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Abstract

Reversing the original signaling model, this study explains how employers signal the non-observable quality of their workplace and thereby reduce labor shortages. Based on a company data set of 204 German firms, the authors find, as predicted by their theory, that the existence of a works council, an apprenticeship training program, and a high-quality incumbent workforce significantly improves recruitment success because they all reliably signal appealing work places. At the same time, frequent hiring of workers with non-matching qualifications reduces recruitment success because it signals low-quality workplaces. The authors' research reveals that certain aspects of labor relations and workplace characteristics exert a significant impact on recruitment success, which cannot be explained by conventional theoretical arguments.

AVOIDING LABOR SHORTAGES BY EMPLOYER SIGNALING: ON THE IMPORTANCE OF GOOD WORK CLIMATE AND LABOR RELATIONS

USCHI BACKES-GELLNER AND SIMONE N. TUOR*

Reversing the original signaling model, this study explains how *employers* signal the non-observable quality of their workplace and thereby reduce labor shortages. Based on a company data set of 204 German firms, the authors find, as predicted by their theory, that the existence of a works council, an apprenticeship training program, and a high-quality incumbent workforce significantly improves recruitment success because they all reliably signal appealing workplaces. At the same time, frequent hiring of workers with non-matching qualifications reduces recruitment success because it signals low-quality workplaces. The authors' research reveals that certain aspects of labor relations and workplace characteristics exert a significant impact on recruitment success, which cannot be explained by conventional theoretical arguments.

Avoiding labor shortages or job vacancies is a key factor in firms' competitiveness, particularly in innovative, high quality, or labor intensive industries. Few studies, however, whether empirical or theoretical, have considered job vacancy rates and how to avoid them. Our study, novel in its approach, investigates how employers may gain a competitive advantage in reducing

their own labor shortage through *employer* signaling¹—the reverse of *employee* signaling as introduced by Michael Spence (1973). We test the implications of our analysis by using a unique company data set that covers a large number of variables on companies' workplace characteristics, thus providing innovative and far-reaching results. We find that companies are clearly able to reduce job vacancies by signaling the quality of their labor relations through a number of observable company characteristics, ones that have so far been related neither to recruitment success nor to the avoidance of high job vacancy rates.

Such a study is warranted for a number of reasons. First, German works councils, the functional analog of workplace unions in other countries, have been extensively

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¹The existence of employer signaling towards other markets such as the capital market and also the labor market is demonstrated by Backes-Gellner and Werner (2007). They demonstrated that newly founded firms signal the quality of their firm to banks and potential employees via educational signals from the founder.

analyzed with respect to worker productivity, investment issues, or the well-being of *incumbent* workers (see for example Addison et al. (2007) or Addison et al. (2004)). Their value to *potential* employees and their *indirect* effects on productivity via improved recruitment success, however, have not been studied. Second, although apprenticeship training has been studied innumerable times with respect to earnings, productivity, or skill shortage prevention through skill enhancement, its *indirect* effect on avoiding job vacancies via improved *recruitment* success from the external workforce has been neither recognized nor empirically studied.² We find that the existence of an apprenticeship training program significantly enhances a firm's *recruitment* of skilled employees and thereby produces a dual positive effect on its ability to avoid high job vacancy rates: internal skill upgrading (which is what has been studied in the past) and external skill acquisition (which is what we introduce and study here). Thus, the choice for firms does not seem to be whether to invest in training or to poach skilled workers on the external labor market; rather, the choice is whether to invest in training *and* thereby also increase chances of recruiting externally skilled workers, or not to invest in training *and* therefore decrease chances of recruiting externally too. A poaching strategy seems particularly dangerous in tight labor markets because our results suggest that simply offering higher wages than one's competitors will usually not be sufficient. We believe therefore that a deeper analysis of employer signaling is an interesting field for future research with potentially far-reaching theoretical and empirical implications.

Inter-Firm Differences in Job Vacancy Rates: The Empirical Phenomenon

Skill shortages and job vacancies are widespread problems that occur whenever the current number of workers with particular skills

is lower than the number of jobs requiring these skills. Given any such skill shortage on the labor market, one of the major challenges for any firm is to fill its own job openings by attracting relatively more workers than others to gain a competitive advantage. And indeed, we observe that firms' ability to fill job vacancies is not at all evenly distributed. Even when severe labor shortages exist on an aggregate level, there are substantial and stable variations across firms on a disaggregated level, including firms for which there are no job vacancies at all (see Holzer 1994 or Morissette and Zhang 2001). There has been a notable lack of theoretical or empirical work, however, investigating such inter-firm differences in job vacancy rates. Micro- or firm-level empirical analyses of job vacancy rates and their determinants were, to the best of our knowledge, non-existent before our studies.

In considering reasons for such vacancies, we evaluated what we believed to be obvious economic explanations for inter-firm differences. For example, job vacancies could be the result of mismatches between the skill requirements of single firms and the skills available in the external workforce. Empirical results do not seem to support such an explanation, however. Differences in inter-firm job vacancy rates are still large when differences in skill requirements are controlled (see, for example, Backes-Gellner et al. 2006).³ Another rather simple economic explanation could be that differences in job vacancy rates occur because of inter-firm wage differentials. But here again, the data do not seem to support the hypothesis. Job vacancies are observed not only in low wage firms but also, and to a similar extent, in high wage firms (see Schmidtke and Backes-Gellner 2002). Higher wages alone obviously do not solve the labor shortage problem, at least not during the tight labor market phase of the late 1990s in Germany, the period covered

²A notable exception is Sadowski (1980), who even then argued that there is a reputation effect to training which should make it easier for firms to hire from the external labor market.

³This is in accordance with the study of Morissette and Zhang (2001), illustrating that there are at least two types of establishments with high job vacancy rates: those with fairly high skill requirements and those with high turnover in low-paid, non-unionized sectors such as retail trade and consumer services industries.

by our data. These results are compatible with what Dey and Flinn (2005) found for the U.S., although they did not *directly* study job vacancy but rather job mobility rates. In their model, firms make health insurance decisions in a cooperative manner, recognizing its productivity effects to the firm and its nonmonetary value for the employee (Dey and Flinn 2005). The resulting equilibrium is one in which not all employment matches are covered by health insurance. Wages for jobs that do provide health insurance are higher than those for jobs that do not, and workers whose jobs provide such benefits are less likely to leave those jobs even after conditioning on the wage rate. Dey and Flinn's argument that health insurance has an additional non-pecuniary value is similar to what we argue in our employer signaling model, which deals with other workplace characteristics that have an additional non-monetary value. However, Dey and Flinn were not studying inter-firm differences in job vacancy rates.

The question of why some firms are able to fill their job openings when others are not in the context of a labor shortage is the subject of this paper. Specifically, we study what differentiates one firm from another by investigating the impact of work atmosphere and labor relations. Our basic assumption is that a firm's ability to fill job openings does not exclusively depend upon monetary issues such as wages or fringe benefits. We argue, rather, that company or job characteristics that foster individual workplace satisfaction provide additional value because they may offer important comparative advantages in the recruitment process. We concentrate on *external* recruitment in our paper and control for differences in the number of job openings that may result from differences in internal staffing and recruitment success.⁴

Non-Observable Workplace Characteristics as a Recruitment Problem and Employer Signaling as a Solution

Let us assume that not all of the job

characteristics that workers prefer are directly observable to them as applicants but only become apparent to them after they have worked for a firm for some time. Let us assume, moreover, that firms with high quality workplaces may experience difficulty in reliably communicating to prospective employees their superior quality. Finally, let us assume that workers face a considerable risk in their job decisions because if they accept a job without reliable information on non-observable qualities, the decision may become quite expensive for them. Before they can reliably learn about the true quality of the firm in question, they may have turned down other job alternatives and may have invested in firm-specific human capital, including, for example, relocating, which makes it difficult or costly to reverse the original job decision. Therefore, workers would ostensibly be interested in finding reliable means to reduce their risk. We argue, in fact, that job applicants, like any other economic agent in any other market with asymmetric information, use signals to reduce the risk resulting from such asymmetric information.

Employing Spence's theory of labor market signaling (1973) and reversing it to explain inter-firm differences in recruitment success, we contend that it is not only employees, as Spence suggested, but also employers who, by means of their observable characteristics, signal their non-observable quality. Job applicants, we believe, prefer to work in firms that send such signals, even if an observable characteristic seems to be of no *direct* interest to the applicant. For example, for a skilled craftsman who has already completed his apprenticeship training, it may seem irrelevant that a company maintains an apprenticeship program since he himself no longer needs one. However, the existence of such a program may—as a signal—still be relevant to a skilled craftsman applying for a job because it serves as a reliable signal that other characteristics exist that the worker values but cannot readily observe, including challenging jobs, good long-term career prospects for employees, and company longevity. Another signal may be the existence of a works council. Although analyzed extensively with respect to their impact on the *incumbent* workforce

⁴For a systematic comparison of internal vs. external recruitment options, see Bayo-Moriones and Ortún-Angel (2006).

(e.g. Addison et al. 2007; Sako and Jackson 2006; Heywood and Jirjahn 2002; Bellmann and Blien 2001), we argue that there is a second and perhaps similarly important effect of a works council, namely, its signaling effect to *potential* employees. In fact, the mere existence of works councils may increase the attractiveness to potential employees and thereby strongly improve recruitment success. Specifically, works councils may signal more job security or a particularly attractive work ethos, just as other human resources (HR) practices and labor relations issues may serve as valuable signals of a positive work atmosphere and thereby help reduce job vacancies and labor shortages.⁵

Employer Signaling: Theoretical Analysis

To be valid, an observable characteristic must meet a few requirements. Following Spence (1973), we begin by assuming that prior to accepting a job offer, prospective employees cannot directly observe all preferred job or company characteristics (they may be non-observable or else not verifiable, with tolerable costs). At the same time, it is important to recognize which of a firm's readily observable characteristics function as reliable signals for non-observable workplace quality. In the original *employee* signaling model, Spence (1973) derived conditions which have to be met to render an individual characteristic a *reliable* signal. We apply his analysis to employer signaling to derive two conditions for reliable *employer* signaling.

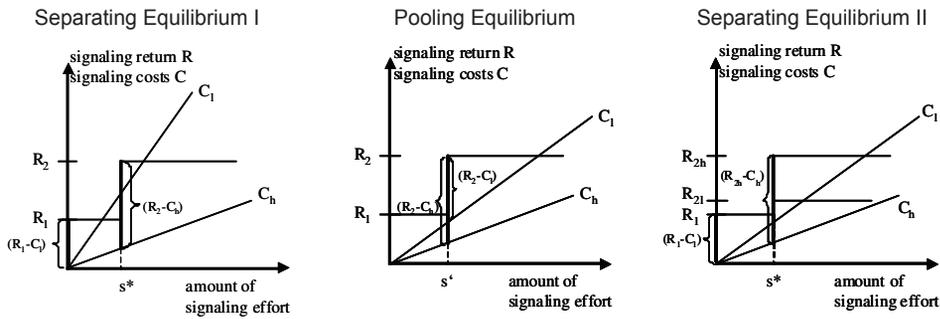
First, assuming that the marginal product of employees possessing certain signals is equal to the wages paid for these signals, potential employees are, according to Spence's (1973) original model, paid higher or lower wages depending upon their possession of a particular signal. Although signals themselves are generally alterable, they come with a cost.

In Spence's original model, for example, employees only invest in a signal (a higher or lower educational level) if the wage gains attached to the signal exceed their individual costs of acquiring this signal. Accordingly, we assume in our model that *employers* signal their non-observable job quality to potential employees through observable company characteristics; however, establishing these company characteristics also comes with a cost. Therefore, companies only invest in a signal if their recruitment gains exceed their costs. To ensure that an acquired characteristic is a *reliable* signal and not just cheap talk or a marketing trick, signaling costs must be sufficiently negatively correlated with the non-observable quality (Spence 1973:358–59)—in our case, with the preferred workplace attribute. We demonstrate this with a well known diagram from Ehrenberg and Smith (2003:293). We have adapted it in panels 1, 2, and 3 of Figure 1 to make it fit the problem of employer signaling.

The costs for employers with highly desirable jobs to produce a signal for their attractiveness are defined by C_h ; the costs for employers with undesirable or unattractive jobs by C_l . The returns are R_2 for employers who acquire the signal, and R_1 for those who do not. Returns in our case are defined in terms of increased competitiveness through improved recruitment success. Given the particular cost and return structure in Diagram 1, there will be a separating equilibrium because the net return ($R - C$) for highly productive employers is largest if they acquire the signal ($[R_2(s^*) - C_h(s^*)] > [R_1(0) - C_h(0)]$), and the net returns ($R - C$) for less productive employers are highest if they do not acquire the signal ($[R_1(0) - C_l(0)] > [R_2(s^*) - C_l(s^*)]$). In the second panel, however, costs are not sufficiently negatively correlated with productivity. The costs for employers with unattractive jobs to produce a signal for attractiveness are much lower in this panel, so that now their net return is highest if they acquire the better signal ($[R_2(s') - C_l(s')] > [R_1(0) - C_l(0)]$). Since nothing has changed for employers with highly attractive jobs, they still also choose to acquire the better signal ($[R_2(s') - C_h(s')] > [R_1(0) - C_h(0)]$). The result is a pooling equilibrium in which

⁵Note that according to Spence (1973:368) an observable characteristic may also have a direct value in addition to the signaling value. As long as the direct value does not cover the full costs of producing the signal, an observable characteristic may still function as a signal (for more information see the theoretical section of this paper).

Figure 1. Separating and Pooling Equilibria



employers with attractive or unattractive jobs are not separated by the signal. These are the two situations distinguished in Spence's (1973) model.

We further argue that a separating equilibrium can also occur if there are sufficient differences in returns, which is demonstrated in panel 3. Returns for employers with highly attractive workplaces (R_{2h}) are now higher than returns for employers with low quality workplaces (R_{2l}), but costs are not different. However, the market result is the same as in panel 1: *net* returns for employers with attractive workplaces are largest if they acquire the signal ($[R_{2h}(s^*) - C_h(s^*)] > [R_1(0) - C_h(0)]$), and *net* returns for low quality employers with unattractive workplaces are highest if they do not acquire the signal ($[R_1(0) - C_1(0)] > [R_{2l}(s^*) - C_1(s^*)]$). Thus, despite rather small or no differences in the cost structure, a separating equilibrium may still evolve if the return structures differ substantially. Differences in returns become possible, for example, if we assume that workers are more motivated in a truly attractive workplace with a positive work atmosphere. They are then likely to be more productive for such firms, and the returns of each additional worker are ostensibly higher for these firms. We discuss these and other situations specifically below.

The second condition that an observable company characteristic must meet to become a valid signal is that it ought to be closely related to the preferred (but non-observable) job characteristics of (potential) employees. For our analysis of employer signaling, this means that if employee preferences differ, the

signals they care about also differ. Thus, an observable employer characteristic may be a signal with respect to some types of workers but not to others. To test our employer signaling idea, therefore, we need information on the job attributes that particular groups of employees care about.

A number of studies in social psychology or in human resources management (HRM) literature provide information on job attributes workers find attractive and satisfying (for a brief overview, see Boswell et al. 2003). They reveal substantial differences in preferences between different groups of workers, to which we return below, but they find one universal preference: the overwhelming importance of soft characteristics, such as work atmosphere, participation, corporate culture, career perspectives, personal development, or challenging tasks. Thus, soft characteristics are presumably as important as for example wages or classic fringe benefits for workers deciding on a job offer (see Boswell et al. 2003). However, these soft characteristics are usually non-observable for potential employees, and so, as suggested earlier, workers are indeed in position of asymmetric information and must find a way to obtain credible information before they make their job decision.

In addition to the universally preferred soft characteristics mentioned above, other job characteristics exist for which preferences differ substantially among different groups of workers. According to previous studies of workers' job preferences, it is important first to distinguish between blue- and white-collar workers because these two groups differ sig-

nificantly in a large number of preferred job attributes (see Gruber et al. 1993). Second, workers differ according to skill level (or hierarchical level) since higher- or lower-skill level employees also differ substantially in their preferences for certain job attributes (see Schmidtke 2002). Accordingly, an analysis of employer signaling should distinguish four groups of employees: “unskilled/semi-skilled blue-collar workers,” “skilled blue-collar workers,” “skilled white-collar workers,” and “managerial staff”—a distinction consistent with the recruiting divisions observed in many human resources departments and that implicitly confirms the relevance of this categorization. Due to data availability and space limitations, we focus only on the latter group, that is, skilled blue-collar workers, which is also the group where labor shortages were most severe in the sample companies in the time period in question.

In what follows, we first identify the job preferences and workplace attributes that skilled blue-collar workers consider important. We then introduce a set of observable company characteristics which may serve as a signal for the preferred yet unobserved workplace attributes.

Job Preferences of Skilled Blue-Collar Workers

For Germany, the source of our company data, Schmidtke and Backes-Gellner (2002) analyzed the impact of different company and job characteristics on job satisfaction using the 12th wave of the German Socio-Economic Panel. They used ordered probit estimates to study the determinants of job satisfaction and found a positive work environment, challenging or interesting tasks, career prospects, job security, and net wages to be highly valued by skilled blue-collar workers. They found no clear preferences, however, for fringe benefits, autonomous workplaces, or performance evaluation. At the same time, longer regular weekly working hours had a negative effect on job satisfaction. Similar results were found by Sousa-Poza and Sousa-Poza (2000) in a large cross-national analysis that included Western European countries

(among them, Germany) and Anglo-Saxon countries (including the United States). They found that an interesting job as well as good worker-management relations (a measure of work environment) to be the two most important determinants of job satisfaction across all countries. Job security, career prospects, and high income also had a significantly positive affect. These findings were further supported by Gaertner (1999), using data from the U.S., Korea, and Kenya. Following these studies, we concentrated on four job attributes in our analysis, namely, work atmosphere, job security and career prospects, challenging tasks, and high-quality workplaces. Since none of these are directly observable to a job applicant, reliable signals are crucial for both applicant and employer.

Observable Company Characteristics as Potential Signals

According to our reversed signaling model, an observable company characteristic may become a valid signal if it is closely related to the preferred workplace characteristics and if the net returns of acquiring the characteristic are substantially lower for employers with high quality jobs than for employers with low quality jobs (otherwise, as we discuss above, an observable company characteristic could well be merely a marketing trick). Since it is impossible for us as researchers, just as it is for job applicants, to obtain precise information on net costs, we have to rely on qualitative reasoning to identify potential signals (for a list of potential signals see Table 1).⁶ Empirical results will reveal whether the characteristics we have identified here are indeed used as signals in the labor market for skilled blue-collar workers, for then employers with these characteristics would have a competitive advantage on the labor market and should as a result experience lower job vacancy rates than employers without these signals (all else being equal).

⁶As argued in the theoretical section, it is not a precondition that an observable characteristic has no direct value to the worker in order to become a valid signal. Therefore, column 2 of table 1 is theoretically not restricted to job attributes workers do not care about.

Table 1. Potential Signals for Skilled Blue-Collar Workers

<i>Potential signals (observable characteristics)</i>	<i>Non-observable but highly valued characteristics</i>
Apprenticeship training Systematic continuing vocational training programs	Career prospects
Works council	Job security
Works council Regular shop-floor meetings	Work atmosphere
Overall skill level of workforce (approximated by percentage of skilled blue-collar workers) Recruitment of workers with non-matching qualifications Apprenticeship training Systematic continuing vocational training programs	Challenging/interesting tasks and workplaces

The first two variables we use as potential signals for skilled blue-collar workers are *existence of apprenticeship training* and *provision of a systematic continuing training program*, which we assume signal challenging jobs and career opportunities. *Apprenticeship training* is assumed to be a reliable signal for challenging jobs because returns from apprenticeship training are certainly higher for firms using these skills later on; therefore, the existence of apprenticeship training signals skill-demanding or challenging jobs for skilled blue-collar workers. Additionally, since an investment in training only pays off if the amortization period is sufficiently long, the existence of apprenticeship training also signals good long-term and career prospects. Only firms confident of their market longevity are willing to invest extensively in training (apprenticeships typically involve three years of intensive training). And only firms confident that their jobs are sufficiently attractive to retain apprentices after graduation (because they offer good career prospects to employees) are willing to invest substantially in training. Therefore, offering an apprenticeship program may be used as a valid signal for jobs with good long-term prospects and with sufficient career prospects. Similarly, the existence of a *systematic continuing training program* may be used to signal challenging jobs and good long-term prospects.

Just as apprenticeship or other training programs signal valued jobs for skilled blue-collar workers, we argue that a works council can act as a signal for job security and a good working environment because works councils

are generally thought to aim at securing jobs and ensuring a positive workplace setting for precisely this group. Despite the fact that according to German Co-determination Law, all workers in firms above a certain size have the *right* to establish a works council, not all firms have them. In fact, a large proportion of companies do not have a works council, and one of the reasons may be that companies implicitly or explicitly discourage workers from exerting their rights. It could be that these companies may not be helpful in setting up the election procedures; they may hamper preparatory meetings or other activities; in the worst case, they may even try to threaten workers to avoid works councils. As a result, only 16% of all companies covered by co-determination law actually have a works council.⁷ Thus, the existence of a works council is not a given and can therefore act as a potential signal for work environment to job applicants.

Even if the work environment itself may be observable to some extent, one should note that the observation is not necessarily reliable, for at least two reasons. First, job applicants coming from the external labor market may only briefly glimpse the company, which offers them a highly random and incomplete picture of the work atmosphere. Second, the company can be assumed to report on work

⁷According to German Co-determination Law workers in firms with more than 5 employees (with slightly changing thresholds over the years) have the right to establish a works council, but a large number of companies do not have a works council (see Addison et al. 2002).

atmosphere with a positive bias (knowing that the applicant will have substantial difficulty in verifying such information), and a query of several incumbent employees does not yield reliable information either (because for obvious reasons incumbent workers may not be willing to make negative statements about their work atmosphere to an outsider). A job applicant can, however, easily and reliably find out about the existence of a works council. Regarding the second condition for valid signals, it seems reasonable to assume that the costs of negotiating with a works council are lower in companies with a better work atmosphere than in companies with a poor work atmosphere (due to insecure and unattractive jobs) because for the latter the potential for conflict is much stronger and more frequent and therefore more costly. In turn, companies with a poor work atmosphere have an interest in discouraging the establishment of a works council. Thus, the existence of a works council does not pay as a mere marketing trick and can therefore serve as a reliable indicator of a firm with a positive work atmosphere and high job security for skilled blue-collar workers.

An alternative although less strong signal may be other forms of worker participation such as *regular, institutionalized shop-floor meetings*, which, similar to works councils, may signal a good work atmosphere. Although shop-floor meetings may from an employer's point of view primarily be used to encourage information sharing and enhance the efficiency of employees, they may still signal a good work atmosphere because presumably such meetings are only effective if a company has an open communication culture, which first and foremost requires a good work atmosphere. Regular shop floor meetings, like works councils, do not pay as a marketing ploy since the cost of such meetings would be too high if working conditions are poor. Returns are higher, moreover, because shop-floor meeting outcomes are positive only if workers are willing to participate cooperatively and productively, which is more likely under better working conditions. We assume applicants can accurately find out about institutionalized shop floor meetings simply by asking randomly selected workers, since

talking about having meetings can hardly be regarded as confidential information.

So far we have discussed how firms' apprenticeship or continuing training programs signal long-term career prospects, and the existence of works councils or regular shop-floor meetings signal job security and a positive work environment. The third variable by which firms signal a non-observable but highly valued workplace characteristic is the skill structure of its workforce (measured by the *percentage of skilled blue-collar workers*). In this third case, we argue that the skill structure of *incumbent* workers reliably signals the quality of the jobs. Such workers, who in principle value the same attributes as skilled *applicants*, would not remain with a firm that offered only monotonous, unchallenging jobs. Thus, firms with more challenging jobs not only need more skilled workers but are also able (and willing) to retain a higher share of skilled workers than firms with less challenging jobs.⁸ It would not pay the latter to fill their jobs with highly skilled workers, who are too expensive to employ anyway if a company only requires its workers to perform simple tedious tasks. Accordingly our hypothesis is: The higher the percentage of skilled blue-collar workers, the lower the job vacancy rate for skilled blue-collar workers (although this might appear to be counterintuitive).

In a similar fashion, the extent to which a firm hires workers with a *non-matching occupational background* to fill a job vacancy may also signal challenging jobs and high quality workplaces. That is, a job opening intended for a mechanical engineer that is filled by an electrical engineer may indicate that the job cannot really be professionally challenging or that quality standards are rather poor. Thus, if vacancies are more frequently filled with workers with non-matching occupational qualifications, this can be interpreted as a

⁸ We use the percentage of skilled blue-collar workers as a proxy for the more qualitative information a job applicant may gather; that is, we do not assume that job applicants really have the exact percentages, we only assume that they obtain a qualitative but nevertheless reliable impression of skill structure by just talking to people.

signal for professionally less challenging jobs. (Here, again, we do not assume that applicants know the exact proportion of jobs with non-matching qualifications, as we do in our data set, but have, rather, a more qualitative picture).

All these signals should help to explain inter-firm differences in job vacancy rates because they render a company more attractive on the external labor market and can therefore be expected to improve recruitment success: more employees are willing to accept a job offer from such a company causing the job vacancy rate to decline. Since it is plausible to assume that better *quality* workers (given a formal skill level) care more about signals for challenging tasks, one might expect the fraction of high quality workers to be larger in companies with positive signals than one with negative signals. Although it would be interesting to study the impact of signaling on the *quality* of workers, our data are not sufficient to do so. Future research should try to address this problem but would need detailed information on individual productivity to do so.

The Impact of Potential Signals on Job Vacancy Rates: Empirical Analysis

In this section we test whether the signals listed in Table 1 help to explain inter-firm differences in recruitment success measured by a comparatively low job vacancy rate.

Estimation methods

To test the impact of our signals on job vacancy rates we estimate the following basic model:

$$\begin{aligned}
 \text{VACANCYRATE} = & \beta_0 + \beta_1 \text{APPRENTICESHIP} + \\
 & \beta_2 \text{CONVOCTRAINING} + \beta_3 \text{WORKSCOUNCIL} + \\
 & \beta_4 \text{REGULARMEETINGS} + \beta_5 \text{SKILLEDWORKERS} + \\
 & \beta_6 \text{NONMATCHQUALS} + \delta \cdot X + u
 \end{aligned}$$

VACANCYRATE is the *number of vacant jobs* for skilled blue-collar workers divided by the total *number of job openings* for skilled blue-collar workers (that is, the sum of vacant and filled jobs). Thus, the dependent variable can be a value between 0, signifying a firm that was totally successful in recruiting workers,

and 1, a firm that was totally unsuccessful in recruiting skilled blue-collar workers. Since we focus on external recruiting, our variable *job openings* does not include internal job openings, that is, jobs filled from within the company. Further, since the dependent variable VACANCYRATE has no negative value⁹ but may take a value that includes fractions of zero because many firms have zero vacancies, ordinary least square estimations are not appropriate. In accordance with Wooldridge (2003:565–73) we use a tobit model to account for this.

As explanatory variables, we use our signaling variables as they are laid out in Table 1: existence of apprenticeship training (APPRENTICESHIP), continuing vocational training (CONVOCTRAINING), works council (WORKSCOUNCIL) and regular or institutionalized shop-floor meetings (REGULARMEETINGS), percentage of skilled blue-collar workers (SKILLEDWORKERS), and recruitment of workers with non-matching qualifications (NONMATCHQUALS).

In addition, we added a broad set of control variables, including company size, location, industry, various HRM measures (including fringe benefits), and some variables characterizing the reputation of the product or the firm. Last, we controlled for the overall number of job openings because the greater the number of these may make it more difficult to fill all openings, thereby increasing job vacancy rates; alternatively, it may allow a firm to recruit more efficiently and thereby reduce job vacancy rates. In other words, recruitment may be more efficient because companies with a larger number of openings may be able to afford to hire recruiting specialists, or because a larger number of openings indicates higher growth rates and thereby makes companies more attractive for potential employees. Thus, empirically, job openings could be positively or negatively correlated with vacancy rates, but in either case this variable has to be controlled for.

⁹Although some firms might have more applicants than jobs for which they wish to fill a particular position, job vacancies would not fall below zero; they would simply fall to zero.

Additionally, we must address one further methodological problem because job openings may not be an exogenous variable but an endogenous one. That is, unobserved firm characteristics may affect both the number of job openings and the job vacancy rate within a firm. For example, well managed firms may be able to avoid job openings because their HR department is well organized and able to anticipate future labor needs, and for the same reasons well managed firms may be able to avoid job vacancies. Thus, to avoid endogeneity problems of the variable job openings, the variable is instrumented. We use the variable *labor office grants* as an instrumental variable because we may assume it to be highly correlated with *job openings* but not with reducing job vacancies for *skilled blue-collar* workers. We can assume this because the aim of these grants is to encourage companies with job openings to hire unemployed, unskilled workers. Thus, the variable is clearly related to *job openings*, but it is not directly related to the *job vacancy rate for skilled blue-collar workers*, because the labor office grants are linked to the employment of *unskilled* workers who are widely available on the external labor market (unlike skilled blue-collar workers who were generally scarce in the period observed). Thus, we can use *labor office grants* as an instrumental variable and take the following steps to solve potential endogeneity problems. First, we estimate the impact of the independent variables plus an instrumental variable on the number of job openings. Second, we estimate job vacancy rates by using the *estimated job openings* from the first step in our regression equation.

Data

We used a dataset based on 740 companies collected in 1999¹⁰ with a special focus on

skilled workers and competitiveness of firms, commissioned by the Institute for Small and Medium Sized Enterprises, Bonn.¹¹ It contains a large number of variables well suited to testing our hypotheses. Firms were asked to report the number of vacant jobs as well as the number of job openings they filled from the external labor market. We used these two numbers to construct our dependent variable *job vacancy rate*, which is the number of vacant jobs for skilled blue-collar workers divided by the number of vacant plus externally filled jobs for skilled blue-collar workers. We also used a large number of variables on labor relations, workplace and company characteristics.¹² The reason for using this particular data set instead of other larger surveys for Germany is that none of the larger surveys provides sufficiently detailed information for our signaling analysis. For example, we needed information on job vacancy rates broken down by type of worker, on recruitment of workers with non-matching qualifications for skilled blue-collar jobs, and on informal meetings, which is not available in other company data sets such as for example the well known IAB-Establishment Panel of the Institute for Employment Research of the Federal Employment Service.

Since we were interested in studying the inter-firm difference in *job vacancy rates of skilled blue-collar* workers we first excluded companies with no job openings and second with no skilled blue-collar workers, reducing our sample to 306 companies.¹³ After eliminating observations with missing data in our

in all these situations companies may gain a competitive advantage over other firms by employer signaling.

¹¹We thank the Institute for Small and Medium Sized Enterprises, Bonn, and particularly Rosemary Kay and Peter Kranzusch, who collected the data set and allowed us to re-use their data in our project.

¹²See Backes-Gellner et al. (2000) for the questionnaire.

¹³Since our theoretical and therefore empirical analysis focuses on *skilled blue-collar* workers and on firms with job openings, the large reduction in sample size is only a minor problem. Results are anyway only generalizable to firms with skilled blue-collar workers and to firms with job openings. However, a comparison of the statistical means for the full sample and the reduced sample reveals hardly any differences.

¹⁰The year 1999 stands for a typical time period of prosperity, characterized by severe labor shortages in Germany (see Backes-Gellner et al. 2000). After the recession at the beginning of the 21st century, labor shortages became a less severe problem. Recent economic developments, however, indicate that shortages may again become a severe problem (Kettner 2007). Results are generalizable to other countries/labor markets or other time periods with severe labor shortages, because

Table 2. Definitions and Descriptions of Variables

Variable	Definition	Mean (s.d.)
Job vacancy rate for skilled blue-collar workers	Number of vacant jobs divided by job openings (sum of vacant and filled jobs for skilled blue-collar workers), in %	0.072 (0.196)
<i>Potential signals</i>		
Apprenticeship	1 if there are apprentices in the company, 0 otherwise	0.725 (0.447)
Continuing vocational training	1 if workers have the opportunity to take part in continuing vocational training, 0 otherwise	0.985 (0.121)
Works council	1 if a works council exists, 0 otherwise	0.485 (0.501)
Shop-floor meetings	1 if regular shop-floor meetings are held, 0 otherwise	0.868 (0.340)
Percentage of skilled worker share	Number of skilled blue-collar workers divided by the total number of workers	40.968 (23.912)
Non-matching qualification workers	Frequency of recruitment of non-matching workers, often = 5 to never = 1	2.721 (1.367)
<i>Control variables</i>		
<i>Personnel policy</i>		
Participation in decisions	1 if workers informally participate in important company decisions, 0 otherwise	0.515 (0.501)
Flexibility of working time	1 = high flexibility to 4 = fixed working time	2.059 (1.297)
Compensated overtime	1 if overtime is paid or compensated by additional vacation days, 0 otherwise	0.775 (0.419)
Uncompensated overtime	1 if overtime is unpaid, 0 otherwise	0.088 (0.284)
Wage above regional level	1 if wage is above regional level, 0 otherwise	0.461 (0.500)
Advertising	1 if help-wanted ads in regional newspapers, in professional journals or on the Internet, 0 otherwise	0.779 (0.416)
Visibility in the labor market	1 if industry leader in visibility in the labor market, otherwise	0.147 (0.355)
Monetary fringe benefits	1 if company pension, bonuses, stock ownership plans or loans are offered, 0 otherwise	0.824 (0.382)
Non-monetary fringe benefits	1 if additional vacation days, company cars or other non-monetary fringe benefits are offered, 0 otherwise	0.441 (0.498)

Continued

explanatory variables, we were left with a sample size of 204 firms.¹⁴ On average, 7.2% of job openings for skilled blue-collar workers remained vacant at the end of the year, with a standard deviation of 19.6%, indicating that there were indeed large inter-firm differences in job vacancy rates. Descriptions for all ex-

planatory variables are given in Table 2. Two of our signaling variables, *regular shop-floor meetings* and *continuing vocational training*, vary hardly at all (almost every company claims to have them), so the variables we were able to measure may not be precise and discriminating enough to function as a valuable signal.

Estimation Results

Table 3 provides our regression results. The first column (specification 1) records results for an estimation without accounting

¹⁴According to Green (1991:503) a sample of 204 observations is enough to identify medium size effects for a set of 26 variables. Moreover, there are practically no significant differences between the full and reduced sample.

Table 2. Continued

Variable	Definition	Mean (s.d.)
<i>Product & firm reputation</i>		
Product development	1 if market leadership in product development, 0 otherwise	3.598 (0.902)
New technologies	1 if market leadership in using new technologies, 0 otherwise	3.657 (0.957)
Closeness of customer relations	1 if market leadership in closeness of customer relations, 0 otherwise	4.059 (0.699)
Fluctuation (quota)	Number of workers who left the company in 1998 divided by total number of workers	9.894 (14.612)
<i>Company characteristics</i>		
Number of employees	Number of employees (log.)	4.166 (1.625)
West/East	1 if company is located in West Germany, 0 if East Germany	0.569 (0.496)
Manufacturing	1 if company is in manufacturing industry, 0 otherwise	0.564 (0.497)
Construction	1 if company is in construction industry, 0 otherwise; Reference	0.123 (0.329)
Trade	1 if company is in trade, 0 otherwise	0.123 (0.329)
Professional activities	1 if company is in professional activities industry, 0 otherwise	0.064 (0.245)
Other services	1 if company is in other services industry, 0 otherwise	0.123 (0.329)
Job openings	Number of hirings and vacant jobs divided by the total number of jobs, in %	16.766 (19.686)

for potential endogeneity whereas in the second column (specification 2) the explanatory variable *job openings* is instrumented to account for endogeneity problems.¹⁵ However, a comparison of specifications 1 and 2 demonstrate, the results of both estimation methods are similar for all *signaling variables*.¹⁶

As expected, we found that firms offering *apprenticeship training* had lower job vacancy

rates, meaning they were more successful in recruiting from the external labor market than were firms without apprenticeship training. Since skilled blue-collar workers by definition have already completed their apprenticeship, this is very strong evidence in favor of the *signaling* explanation we propose. Skilled workers do not benefit directly if a company offers apprenticeship training, and yet they may regard it as a signal for a high quality workplace with a potential for long-term prospects and favorable career options. Firms that offer such training signify that they are an attractive employer, which gives them a competitive advantage in recruiting skilled blue-collar workers and reducing labor shortages. At the same time, however, our empirical results reveal that the existence of *continuing vocational training* as measured in our questionnaire does not significantly reduce job vacancies (although the coefficient points in the expected direction). But the absence of significance may be explained by problems of the variable, which differenti-

¹⁵A specification test (Hausman 1978) shows that an instrumental variable estimation is necessary, because the difference between ordinary least squares estimators and instrumental variable estimators is significant, indicating that the variable *job openings* is endogenous.

¹⁶There are some differences between specifications (1) and (2) among the control variables. The variable *JOB OPENINGS* does not have a significant effect in column (1) but has a significantly negative coefficient if endogeneity is controlled for in specification (2). Thus, companies with larger numbers of job openings have lower job vacancy rates. They are obviously better able to fill their job openings either because their recruiting is more professional or because they are more attractive employers with higher job growth.

Table 3. Tobit Estimation of the Job Vacancy Rate for Skilled Blue-Collar Workers

Variable	Specification (1)		Specification (2)	
	Coef.	Std.Error	Coef.	Std.Error
<i>Potential signals</i>				
Apprenticeship	-0.229**	(0.105)	-0.498***	(0.147)
Continuing vocational training	-0.284	(0.392)	-0.341	(0.384)
Works council	-0.197*	(0.111)	-0.379***	(0.133)
Shop-floor meetings	0.030	(0.120)	0.077	(0.118)
Skilled worker share	-0.005**	(0.002)	-0.003*	(0.002)
Non-matching qualification workers	0.040*	(0.024)	0.113***	(0.036)
<i>Control variables</i>				
<i>Personnel policy</i>				
Participation in decisions	-0.064	(0.066)	-0.017	(0.062)
Flexibility of working time system	0.033	(0.027)	0.051*	(0.027)
Compensated overtime	0.086	(0.094)	0.216**	(0.106)
Uncompensated overtime	0.191	(0.121)	0.467***	(0.143)
Wage above regional level	0.008	(0.065)	-0.126*	(0.074)
Advertising	0.209*	(0.107)	0.376***	(0.134)
Visibility in the labor market	-0.296**	(0.129)	-0.394***	(0.133)
Monetary fringe benefits	-0.095	(0.103)	-0.187*	(0.102)
Non-monetary fringe benefits	0.043	(0.076)	-0.086	(0.088)
<i>Product & firm reputation</i>				
Product development	-0.064	(0.050)	-0.033	(0.048)
New technologies	0.031	(0.040)	0.024	(0.037)
Closeness of customer relations	0.025	(0.049)	0.107**	(0.052)
Fluctuation (quota)	0.006**	(0.003)	0.022***	(0.006)
<i>Company characteristics</i>				
Number of employees	-0.014	(0.030)	-0.053	(0.033)
West/East	0.133*	(0.073)	0.022	(0.075)
Manufacturing	0.032	(0.113)	0.284**	(0.139)
Trade	-0.207	(0.134)	-0.008	(0.142)
Professional services	-0.472*	(0.268)	-0.753***	(0.255)
Other services	-0.165	(0.147)	0.214	(0.184)
Job openings	0.001	(0.002)	-0.033***	(0.011)
Constant	0.172	(0.471)	0.041	(0.457)
Prob > χ^2		0.007		0.002
McFadden-R ²		0.294		0.329
N	204		204	

Notes: Specification (1) is a simple tobit estimation of equation (1); in specification (2) the variable job openings is instrumented. Robust standard errors are in parentheses.

*Statistically significant at the .10 level; **at the .05 level; ***at the .01 level (two-tailed tests). For more information about McFadden-R² see McFadden (1974).

ates very little between firms and does not cover different types of training (which may be important for a signal).

We also found, as expected, that the existence of a *works council* reduces the vacancy rate significantly. Job applicants regard its existence as a signal for job security or for attractive workplaces with good career prospects and are more willing to accept job offers from companies with a works council, thus providing firms with a competitive advantage

on the labor market for skilled blue-collar workers. Even if job applicants expect to benefit directly because of the existence of a works council (for example, if they themselves are interested in becoming a works council member), for most applicants it is probably the signaling value that matters most, for not all job applicants can seriously expect to become a works council member or earn a direct private return. Thus, it is more the *overall* workplace attractiveness that is

signaled by the existence of a works council rather than the direct benefit of works councils, which makes job applicants more likely to accept jobs and gives firms a competitive advantage on tight labor markets for skilled blue-collar workers. However, *regular shop-floor meetings* as measured in our questionnaire do not have a significant effect on job vacancy rates. The absence of significance may again be explained by statistical problems of this variable: it hardly varies and there may be too many different types of meetings that we are unable to distinguish but may nevertheless be important in order to identify a clear signal.¹⁷

Once more, as expected, the *share of skilled blue-collar workers* significantly reduces the job vacancy rate and *employment of workers with non-matching qualifications* significantly increases job vacancy rates. Skilled workers are obviously interested in firms with a highly skilled workforce because it signals high quality standards and challenging jobs, but they are not interested in working in firms where jobs are often filled by workers with non-matching qualifications since this signals professionally non-challenging jobs and/or low quality standards.

The results for the control variables contain no surprises; therefore, we will not elaborate here except to point out two theoretically and economically important results. We find that *high wage levels* significantly reduce job vacancies, as any economic theory would suggest. Additionally, we find that the existence of *monetary fringe benefits* significantly reduces job vacancy rates. For companies paying *wages above regional level* it is obviously easier to recruit from the external labor market to reduce skill shortages,¹⁸ and for companies

providing *monetary fringe benefits* it is easier to recruit skilled blue-collar workers. Thus, as Dey and Flinn (2005) have already argued, the attractiveness of a workplace is not fully determined by the level of wages; rather, workers attach additional value to particular fringe benefits such as company-provided health insurance, as the Dey and Flinn study illustrates, or other *monetary fringe benefits*, as our study demonstrates.¹⁹ We also find, however, that money is not all that matters because our signaling variables have a considerable impact on reducing job vacancies; the effect is at least as important as paying above average wages or offering monetary fringe benefits.

Conclusions

In this paper we have demonstrated how some firms are able to gain a competitive advantage on the labor market despite an aggregate shortage in skilled workers, thereby helping to explain inter-firm differences in job vacancy rates. Our study is the first to analyze, both theoretically and empirically, the role of employer signaling in attracting skilled workers. Previous psychological or human resources studies on workers' preferences have indicated that soft characteristics of a job or workplace are important in a skilled worker's job choice. However, no previous research has illustrated precisely how these typically *non-observable* soft characteristics are credibly communicated. We have suggested a novel theoretical approach by reversing Spence's original signaling model to explain how *employer* signaling may help a firm to

¹⁷For example, in academia, where administrative meetings would have to be distinguished from research seminar meetings, having more of the former would be a negative signal whereas having more of the latter would be a positive signal in recruiting high quality faculty members. A similar distinction may be important for skilled blue-collar workers, but since we cannot distinguish different types of meetings with our questionnaire our variable REGULARMEETINGS may not represent the real signal and thus make it impossible to capture a significant signaling effect.

¹⁸Unfortunately, we do not have absolute wage levels in our data set. But we assume that the *relative* wage

level is even more important for workers deciding on whether to accept a job or not. Moreover, omitting the absolute wage level only makes the test tougher. If there is a relationship between the absolute wage level and the potential signals it is most likely positive: firms paying higher wages are less impelled to invest in signals to attract potential employees. Thus, omitting absolute wages causes results to be downward biased and with a lower probability for significant results.

¹⁹Company-provided health insurance is a minor issue on the German labor market because all workers are covered by mandatory health insurance and by law, all firms must pay half of the insurance premium.

improve recruitment success and thereby gain a competitive advantage on tight labor markets. We have determined which criterion a company characteristic must meet to become a valid signal and have used a company data set to test our predictions. Our empirical results demonstrate that some company characteristics exert a significant effect that cannot otherwise be explained by conventional theoretical arguments. For example, the *existence of apprenticeship training* improves the recruitment success of skilled blue-collar workers even though skilled workers have already finished their apprenticeship and are therefore not interested in apprenticeship training *per se*. Companies offering apprenticeship training reduce labor shortages not only by upgrading skills within their own workforce (which has been studied), but also by improving their recruitment success among skilled workers from the external labor market.

The findings of our study go beyond what has been published about company characteristics and their impact on reducing labor shortages among individual firms. For example, although works councils have often been analyzed with respect to productivity effects or the well being of *incumbent* workers, their value to *potential* employees and their *indirect* effects via improved recruitment success have not been studied. Likewise, apprenticeship training has been studied extensively with respect to earnings or productivity, but its *indirect* effect on avoiding job vacancies via improved recruitment success has not been studied. Only the use of the employer signaling approach pointed at studying the dual effect of training on reducing job vacancy rates: internal upgrading of

skills and improved external skill acquisition. The advantage of our employer signaling model is that it helps to identify variables which would otherwise not be considered important or which would sometimes even be regarded as having the opposite effect on job vacancies. The existence of apprenticeship training may not at first glance appear to be important in the recruitment of skilled workers. However, with our employer signaling model it is clear why apprenticeships could still be important. Interestingly, such non-observable characteristics and their corresponding signals appear to be at least as important as wages.

An important and far-reaching consequence for labor relations and human resources management issues is that workplace or company characteristics should be evaluated not only in the context of their original goals and direct effects, that is, by the returns they generate within their own policy field, but also by their signaling value or indirect effects in other policy areas. For example, the existence of apprenticeship training should be evaluated by the productivity effects of each individual apprentice as well as by its effect on improved recruitment. Alternatively, works councils should be evaluated by their direct effect—the participation and co-determination of *incumbent* workers—and by their additional signaling effect on the external labor market, or in other words their value for *potential* employees. Our results indicate that given an aggregate labor market shortage for skilled workers, individual companies can significantly improve their relative position and ensure above average hiring rates by sending high quality signals to potential employees.

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