Avoiding Labor Shortages by Employer Signaling – On the Importance of Good Work Climate and Labor Relations

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Abstract

Avoiding labor shortages for skilled employees is one of the major challenges for highly competitive firms acting in tight labor markets. The ability to avoid labor shortages on the company level, for example measured by the share of vacant jobs, is distributed very unevenly and cannot in general be explained by differences in wages and compensation packages as standard economic theory would suggest. In our paper we present a theoretical explanation for large and persisting inter-firm differences in job vacancy rates. Many psychological studies show that unobservable job and company characteristics such as work atmosphere or individual self determination are crucial for employees' job choices. However, since these characteristics are not reliably observable to an outsider, we argue that potential employees use other, on the surface nonessential company characteristics as signals for their preferred characteristics in their job decision. To derive empirically testable hypotheses we reverse Spence's labor market signaling model and study how employers can reliably signal the quality of their work climate and labor relations to potential employees. We use a rich data set from approximately 700 firms to test our hypotheses and do find in fact that formal features of labor relations which on the surface may not seem relevant for recruitment success of skilled workers nevertheless exert significant effects on recruitment success and job vacancies.

Skilled employees are one of the core factors in the competitiveness of firms in industrialized countries. Recruiting and retaining skilled employees are thus at the heart of competitiveness. Successful recruitment is particularly important for firms operating in tight labor markets where the number of jobs for skilled workers exceeds the number of skilled workers that are available to fill the jobs appropriately. One of the major challenges of general and human resource management in these firms is their ability to satisfactorily and instantaneously fill job openings in order to avoid long-term job vacancies. Empirically we observe that the ability to fill job vacancies is not at all evenly distributed among firms, i.e. despite labor shortages on an aggregate level there are substantial and stable variations across firms on a disaggregated level, including firms without any job vacancies (see e.g. Holzer 1994: 17ff). However, there has been a notable lack of theoretical or empirical work investigating such inter-firm differences in job vacancy rates. Micro-level - or more precisely - firm-level analyses of job vacancy rates are almost non-existent. One rather obvious economic explanation could be that varying job vacancy rates are due to mismatches between the skill requirements of firms and the skills that are available in the external workforce. Inter-firm variations in job vacancy rates would then be a result of systematic inter-firm differences in skill requirements. However, empirical results for Germany do not support such an explanation; differences in job vacancies are still large when differences in the skill requirements of job offers are controlled for. Another rather simple economic explanation would be that differences in job vacancy rates are due to wage differentials between firms with high and low vacancy rates. But here again the data do not support the hypothesis. Job vacancies are not only observed in low wage firms but also, and to a similar extent, in high wage firms (see e.g. Schmidtke and Backes-Gellner 2002).

Thus, the question as to why some firms are able to fill their job openings despite an aggregate labor shortage and other firms are unable to avoid job vacancies remains

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unanswered. In this paper we are interested in determining what characterizes one type of firm or the other and especially in discovering the impact of differing labor relations. Our basic assumption is that the ability to fill job openings does not exclusively depend on monetary issues such as wages or fringe benefits, but also on company or job characteristics that foster individual workplace satisfaction because they provide 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 be due to differences in internal recruitment.[1]

We further assume that not all of the characteristics workers are interested in are directly observable to a job applicant, but may only become apparent after they have worked for some time; however, in the meantime they have turned down other job alternatives and may have substantially invested in firm-specific human capital, including for example moving to a firm's location, which makes it difficult or costly to reverse the original job decision. Thus, workers have to make the decision to accept a job in a situation with asymmetric information and bear a considerable risk, which they will obviously try to minimize. Workers should therefore be interested in finding ways and means to reduce their risk.

In our paper we argue that in such a situation of asymmetric information workers use labor market signals. Thus, we reverse the argument of Spence's labor market signaling (1973), but unlike in the original model, we propose that it is not the employees but the employers who, by means of their observable characteristics, signal the quality of their unobservable workplace characteristics. In such a world employees may even prefer to work in firms with characteristics that appear to be of no direct interest to them because they only use these

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[1] For a systematic comparison of internal vs. external recruitment options, see e.g. Bayo-Moriones and Ortín-Ángel (2006).

characteristics as a signal for something unobservable that they are strongly interested in. This theoretical explanation implies that company characteristics which seem unrelated to attracting a particular group of employees are instead very important for recruitment success and avoiding labor shortages. For example, it may seem irrelevant for a skilled craftsman who has already finished his apprenticeship training whether the company that wants to hire him maintains an apprenticeship program because he himself does not need an apprenticeship anymore, but whether a firm offers an apprenticeship program may still be relevant to him because it serves as a signal for other characteristics that a skilled worker values highly, such as the importance of high quality work, innovativeness, long-term orientation and career options, which may not be directly observable on the spot or at least not reliably observable for an outsider. Another example is works councils. So far, they have been extensively analyzed with respect to their impact on the incumbent workforce (e.g. Addison et al. 2007, Sako and Jackson 2006, Heywood and Jirjahn 2002, Bellmann and Blien 2001). Within our framework, we argue that there is another effect of works councils that should be taken into account: the mere existence of works councils may have an impact on potential employees and their decisions. Works councils may be seen as a signal for a secure job or a work ethos that is particularly attractive to a skilled worker. In the same way, other HR practices, and particularly labor relations, may serve as valuable signals for a good work climate and help reduce labor shortages.

In the first part of the remaining paper we analyze theoretically what prerequisites a company characteristic has to meet in order to become a valid signal and derive empirically testable hypotheses which we then test in the second part using a unique data set that extensively covers human resources and general management issues.

Employer signaling: theoretical analysis

Reversing Spence's labor market signaling model, which involves signaling by employees in a situation with asymmetric information about their unobservable productivity, we hypothesize that employers also use signaling to overcome problems of asymmetric information about unobservable job or company characteristics. Our basic assumption is that prior to accepting a job offer (or even prior to applying for a job) prospective employees cannot directly observe all job or company characteristics that are of interest to them, but at the same time know that accepting the wrong job will be costly due, for example, to job offers that may have been turned down, to firm-specific human capital investments or to mobility costs. In order to avoid such costs employees are interested, before committing themselves, in obtaining reliable information on those job characteristics that are of interest but not readily observable to them. At the same time, there are a variety of company characteristics which may not be of direct interest to prospective employees or may not even directly affect them, but which can be used as a signal for the characteristics they are interested in. The key question is what is a reliable proxy for those characteristics that are unobservable or not verifiable with tolerable costs. In the original labor market signaling model Spence derives two important conditions that have to be met to make an individual characteristic a reliable signal to the employer. We assume that the same conditions have to be met to make a company's characteristic a reliable signal to the employee.

In Spence's original signaling model the marginal product for employees with a set of signals equals the wages offered to applicants with those characteristics. Potential employees are thus confronted with wage schedules that are dependent on the signals they send. In general signals are alterable by the job applicant, but there are costs attached: the so-called signaling costs. Thus, individual applicants only invest in a signal (e.g. education) if the wage gains attached to the signal exceed their costs of acquiring the signal, or more precisely, they invest

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in those signals that maximize the difference between the wage gains and the respective signaling costs. We assume that firms can also use acquired signals to transmit their job quality to potential employees but they will also only invest in those signals that maximize the difference between their returns and the respective signaling costs. However, in order to make an acquired characteristic a true signal that reliably distinguishes applicants with higher and lower productivity on the job or firms with more or less attractive job offerings, certain conditions have to be met (Spence 1973: 385-359). Firstly, signaling costs have to be negatively correlated with productivity, in our case workplace attractiveness, which can be easily demonstrated by a figure that is well known from Ehrenberg/Smith (2003: 293) and has been adapted in diagrams 1, 2, and 3 of Figure 1.

------------- Figure 1 --------------

The costs for individuals with high productivity to acquire a signal (in our case for a firm with highly attractive jobs to produce a signal for their attractiveness) are defined by C_h; the costs for individuals with low productivity (firms with unattractive jobs) by C_l. The returns are R_2 for individuals (firms) who acquire the signal, or else R_1. Returns R for firms could be defined in terms of increased competitiveness through 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 individuals (firms) 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 individuals (firms) are highest if they do not acquire the signal ($[R_1(0)-C_l(0)] > [R_2(s^*)-C_l(s^*)]$). In the second diagram, however, costs are not sufficiently negatively correlated with productivity. The costs for individuals with low productivity to acquire a better signal (for firms with unattractive jobs to produce a signal for attractiveness) are much lower in this diagram, 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 high productive individuals (firms) they still also choose to acquire

the better signal ($[R_2(s')-C_h(s')] > [R_1(0)-C_h(0)]$) and the result is what Spence calls a pooling equilibrium, where high and low productive individuals (firms) are not separated by the signal. These are the two situations that are distinguished in the original Spence model. However, a separating equilibrium might occur not only if costs are sufficiently negatively correlated, but also if there are sufficient differences in the return structure for individuals (firms) with high and low productivity. To show this effect, in diagram 3, the return structure has been changed. Returns for high productive individuals (firms) (R_{2h}) are now higher than returns for low productive individuals (firms) (R_{2l}) but costs do not differ. However, the result is similar to what is found in diagram 1: net returns for high productive individuals (firms) are largest if they acquire the signal ($[R_{2h}(s^*)-C_h(s^*)] > [R_1(0)-C_h(0)]$), and net returns for low productive individuals (firms) are highest if they do not acquire the signal ($[R_1(0)-C_l(0)] > [R_{2l}(s^*)-C_l(s^*)]$). Thus, despite rather small differences in the cost structure, a separating equilibrium can still evolve if the (long term) return structures differ substantially. How can long term returns for high productive individuals (firms) be higher than for low productive individuals (firms)? Individual returns could probably be higher because they know they are good learners, will be more successful in company specific training measures and thus gain higher and faster wage increases in the long run. The returns of firms with more attractive workplaces could be higher because they know their skilled workers are more motivated because of the good work climate, they have better long term development opportunities and will be more productive in the long run. Likewise returns from maintaining systematic training programs (observable signal) could be higher for economically successful and innovative firms with better career prospects and self determined work environments (unobservable but highly attractive work characteristic) because their workers are more likely to use their new skills efficiently.

A second prerequisite, which is actually a prerequisite for the first one, is that for an acquired characteristic to become a valid signal, it has to be related to the type of productive capability required on the respective job. For individuals this means, e.g., if a firm has a job opening for a creative hairdresser, the fact that an applicant holds a law degree may not be a very reliable signal because the capabilities required to finish a law degree may be very different from (in fact may be the opposite of) the capabilities required in a creative hairdresser's job. For firms the same condition has to be met if characteristics of firms are to serve as an employer signal. Only if potential employees indeed value a particular company or job characteristics will they be used as valid information in their job decision. Therefore, it is likely that an observable firm characteristic is a signal with respect to some types of jobs or groups of workers but not with respect to other jobs. Thus, a necessary condition in testing employer signaling is that the observable job characteristics have to be related to those job attributes to which the applicants in question attach high value.

So what is it that workers actually value? There are a large number of studies in social psychology or in human resources management literature which provide information on job attributes (or company characteristics) that workers find attractive and lead them to accept a job (or stay in a job). These studies also show that there are substantial differences in preferences between different groups of workers. However, one finding that almost all these empirical studies have in common is the overwhelming importance of soft characteristics, such as work atmosphere, participation, corporate culture, career perspectives, personal development or challenging tasks. Thus, soft characteristics seem to be more important in the decision to accept a job offer than, e.g., wages or classic fringe benefits (e.g. CSC Ploenzke 2000). However, soft characteristics are usually occluded for potential employees, so, as suggested earlier, workers are indeed in a situation of asymmetric information as far as these decisive criteria are concerned and thus have to find a way to obtain credible information

before deciding on a job offer. As argued above, we suspect that workers use readily observable characteristics as signals for the non-observable but actually more important soft characteristics.

Thus, to test our hypothesis we must first identify homogeneous groups of workers or labor market segments and then analyze what company or workplace characteristics make a job offer more or less attractive to the type of worker in question. In the third and last step we can then test whether the signals we identify for the different worker groups help to explain differences in recruitment success, or interfirm job vacancy rates.

The impact of potential signals on job vacancy rates: empirical analysis

Since empirical studies show that there are substantial and stable differences in job preferences of different groups of workers, we should observe different kinds of signals for different groups of workers. Therefore different groups of workers have to be distinguished and analyzed separately. A first distinction has to be made between blue and white-collar workers because a large number of empirical studies show that those two groups differ significantly in all kinds of attitudes (e.g. CSC Ploenzke 2000; Gruber et al. 1993). A second distinction has to be made between hierarchical levels, because it has been shown that managerial and other white-collar employees differ substantially in their preferences for certain job attributes. Taking these results into account it seems appropriate to separately analyze "skilled blue-collar workers" [2], "skilled white-collar workers" and "managerial staff" – a distinction which is also consistent with the recruiting divisions observed in many human

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[2] As there are hardly any (if at all) blue-collar managerial jobs, we will not distinguish among different groups of blue-collar workers.

resources departments (at least in large companies). The group we focus on are skilled blue-collar workers, because here the best data are available.

Workers' preferences

Since workers' preferences are difficult to measure directly, one must attempt to measure them indirectly. Using the 12th wave of the German Socio-Economic Panel Schmidtke/Backes-Gellner (2002) propose to analyze the impact of different company and job characteristics on job satisfaction. Their results of ordered probit estimations are summarized in Table 1.

------------- Table 1 --------------

According to these results work atmosphere, challenging or interesting tasks, career prospects, job security, and net wages should positively affect the job decision of potential employees, whereas fringe benefits, autonomous workplaces and performance evaluation should have no or only minor effects. Longer regular weekly working hours have a negative impact on job satisfaction.[3] However, as already mentioned, most of the items found to be important are unobservable, which means that workers have to find proxies which they can use as signals for the workplace characteristic they are actually interested in.

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[3] Similar but not always the same results are found in other studies. Gruber et al. (1993) and Reich (1995) showed that on the one hand skilled workers prefer jobs with good work atmosphere and possibilities of occupational advancement, but that on the other hand observable characteristics such as wage and fringe benefits are also important. The latter result is also in line with Lutz (2005) who found a significant positive correlation between fringe benefits and productivity, which he interprets as an incentive effect resulting from a supply of the fringe benefits that workers favor.

Observable characteristics that are potential signals

Given the non-observable nature of most key job characteristics listed above, we need to identify which observable job or company characteristics could act as potential signals. According to our theoretical considerations based on the reversed labor market signaling model, a company characteristic can only become a valid signal if the net returns of acquiring this observable signal are substantially lower for firms with more desirable jobs (conditions) in comparison with firms with less desirable jobs (conditions). Table 2 summarizes the observable company characteristics that we assume (according to what is explained below) workers will use as signals for the above mentioned non-observable but highly valued workplace characteristics.

-------------- Table 2 --------------

Of course it is impossible to obtain precise information on the cost functions for the production of all kinds of signals. Therefore we have to rely on qualitative reasoning here to justify the choice of the variables we use. Our empirical results will tell whether our assumptions were adequate. We argue that regular, institutionalized shop-floor meetings, which are easily observable, can be used as a signal for work atmosphere, which might be reported with a positive bias to an external applicant who has no chance to verify the information. Why can regular shop-floor meetings be considered a reliable signal in the above mentioned theoretical sense? From an employer's point of view shop-floor meetings may primarily be used to encourage information sharing and enhance the efficiency of employees, so why should this be important to employees? We would argue that the implementation of regular shop-floor meetings signals much more. Such meetings are only effective if an open communication culture with mutual trust exists in the firm, which in turn requires a good work atmosphere. Expected costs of having meetings and discussing everything with shop-floor workers are lower if working conditions and work atmosphere are better. At the same

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time returns are higher because shop-floor meetings only have a positive outcome if workers are willing to participate in a productive way, which is more likely given better working conditions and a good work atmosphere. At the same time, shop-floor meetings may directly contribute to a good work atmosphere which reinforces these positive effects. Taken together regular shop-floor meetings may act as a signal for the unobserved firm characteristic work climate.

Secondly, skilled blue-collar workers prefer jobs with challenging or interesting tasks. Thus, it can be assumed that incumbent skilled workers would not stay but would leave firms if they only offer monotonous work. Thus firms with more challenging jobs would not only need more skilled workers but would also be able to retain a higher share of skilled workers than firms with less challenging jobs. Moreover, it would not pay the latter firms to fill their jobs with highly skilled workers, who would be too expensive given that the jobs only involve simple activities. Therefore, the higher the percentage of skilled blue-collar workers, the higher the chance of challenging and diversified tasks. On the other hand, the recruitment of workers with non-matching qualifications is an indicator for easily learnable work and therefore less challenging jobs. Thus, if vacancies are more frequently filled with workers with non-matching occupational qualifications this can be interpreted by applicants as a signal for less challenging jobs.

Thirdly, the provision of a systematic continuing vocational training program is assumed to signal career opportunities because establishing and maintaining a formalized program for continuing training is only worthwhile for companies offering sufficient career opportunities, since continuous skill development can only pay if new skills are later matched with new jobs with higher skill requirements.[4] The same is true for firms with apprenticeship programs. The

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[4]   See Sadowski (1980: 81) who stresses the interpretation of training as signal for career advancements.

returns to apprenticeship training are higher for firms if they later provide enough jobs with appropriate skill requirements and career development. Additionally, the investment only pays off for firms if the time after apprenticeship completion is long enough to accrue a sufficient amount of returns. Thus only firms that know their jobs are attractive enough to keep their apprentices after they have finished their apprenticeship and that know they will be in the market for a longer time are willing to invest. Therefore, having an apprenticeship program can be used as a valid signal for attractive jobs.

Finally, the existence of a works council can be used as a signal for job security and good working conditions for blue-collar skilled workers because it can be assumed that one of the works council's main goals is to secure the jobs and the working conditions of their clientele. Therefore, the costs to the company of having to deal with a works council are lower in companies that offer safer and more attractive jobs. On the other hand, for companies with low job security it could even be advantageous to take measures to avoid works councils. Both effects make it likely that the existence of a works council is a reliable indicator for higher job security and more attractive working conditions.

In the next sections we test whether the signals listed in Table 2 really help to explain differences in recruitment success as predicted by the employer signaling model presented in our theoretical section.

Estimation methods

To test the impact of the signals we derived in the theoretical section on the recruitment success of firms, we estimate the following basic model:

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\begin{aligned}
\text{JOBVACANCYRATE} = \ & \beta_0 + \beta_1 \text{SKILLEDWORKERSHARE} + \beta_2 \text{NON-MATCHINGQUALIFICATIONWORKERS} \\
& + \beta_3 \text{CONTINUINGVOCATIONALTRAINING} + \beta_4 \text{APPRENTICESHIP} + \beta_5 \text{WORKSCOUNCIL} \qquad (1) \\
& + \beta_6 \text{SHOPFLOORMEETINGS} + \delta \cdot X + u
\end{aligned}
$$

Job vacancy rate is the number of vacant jobs divided by the number of job openings (sum of vacant and filled jobs)[5]. Since the dependent variable cannot take on negative values, but will have a considerable fraction of firms with a value of zero, ordinary least squares estimation is not appropriate. Therefore, we use a tobit model in accordance with Wooldridge (2003: 565-573). As independent variables we use the variables that were identified as potential signals in the previous section. These are the *percentage of skilled blue-collar workers* and the *frequency of recruitment of workers with non-matching qualifications*, dummy variables for the provision of *continuing vocational training* and for the supply of *apprenticeship,* a dummy variable indicating the existence of a *works council* and, last but not least, a dummy variable for the existence of *shop-floor meetings* (see Table 2).

In addition, a broad set of control variables are added, including company size, location, industry, various personnel policy measures (e.g. bonuses) and characteristics of the product and the production process (e.g. using new technologies). Finally, we use the variable number of job openings to control for differences in the initial problem.

A major methodological problem is that unobserved firm characteristics which have an impact on the number of job openings also have an impact on the job vacancy rate which would cause serious endogeneity problems. For example well managed firms may avoid having job openings because their HR department is well organized, and for the same reasons they may avoid job vacancies by more efficient recruitment processes. Thus, we have to take into account that the variable job openings may be endogenous, so the variable has to be instrumented to make it exogenous. As an instrumental variable we use the variable *labor office grants*. The aim of these grants is to encourage companies with job openings to hire

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[5] Thus, the dependent variable can take on values between 0, a firm was totally successful in recruiting workers, and 100, a firm was totally unsuccessful and non of the job openings for blue-collar workers could be filled.

unemployed workers who may require special help in adjusting to the new job (e.g. older or long-term unemployed persons). Thus, the variable is clearly related to the number of job openings. However, it is not directly related to the job vacancy rate for blue collar workers, because labor office grants are linked to the employment of unskilled workers who are plentiful on the external labor market, unlike skilled blue-collar workers who are generally scarce.

The empirical approach we use to take potential endogeneity into account is as follows: first, we estimate the impact of the independent variables explained above plus an instrumental variable on the number of job openings. In a second step we estimate equation (1) using the estimated job openings from the first step.

Data

To test our hypotheses we use a dataset with 740 companies collected in 1999 with a special focus on skilled workers and competitiveness of firms, commissioned by the Institute for Small and Medium Sized Enterprises Bonn.[6] It contains a large number of variables well suited to testing our hypotheses.[7]

Since we are interested in studying differences in *job vacancy rates* we first exclude all companies without any job openings during the year of study. Moreover, we are only interested in firms which employ skilled blue-collar workers which reduces the sample to 308 companies. All the companies in the sample had at least one job opening that was either

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[6] We 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.

[7] See Backes-Gellner et al. (2000) for the questionnaire.

occupied or remained vacant at the end of the year. After eliminating observations with missing data in one of these crucial explanatory variables, a sample of 169 firms was left for analysis. On average 7.5% of openings for skilled blue-collar workers remained vacant at the end of the year. Descriptives for all explanatory variables are given in Table 3. Regarding the variables identified as potential signals, it should be kept in mind that almost every company has shop-floor meetings and offers systematic continuing vocational training.

-------------- Table 3 --------------

Estimation Results

Our results for estimating the effect of potential signals on job vacancy rates for skilled blue-collar workers are reported in Table 4. The first column provides results for the estimation of equation (1) without taking into account potential endogeneity. In the second column (2) the explanatory variable job openings is instrumented to take into account unobserved characteristics influencing the number of job openings as well as the job vacancy rate.[8] As can be seen, the estimates of column (1) and (2) are similar with a few exceptions. As expected, the existence of a *works council* reduces the vacancy rate significantly. Companies with works councils enjoy lower vacancy rates than companies without. Our interpretation of this result is that the existence of a works council serves as a signal for job security. Even if job applicants also expect a direct benefit with the existence of a works council, they additionally attach high value to a works council because it is a signal for more. Turning to the variables hypothesized to represent challenging or interesting tasks, we find that the *share of skilled*

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[8]   A specification test (Hausman 1978) shows that an instrumental variable estimation is necessary, as the difference between ordinary least squares estimator and instrumental variable estimator is significant and the variable job openings endogenous.

blue-collar workers has a highly significant negative impact on the job vacancy rate (i.e. a positive impact on recruitment success), but *employment of workers with non-matching qualifications* does not have a significant effect. *Engaging in apprenticeship training* obviously increases recruitment success because we find that it lowers job vacancies significantly. Since skilled blue-collar workers by definition have already completed an apprenticeship they do not have a direct personal benefit if a company engages in apprenticeship training, so this positive correlation can only be due to a signaling effect. Providing apprenticeship training is a signal for a high quality workplace, for good economic prospects and for favorable career options. So this result actually provides very strong support for our signaling hypothesis. Apprenticeship training is seen as a signal for an attractive employer because they only pay off in companies with highly-valued jobs in the first place. However, the existence of a systematic *continuing vocational education and training system* as a potential signal for career prospects does not have a significant effect although the coefficient points in the expected direction. But the absence of significance may also be explained by deficiencies in the variable, which does not differentiate precisely enough between different types of further education.[9]

Also, there are no significant effects of *regular shop-floor meetings.* One interpretation would be that a good work atmosphere may not be as decisive for solving recruitment problems as expected. However, we would argue that the signal may indeed not be a good one because it is just too imprecise. This seems plausible insofar as the variable has very little variance: almost 90% of the companies in the sample state that they organize regular shop-floor meetings so it seems reasonable to follow that this cannot lead to a separating equilibrium.

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[9] This might also be the reason for the very high number of companies stating that they offer systematic continuing vocational training.

However, not all variables show the same effect in column (1) and (2). The variable *job openings* which does not have a significant effect in column (1) turns out to have a significant negative coefficient if endogeneity is sufficiently controlled for, i.e. when job openings increase, the rate of vacant jobs declines, which we assume is due to an even larger number of successful recruitments. This may be the case because an increasing number of job openings are associated with growth, which can in itself be seen as an indicator for increased job security. The variable *frequency of recruitment of workers with non-matching qualifications* had no effect on specification (1) but turns out to have a significant positive effect when endogeneity is controlled for. Thus, firms which hire a larger number of workers with non-matching qualifications have more severe recruitment problems. We argue that this is due to signaling. Highly skilled workers are not interested in working in firms with jobs that are not challenging, and which could also be done by workers without appropriate qualifications.

-------------- Table 4 --------------

Regarding the control variables, there are no surprising results. As far as working time patterns are concerned, we find that flexible working time is not valued by skilled blue-collar workers (neither *flexibility* nor *overtime compensated by vacation* are significant). However, regular *unpaid overtime* has a significant negative impact on recruiting success. Interestingly, *wage levels and fringe benefits* do not have a significant effect. However, this only stresses the importance of the quality of the workplace and the job characteristics fostering individual job satisfaction in comparison to monetary issues (all else being equal).

Conclusions

In this paper, we examined the causes and consequences of differences in labor shortages or more precisely of differences in job vacancy rates. Previous studies on workers' preferences

had already indicated that non-observable job characteristics are very important factors in a worker's job or company choice. However, no studies exist on how these characteristics are credibly communicated and thus how companies that have these favorable job characteristics are able to turn them into lower job vacancy rates. We argue that they are communicated via observable characteristics that are used as reliable signals of the unobserved job quality. We reverse Spence's signaling model to theoretically explain the relation between workplace characteristics that have a significant effect on recruitment success but seem unrelated to what workers are ostensibly interested in when looking for a new job.

Our empirical estimates of job vacancy rates show that a great number of these signals are effectively used in the sense that workers prefer jobs with these observable characteristics. Thus, companies that send these signals have lower job vacancy rates than other companies. The advantage of using a signaling model is that it helps to identify variables which would otherwise not be considered important or which would be assumed to have a different effect on job vacancies. The existence of apprenticeships for example does not seem to be important for the recruitment of skilled workers, since they have already finished an apprenticeship and cannot expect direct positive returns. However, with our reversed signaling model it is clear why apprenticeships could still be important for recruitment success. Interestingly such non-observable characteristics and their corresponding signals seem to be even more important than monetary incentives such as wages and fringe benefits. For labor relations and human resources management and for general management issues this, in turn, means that some workplace or company characteristics should be evaluated not only by their originally intended returns, i.e. by the returns they generate within their own policy field, but also by their signaling value. Thus, the existence of apprenticeships, e.g., should be evaluated not only by the increased productivity of the individual apprentices, but also by their effect on other policy fields. such as an improved acceptance rate in tight labor markets. Further, works

councils should be evaluated not only by their direct effect, i.e. participation and codetermination of incumbent workers, but also by their additional signaling value for potential employees from the external labor market. Overall, we conclude that given a fixed level of aggregate labor market shortage for skilled workers, single companies can improve their individual position and ensure above average acceptance rates by using signals to communicate a higher job quality.

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Tables, Figures

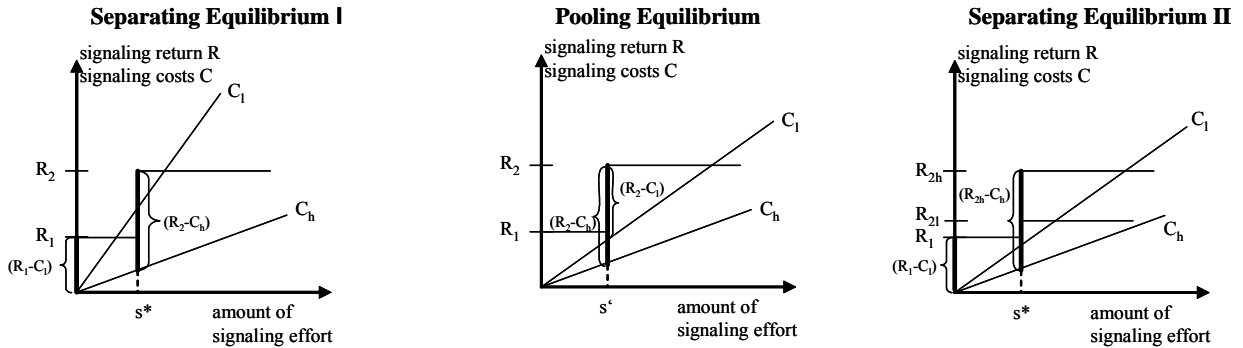## Figure 1: Separating and Pooling Equilibria

Table 1: Preferences of blue-collar workers measured by impact on job satisfaction

Non-observable job and company characteristics	
Work atmosphere with respect to supervisors	0.6419***
Work atmosphere with respect to co-workers	0.5719**
Autonomous workplace	0.0596
Challenging/interesting tasks	0.5199**
Career prospects	0.4415***
Physical exertion	-0.0309
Psychological exertion	-0.0941
Performance evaluation	-0.0218
Job security	0.2491***
Observable job and company characteristics	
Working time	
Regular weekly working time	-0.0209*
Flex-time system	-0.0236
Overtime	0.0237
Unpaid overtime	0.5474
Wage	
Net-wage (log.)	0.0002***
Fringe benefits	
Company pension	-0.0936
13th (14th) wage	0.1658
Christmas bonus	0.1256
Profit-sharing / bonuses	-0.0032
Special vacation bonus	-0.0381
Other variables controlled for: company size, industry, company location, individual characteristics	

*** (.01), ** (.05), * (.10).

Source: Schmidtke and Backes-Gellner (2002); for more details on data and methodology see Schmidtke (2001)

Table 2: Potential signals for skilled blue-collar workers

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

Table 3: Definitions and descriptives of variables

Variable	Definition	Mean (Std.dev.)
DEPENDENT VARIABLE		
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 %	7.483 (19.802)
INDEPENDENT VARIABLES		
Potential signals		
Skilled worker share	Number of skilled blue-collar workers divided by the total number of workers	39.142 (22.827)
Non-matching qualification workers	Frequency of recruitment of non-matching workers, often = 5 to never = 1	2.728 (1.340)
Continuing vocational training	1 if workers have the opportunity to take part in continuing vocational training, 0 otherwise	0.982 (0.132)
Apprenticeship	1 if there are apprentices in the company, 0 otherwise	0.740 (0.440)
Works council	1 if a works council exists, 0 otherwise	0.497 (0.501)
Shop-floor meetings	1 if regular shop-floor meetings are held, 0 otherwise	0.876 (0.331)
Control variables		
Personnel policy		
Participation in decisions	1 if workers informally participate in important company decisions, 0 otherwise	0.521 (0.501)
Collective wage agreement	1 if collective wage agreement is in force, 0 otherwise	0.604 (0.491)
Working time above collective agreement	1 if regular weekly working hours above collective agreement, 0 otherwise	0.284 (0.452)
Flexibility of working time system	1 = high flexibility to 4 = fixed working time	2.059 (1.299)
Paid overtime	1 if overtime is paid, 0 otherwise	0.527 (0.501)
Unpaid overtime	1 if overtime is unpaid, 0 otherwise	0.065 (0.247)
Overtime compensated by vacation	1 if overtime is compensated by additional vacation days, 0 otherwise	0.544 (0.500)
Wage above regional level	1 if wage is above regional level, 0 otherwise	0.438 (0.498)
Advertising in newspaper	1 if help-wanted ads in regional newspapers, 0 otherwise	0.704 (0.458)
Advertising in professional journals	1 if help-wanted ads in professional journals, 0 otherwise	0.379 (0.487)
Advertising on the internet	1 if help-wanted ads on the internet, 0 otherwise	0.237 (0.426)
Visibility in the labor market	1 if industry leader in visibility in the labor market, 0 otherwise	0.154 (0.362)
Company pension	1 if company pension is offered, 0 otherwise	0.213 (0.411)
Bonuses	1 if bonuses are offered, 0 otherwise	0.775 (0.419)
Stock ownership plan	1 if stock ownership plans are offered, 0 otherwise	0.112 (0.317)

Additional vacation days	1 if additional vacation days are offered, 0 otherwise	0.065 (0.247)
Company car	1 if company cars for private use are offered, 0 otherwise	0.053 (0.225)
Loans	1 if loans are offered, 0 otherwise	0.207 (0.406)
Number of other fringe benefits	Number of other fringe benefits	0.959 (0.966)
Product - & firm reputation		
Product development	1 if market leadership in product development, 0 otherwise	3.604 (0.868)
New technologies	1 if market leadership in using new technologies, 0 otherwise	3.621 (0.950)
Closeness of customer relations	1 if market leadership in closeness of customer relations, 0 otherwise	4.030 (0.711)
Sales	Sales per employee in million DM (log.)	12.182 (0.768)
Company age	Age of company	34.432 (40.091)
Fluctuation (quota)	Number of workers who left the company in 1998 divided by total number of workers	9.605 (14.996)
Company characteristics		
Number of employees	Number of employees (log.)	4.261 (1.632)
Hierarchical levels	Number of hierarchical levels in the company	2.976 (0.879)
West/East	1 if company is located in West Germany, 0 if company is located in East Germany	0.598 (0.492)
Manufacturing	1 if company is in manufacturing industry, 0 otherwise; Reference	0.568 (0.497)
Construction	1 if company is in construction industry, 0 otherwise	0.130 (0.337)
Trade	1 if company is in trade, 0 otherwise	0.118 (0.324)
Professional activities	1 if company is in professional activities industry, 0 otherwise	0.059 (0.237)
Other services	1 if company is in other services industry, 0 otherwise	0.118 (0.324)
Job openings	Number of hirings and vacant jobs divided by the total number of jobs , in %	15.861 (17.537)
Instrument		
Labor office grants	1 if labor office grants were given, 0 otherwise	0.479 (0.501)

Table 4: Tobit estimation of the job vacancy rate for skilled blue-collar workers

	Specification [a]	
	(1)	(2)
Potential signals		
Skilled worker share	-0.706***	-0.653***
	(0.218)	(0.213)
Non-matching qualification workers	4.876	5.753*
	(3.357)	(3.349)
Continuing vocational training	-17.624	-29.033
	(29.734)	(30.275)
Apprenticeship	-19.972*	-33.637***
	(10.250)	(12.133)
Works council	-25.119**	-27.781**
	(12.429)	(12.328)
Shop-floor meetings	-7.811	3.286
	(14.101)	(14.787)
Control variables		
Personnel policy		
Participation in decisions	-1.016	-2.604
	(9.163)	(9.082)
Collective wage agreement	2.466	-5.519
	(9.999)	(10.249)
Working time above collective agreement	0.061	4.027
	(8.742)	(8.889)
Flexibility of working time system	1.061	3.942
	(3.246)	(3.423)
Paid overtime	19.054**	13.950
	(9.277)	(9.196)
Unpaid overtime	33.197*	58.261***
	(19.153)	(21.814)
Overtime compensated by vacation	-2.766	-1.638
	(8.823)	(8.654)
Wage above regional level	0.124	-0.620
	(8.781)	(8.657)
Advertising in newspaper	20.267*	26.248**
	(10.756)	(11.122)
Advertising in professional journals	1.527	1.058
	(9.120)	(9.047)
Advertising on the internet	2.245	23.244
	(11.637)	(14.204)
Visibility in the labor market	-34.659***	-40.874***
	(13.041)	(13.407)
Company pension	4.196	3.574
	(10.739)	(10.677)
Bonuses	-4.819	-12.903
	(10.832)	(11.605)
Stock ownership plan	12.079	13.828
	(13.586)	(13.492)
Additional vacation days	-5.370	-7.463
	(15.066)	(14.737)
Company car	23.028	19.130
	(15.324)	(15.124)
Loans	-22.202*	-27.400**
	(11.352)	(11.497)
Number of other fringe benefits	5.343	6.139
	(5.015)	(4.971)

	(1)	(2)
Product - & firm reputation		
Product development	-8.186 (5.614)	-7.228 (5.587)
New technologies	5.369 (5.104)	9.417* (5.343)
Closeness of customer relations	3.063 (6.696)	7.490 (6.967)
Sales	-1.804 (6.112)	-6.616 (6.303)
Company age	-0.081 (0.127)	-0.118 (0.126)
Fluctuation (quota)	0.367 (0.323)	1.793** (0.730)
Company characteristics		
Number of employees	-2.536 (4.626)	-7.780 (4.891)
Hierarchical levels	-6.213 (6.787)	-4.159 (6.761)
West/East	19.937* (11.348)	24.094** (11.496)
Manufacturing	10.917 (13.581)	32.952* (17.004)
Trade	-25.688 (16.662)	-12.300 (17.346)
Professional activities	-39.607 (26.598)	-72.128** (30.828)
Other services	-4.972 (18.776)	8.568 (19.438)
Job openings	0.263 (0.274)	-2.338* (1.223)
Constant	48.614 (80.400)	102.690 (81.975)
Pseudo-R^2	0.110	0.114
Prob > χ^2	0.001	0.001
N	169	169

Robust std.errors in parentheses; *** (.01), ** (.05), * (.10).
[a] Specification (1) is a simple tobit estimation of equation (1); in specification (2)
the variable job openings is instrumented.