hours	196,658	6.579	1.488	0.004	74.2
Temporary contract? (D)	196,658	0.093	0.29	0	1.00
<b>Highest attained education</b>					
No vocational degree (D)	196,658	0.06	0.228	0	1.00
Apprenticeship training cert. (D)	196,658	0.547	0.498	0	1.00
Meister/Technician (D)	196,658	0.082	0.275	0	1.00
University/College degree (D)	196,658	0.209	0.406	0	1
Doctoral degree (D)	196,658	0.013	0.115	0	1.00
Vocational education unknown (D)	196,658	0.094	0.291	0	1

*Data source:* German Administrative Employment Histories, 15 April 2012, analysis sample.



**Table 3**  
**Relative probabilities of promotions within and across establishments, multinomial logit**

Outcome categories reference: 'not promoted'	Panel A				Panel B			
	Baseline specification				Specification within workplaces			
	Promotion across	Promotion within	Non-promoted mover	Difference	Promotion across	Promotion within	Non-promoted mover	Difference
	(1)	(2)	(3)	(2)-(1)	(4)	(5)	(6)	(5)-(4)
Female	0.591*** (0.011)	0.724*** (0.015)	0.967 (0.027)	0.133***	0.629*** (0.016)	0.725*** (0.019)	1.018 (0.036)	0.096***
Foreign citizenship	0.692*** (0.022)	0.749*** (0.026)	1.142*** (0.046)	0.057**	0.681*** (0.029)	0.773*** (0.032)	0.981 (0.053)	0.092***
Actual daily working hours	1.144*** (0.008)	1.167*** (0.009)	0.948*** (0.009)	0.023***	1.318*** (0.018)	1.527*** (0.022)	0.885*** (0.016)	0.209***
Apprenticeship training cert.	1.433*** (0.057)	1.285*** (0.052)	0.994 (0.043)	-0.148**	1.287*** (0.068)	1.204*** (0.060)	0.999 (0.058)	-0.083
Meister	3.687*** (0.172)	2.650*** (0.127)	0.863** (0.060)	-1.037***	3.353*** (0.213)	2.638*** (0.159)	0.862 (0.080)	-0.715***
University/College degree	2.809*** (0.122)	2.037*** (0.092)	1.144** (0.061)	-0.772***	2.707*** (0.155)	2.091*** (0.116)	1.168** (.083)	-0.616***
Doctoral degree	4.119*** (0.293)	3.083*** (0.236)	1.182 (0.142)	-1.036***	3.881*** (0.354)	3.140*** (0.289)	1.167 (0.176)	-0.741**
Skilled tasks	1.573*** (0.055)	1.398*** (0.052)	0.892*** (0.035)	-0.175***	1.980*** (0.103)	1.514*** (0.077)	0.928 (0.054)	-0.466***
Specialized skilled tasks	2.000*** (0.082)	1.304*** (0.057)	0.991 (0.051)	-0.696***	2.252*** (0.132)	1.404*** (0.082)	0.968 (0.070)	-0.848***
Highly specialized expert tasks	2.012*** (0.086)	1.232*** (0.057)	1.157*** (0.065)	-0.780***	2.337*** (0.143)	1.229*** (0.075)	1.147* (0.091)	-1.108***
Pseudo R-squared	0.332				0.342			
Observations	196,646				196,646			

*Data source:* German Administrative Employment Histories, 15 April 2012, analysis sample.

*Notes:* Reported coefficients are relative risk ratios of 1) transitioning to a managerial position across establishments, 2) transitioning to a managerial position within establishments or 3) staying non-promoted but changing the establishment. The reference category comprises individuals who are not promoted and who stay with the current employer. Standard errors are presented in parentheses. Asterisks indicate significance levels: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Panel A contains individual controls, including age (45 categories), tenure, tenure squared, experience, experience squared, initial wages, past regional mobility, past job mobility, initial occupational field (36 dummies), and a dummy for temporary contracts. Panel B comprises all variables included in panel A and additionally controls for establishment heterogeneity by adding establishment-level means of each covariate. Panel C is based on the alternate sample and contains all variables from panel A. All three specifications control for some basic establishment variables, including log firm size, share of managers, share of promotions, industry (19 categories), and churning rate; all these establishment variables are included for both the initial and the destination establishment.

**Table 4**  
**Interactions of gender and citizenship with actual working hours**

Outcome categories reference: 'not promoted'	Panel A				Panel B			
	Baseline specification				Specification within workplaces			
	Promotion across	Promotion within	Non- promoted mover	Difference	Promotion across	Promotion within	Non- promoted mover	Difference
	(1)	(2)	(3)	(2)-(1)	(4)	(5)	(6)	(5)-(4)
Female	0.591*** (0.011)	0.726*** (0.016)	0.970 (0.027)	0.135***	0.630*** (0.016)	0.729*** (0.020)	1.020 (0.036)	0.103***
Foreign citizenship	0.696*** (0.023)	0.748*** (0.026)	1.137*** (0.046)	0.052**	0.681*** (0.029)	0.767*** (0.032)	0.979 (0.053)	0.097**
Actual daily working hours	1.131*** (0.008)	1.148*** (0.009)	0.944*** (0.011)	0.017**	1.309*** (0.019)	1.513*** (0.023)	0.883*** (0.018)	0.189***
Female * actual working hours	1.070*** (0.013)	1.081*** (0.014)	0.999 (0.018)	0.011	1.058*** (0.019)	1.062*** (0.020)	0.989 (0.025)	0.004
Foreigner * actual working hours	0.952** (0.019)	0.986 (0.020)	1.038 (0.024)	0.034*	0.918*** (0.026)	0.971 (0.028)	1.051 (0.037)	0.054*
Apprenticeship training cert.	1.429*** (0.057)	1.282*** (0.052)	0.994 (0.043)	-0.147**	1.287*** (0.068)	1.204*** (0.060)	0.998 (0.058)	-0.126
Meister	3.676*** (0.172)	2.642*** (0.126)	0.863** (0.060)	-1.034***	3.353*** (0.213)	2.637*** (0.159)	0.861 (0.080)	-0.961***
University/ College degree	2.803*** (0.122)	2.033*** (0.092)	1.145** (0.061)	-0.770***	2.707*** (0.155)	2.091*** (0.116)	1.167** (.083)	-0.921***
Doctoral degree	4.112*** (0.293)	3.077*** (0.236)	1.183 (0.142)	-1.035***	3.877*** (0.354)	3.137*** (0.289)	1.167 (0.176)	-1.330**
Skilled tasks	1.570*** (0.055)	1.396*** (0.052)	0.893*** (0.035)	-0.174***	1.973*** (0.103)	1.511*** (0.077)	0.929 (0.054)	-0.466***
Specialized skilled tasks	1.995*** (0.081)	1.301*** (0.057)	0.993 (0.051)	-0.694***	2.244*** (0.132)	1.401*** (0.082)	0.970 (0.070)	-0.848***
Highly specialized expert tasks	2.008*** (0.086)	1.230*** (0.057)	1.160*** (0.065)	-0.778***	2.328*** (0.143)	1.227*** (0.075)	1.150* (0.091)	-1.108***
Pseudo R-squared	0.332				0.343			
Observations	196,646				196,646			

*Data source:* German Administrative Employment Histories, 15 April 2012, analysis sample.

*Notes:* Reported coefficients are relative risk ratios of 1) transitioning to a managerial position across establishments, 2) transitioning to a managerial position within establishments or 3) staying non-promoted but changing the establishment. The reference category comprises individuals who are not promoted. Standard errors are presented in parentheses. Asterisks indicate significance levels: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Control variables are as in Table 3.

**Table 5**

**Differentiation between promotions to supervisory positions and promotions to executive positions, multinomial logit specification within workplaces**

Outcome categories reference: 'not promoted'	Panel A				Panel B			
	Promotions to <b>supervisory positions</b>				Promotions to <b>executive positions</b>			
	Promotion across	Promotion within	Non-promoted mover	Difference	Promotion across	Promotion within	Non-promoted mover	Difference
	(1)	(2)	(3)	(2)-(1)	(4)	(5)	(6)	(5)-(4)
Female	0.728*** (0.025)	0.745*** (0.027)	1.003 (0.036)	0.017	0.586*** (0.018)	0.744*** (0.026)	1.018 (0.036)	0.180***
Foreign citizenship	0.657*** (0.037)	0.760*** (0.039)	0.971 (0.052)	0.103**	0.702*** (0.039)	0.780*** (0.046)	0.977 (0.053)	0.099
Actual daily working hours	1.207*** (0.020)	1.433*** (0.024)	0.868*** (0.016)	0.226***	1.374*** (0.023)	1.584*** (0.030)	0.877*** (0.016)	0.163***
Apprenticeship training cert.	1.305*** (0.086)	1.241*** (0.072)	1.004 (0.059)	-0.064	1.267*** (0.090)	1.120 (0.086)	1.012 (0.060)	-0.291
Meister	4.307*** (0.338)	3.301*** (0.233)	0.911 (0.084)	-1.006***	2.495*** (0.212)	1.726*** (0.158)	0.924 (0.085)	-1.189***
University/ College degree	2.637*** (0.194)	1.756*** (0.120)	1.180** (0.084)	-0.881***	2.727*** (0.207)	2.374*** (0.195)	1.221*** (.088)	-0.646
Doctoral degree	2.615*** (0.363)	1.689*** (0.265)	1.177 (0.175)	-0.926**	3.987*** (0.430)	3.355*** (0.380)	1.197 (0.179)	-0.969
Skilled tasks	1.742*** (0.109)	1.535*** (0.089)	0.945 (0.055)	-0.207*	2.554*** (0.187)	1.584*** (0.131)	0.944 (0.055)	-0.466***
Specialized skilled tasks	1.789*** (0.129)	1.109 (0.077)	1.001 (0.073)	-0.680***	3.416*** (0.272)	2.180*** (0.196)	1.018 (0.074)	-0.848***
Highly specialized expert tasks	1.744*** (0.134)	0.843** (0.063)	1.177** (0.093)	-0.901***	3.711*** (0.305)	2.156*** (0.198)	1.211** (0.096)	-1.108***
Pseudo R-squared	0.337				0.368			
Observations	142,269				149,880			

*Data source:* German Administrative Employment Histories, 15 April 2012, analysis sample.

*Notes:* Reported coefficients are relative risk ratios of 1) transitioning to a managerial position across establishments, 2) transitioning to a managerial position within establishments or 3) staying non-promoted but changing the establishment. The reference category comprises individuals who are not promoted. Standard errors are presented in parentheses. Asterisks indicate significance levels: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Control variables are as in Table 3.

**Table 6**  
**Adding an additional outcome category, multinomial logit specification within initial workplaces**

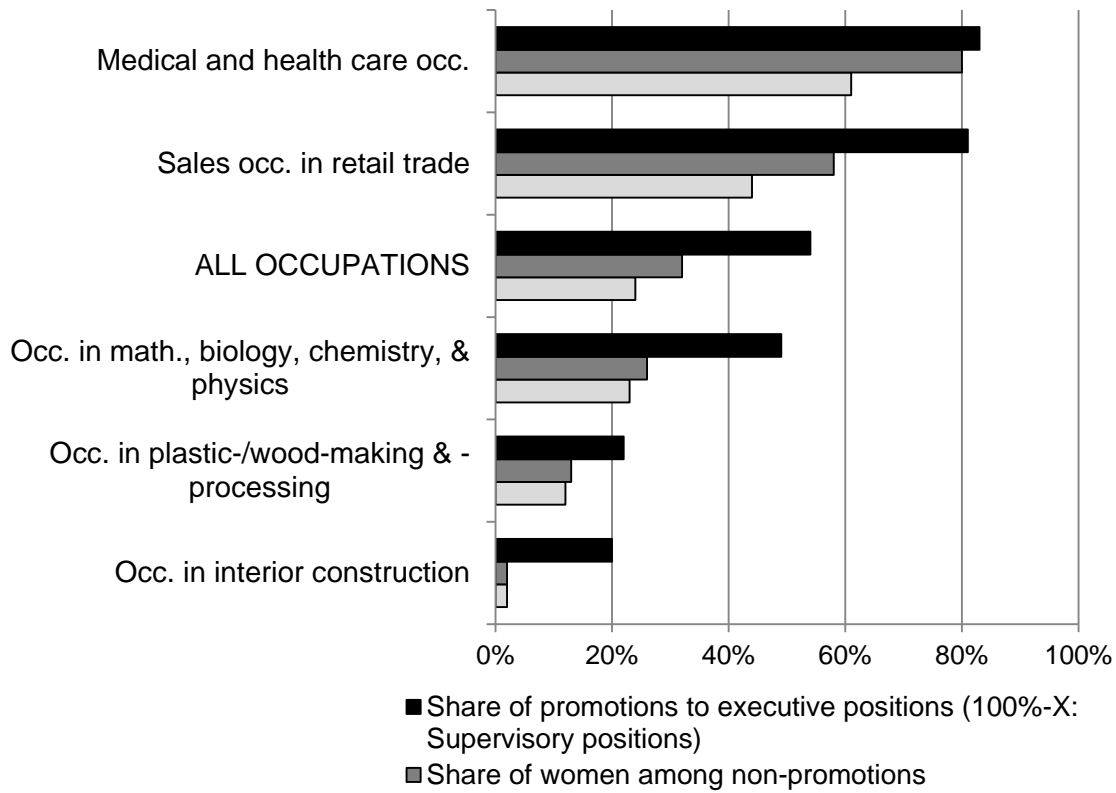
Reference category: non-promoted	Merging non-promoted workers: Specification within establishments			Adding individuals leaving full-time employment: Specification within (initial) establishments				
	Promotion across (1)	Promotion within (2)	Difference (2)-(1)	Promotion across (3)	Promotion within (4)	Non- promoted mover (5)	Leaving full- time employ- ment (6)	Difference (5)-(4)
Female	0.631*** (0.016)	0.728*** (0.019)	0.097***	0.629*** (0.014)	0.717*** (0.018)	1.015 (0.034)	1.385*** (0.051)	0.088***
Foreign citizenship	0.678*** (0.029)	0.772*** (0.032)	0.094***	0.672*** (0.025)	0.765*** (0.030)	0.990 (0.050)	1.387*** (0.071)	0.093***
Actual daily work. hours	1.353*** (0.018)	1.557*** (0.022)	0.204***	1.212*** (0.015)	1.430*** (0.019)	0.887*** (0.015)	0.677*** (0.012)	0.218***
Apprent. train. cert.	1.291*** (0.067)	1.201*** (0.059)	-0.090	1.337*** (0.061)	1.233*** (0.057)	1.037 (0.057)	0.802*** (0.043)	-0.104
Meister	3.328*** (0.207)	2.612*** (0.155)	-0.716***	3.395*** (0.189)	2.664*** (0.151)	0.843* (0.075)	0.735*** (0.068)	-0.731***
University/ College degree	2.628*** (0.148)	2.034*** (0.111)	-0.594***	2.647*** (0.133)	2.118*** (0.110)	1.246*** (.083)	0.779*** (.055)	-0.529***
Doctoral degree	3.800*** (0.337)	3.067*** (0.277)	-0.733**	3.885*** (0.318)	3.164*** (0.275)	1.336** (0.192)	0.867 (0.134)	-0.721**
Skilled tasks	2.004*** (0.103)	1.516*** (0.076)	-0.488***	1.861*** (0.085)	1.496*** (0.071)	0.937 (0.052)	0.838*** (0.048)	-0.365***
Specialized skilled tasks	2.243*** (0.129)	1.392*** (0.080)	-0.851***	2.222*** (0.114)	1.410*** (0.077)	0.977 (0.068)	1.046 (0.077)	-0.812***
Highly specialized expert tasks	2.283*** (0.137)	1.202*** (0.072)	-1.081***	2.194*** (0.118)	1.260*** (0.072)	1.138* (0.086)	1.511*** (0.120)	-0.934***
Pseudo R <sup>2</sup>		0.363				0.277		
Observations		196,646				203,694		

*Data source:* German Administrative Employment Histories, 15 April 2012, analysis sample.

*Notes:* Reported coefficients are relative risk ratios of 1) transitioning to a managerial position across establishments, 2) transitioning to a managerial position within establishments, 3) staying non-promoted but changing the establishment or 4) leaving full-time employment. The reference category comprises individuals who are not promoted (in panel A, the individuals also stay at the establishment). Standard errors are presented in parentheses. Asterisks indicate significance levels: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Controls are as in Table 3, panel A. However, this specification includes establishment-level averages of the initial establishment but omits establishment heterogeneity of the destination establishments, simply because individuals leaving the sample of establishments do not have peers at the destination establishment.

**Figure 1**

**Occupations with different (high – average – low) shares of promotions to executive positions and their shares of women**



*Data source:* German Administrative Employment Histories, 15 April 2012, analysis sample.

## Appendix

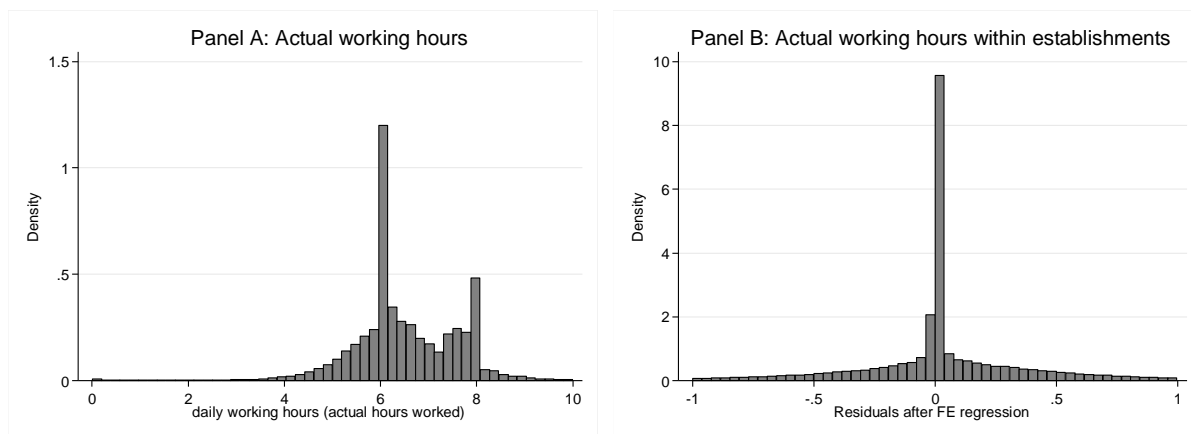
### Appendix A: Actual working hours in the administrative employment register

The information on actual working hours in the data is retrieved from the compulsory injury insurance. Since 2010, employers are obliged to report actual working hours while excluding periods of vacations or sickness for each of their employees. However, if the employer does not track each employee's working time separately, he is expected to report a standard value for full-time employees or, in the case of part-time work, proportions of this value.

Figure A.1 presents the density of actual working hours. Panel A shows the raw data of working hours, with remarkable spikes at approximately 6 and 8 hours per day. Panel B reports the same density plot within establishments, i.e., after we partial out establishment fixed effects. Here, the density of actual daily working hours looks much smoother, but we still observe a tremendous spike at zero. This spike comprises all employees in establishments at which we do not observe variation in working hours. This result may be obtained for two reasons: first, some of the establishments do not allow for over-time hours; second, some of the establishments report standard values or contractual rather than actual working hours.

In our estimations controlling for establishment heterogeneity, we hence identify an effect from establishments (a) allowing over-time hours and (b) reporting exact information about actual working hours.<sup>12</sup>

**Figure A.1**  
**Distribution of actual working hours**



*Data source:* German Administrative Employment Histories, 15 April 2012, analysis sample.

<sup>12</sup> The establishment-level averages also control for other economic differences across establishments, which are not related to the construction of the data. Such economic differences can be general firm policies concerning regular working hours.

## **Online Appendix B: Schooling and vocational degrees**

In our analysis, we use vocational degrees instead of schooling degrees. The rationale behind this choice is that promotions to managerial positions usually require a vocational degree. Vocational and tertiary degrees are usually ascribed as the highest educational degrees of an individual; thus, they play a more important role than schooling degrees.

As educational systems differ across countries, we provide a brief description of the German vocational degrees: In the dual apprenticeship system, apprentices acquire a vocational degree after they successfully pass through a vocational training lasting between two to three years, which takes place in both vocational schools and the training establishments. On-site training contents and examinations are both standardized. After completing apprenticeship training and gaining some experience as a journeyman (*Geselle*), degree holders may attend a technical college in order to become a Meister (Master craftsman) or a technician, which again takes about 4 to 6 years and is valued as a tertiary degree.

The regular track to acquire a tertiary degree is to proceed to a college after graduation from high school. At colleges, two tracks are possible in Germany. About two-thirds of students attend universities, for which an Abitur (A-levels) is usually required, while another third attend universities of applied sciences, where admission is also possible when candidates hold an advanced technical certificate. Finally, university graduates can apply for graduate studies to obtain a doctoral degree.

To demonstrate the sensitivity of our results to the choice between schooling and vocational degrees, Table B.1 (next page) reports the coefficients from a replication of Table 2. Our conclusions remain unaffected.

**Table B.1**  
**Relative probabilities of promotions within and across establishments, multinomial logit**

Outcome categories reference: 'not promoted'	Panel A				Panel B			
	Baseline specification				Specification within workplaces			
	Promotion across	Promotion within	Non-promoted mover	Difference	Promotion across	Promotion within	Non-promoted mover	Difference
	(1)	(2)	(3)	(2)-(1)	(4)	(5)	(6)	(5)-(4)
Female	0.562*** (0.011)	0.702*** (0.015)	0.965 (0.027)	0.140***	0.599*** (0.015)	0.695*** (0.019)	1.007 (0.036)	0.096***
Foreign citizenship	0.728*** (0.024)	0.754*** (0.026)	1.171*** (0.047)	0.026	0.731*** (0.032)	0.797*** (0.033)	1.014 (0.055)	0.066*
Actual daily working hours	1.150*** (0.008)	1.176*** (0.009)	0.949*** (0.009)	0.026***	1.330*** (0.018)	1.541*** (0.022)	0.885*** (0.016)	0.211***
Secondary school leav. certif.	1.393*** (0.033)	1.232*** (0.030)	0.993 (0.032)	-0.161***	1.487*** (0.051)	1.379*** (0.045)	1.044 (0.048)	-0.108**
High-school diploma	2.018*** (0.054)	1.354*** (0.038)	1.025 (0.039)	-0.664***	2.183*** (0.082)	1.729*** (0.064)	1.018 (0.054)	-0.454***
Skilled tasks	1.493*** (0.052)	1.408*** (0.053)	0.868*** (0.034)	-0.085	1.804*** (0.094)	1.477*** (0.075)	0.901* (0.053)	-0.327***
Specialized skilled tasks	1.993*** (0.081)	1.405*** (0.061)	0.962 (0.050)	-0.588***	2.169*** (0.127)	1.443*** (0.084)	0.937 (0.068)	-0.726***
Highly specialized expert tasks	1.997*** (0.085)	1.373*** (0.063)	1.128** (0.063)	-0.624***	2.237*** (0.137)	1.289*** (0.078)	1.116 (0.088)	-0.948***
Pseudo R-squared	0.333				0.343			
Observations	196,646				196,658			

Data source: German Administrative Employment Histories, 15 April 2012, analysis sample.

Notes: Reported coefficients are relative risk ratios of 1) transitioning to a managerial position across establishments and 2) transitioning to a managerial position within establishments. The reference category comprises individuals who are not promoted. Standard errors are presented in parentheses. Asterisks indicate significance levels: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Panel A contains individual controls, including age (45 categories), tenure, tenure squared, initial wages, past regional mobility, past job mobility, and dummy for temporary contracts. Panel B comprises all variables included in panel A and additionally controls for establishment heterogeneity by adding establishment-level means of each covariate. Panel C is based on the alternate sample and contains all variables from panel A. All three specifications control for some basic establishment variables, including log firm size, share of managers, share of promotions, industry (18 categories), and churning rate; all these establishment variables are included for both the initial and the destination establishment.



**Online Appendix C: IIA Assumption and multinomial probit**

We check the robustness of the IIA assumption by replicating our estimations using a multinomial probit specification that does not rely on the IIA assumption. Because the multinomial probit does not allow us to calculate rrrs, we rely on a comparison of partial effects. The partial effects of both estimations, multinomial logit and probit, are presented in Table C.1, and by visual inspection, the two estimation techniques do not exhibit any meaningful differences.

**Table C.1**  
**Comparing partial effects from multinomial logit and multinomial probit regression, specification within workplaces**

Outcome categories refer- ence: 'not promoted'	Panel A: Baseline specification				Panel B: Specification within workplaces			
	Promotion across		Promotion within		Promotion across		Promotion within	
	mlogit	mprobit	mlogit	mprobit	mlogit	mprobit	mlogit	mprobit
Female	-0.051*** (0.002)	-0.054*** (0.002)	-0.006*** (0.002)	-0.008*** (0.002)	-0.043*** (0.003)	-0.046*** (0.003)	-0.009*** (0.003)	-0.011*** (0.003)
Foreign citizenship	-0.035*** (0.004)	-0.036*** (0.004)	-0.012*** (0.003)	-0.013*** (0.003)	-0.035*** (0.005)	-0.037*** (0.005)	-0.007 (0.004)	-0.008* (0.004)
Actual daily working hours	0.010*** (0.001)	0.010*** (0.001)	0.010*** (0.001)	0.010*** (0.001)	0.014*** (0.002)	0.014*** (0.002)	0.031*** (0.001)	0.030*** (0.001)
Apprenticeship training cert.	0.034*** (0.005)	0.035*** (0.005)	0.008* (0.004)	0.012*** (0.004)	0.023*** (0.006)	0.020*** (0.006)	0.006 (0.005)	0.008 (0.005)
Meister	0.120*** (0.005)	0.129*** (0.005)	0.035*** (0.005)	0.046*** (0.005)	0.106*** (0.008)	0.110*** (0.008)	0.039*** (0.006)	0.047*** (0.006)
University/ College degree	0.095*** (0.005)	0.102*** (0.005)	0.020*** (0.005)	0.027*** (0.004)	0.086*** (0.007)	0.090*** (0.007)	0.024*** (0.006)	0.029*** (0.006)
Doctoral degree	0.122*** (0.008)	0.130*** (0.008)	0.044*** (0.007)	0.053*** (0.007)	0.111*** (0.011)	0.118*** (0.011)	0.048*** (0.009)	0.053*** (0.009)
Skilled tasks	0.043*** (0.004)	0.045*** (0.004)	0.012*** (0.004)	0.015*** (0.004)	0.067*** (0.006)	0.067*** (0.006)	0.008 (0.005)	0.011** (0.005)
Specialized skilled tasks	0.077*** (0.005)	0.080*** (0.005)	-0.010** (0.004)	-0.004 (0.004)	0.087*** (0.007)	0.090*** (0.007)	-0.008 (0.006)	-0.001 (0.006)
Highly specialized expert tasks	0.079*** (0.005)	0.083*** (0.005)	-0.017*** (0.005)	-0.012*** (0.004)	0.097*** (0.007)	0.101*** (0.007)	-0.025*** (0.006)	-0.018*** (0.006)

*Data source:* German Administrative Employment Histories, 15 April 2012, analysis sample.

*Notes:* Reported coefficients are marginal effects of 1) transitioning to a managerial position across establishments, 2) transitioning to a managerial position within establishments or 3) staying non-promoted but changing the establishment. The reference category comprises all individuals who are not promoted. Standard errors are presented in parentheses. Asterisks indicate significance levels: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Controls are as in Table 3, panel A and panel B.

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