Inter-firm Differences in Job Vacancy Rates and Employer Signaling[1]

FIRST DRAFT

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Abstract
Given tight labor markets for skilled employees in Germany, we observe severe inter-firm differences in the recruitment success of individual firms. We explain why labor shortage is unequally distributed among firms and what kind of firms will be more or less successful in getting their share of skilled labor. A vast amount of psychological and marketing papers show that non-observable job and company characteristics are crucial for employees' choices of a particular workplace or firm. The question is how employees collect reliable information on these non-observable characteristics. We argue that employees use signals as a proxy for the unobservable characteristics, i.e. we reverse the original labor market signaling idea of Spence: the employer is signaling his quality to the employee. The hypotheses we derive from the theoretical model are tested with a company data set of approximately 700. The results support our basic hypothesis: inter-firm differences in job vacancy rates can be explained by a reversed signaling model.

JEL Classification: M51, J63, M12

Keywords : Job vacancies, employer signaling, recruitment success, reversed labor market signaling

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1. Introduction

Skilled employees are of increasing importance for the competitive advantage of firms. Globalization and ongoing technological innovation foster the substitution of unskilled labor by skilled labor. Thus, there is an ever increasing demand for skilled labor while at the same time supply decreases steadily. In the year 2001 approximately twenty percent of the job offers for skilled workers in Germany remained vacant and forecasts for the years to come are even worse (*Schmidtke* 2001a, *Kölling* 2001: 512). Given these developments, recruitment and retention of skilled workers will be one of the major challenges for human resources management. However, the ability to fill job vacancies is not evenly distributed among firms. Empirical studies on a disaggregated level show that there are substantial and stable variations across firms (*Holzer* 1994: 17ff; *Schmidtke* 2001a: 10), but there is a notable lack of theoretical or empirical work to explain such patterns.[2] Micro-level - or more precisely - firm-level analyses of job vacancy rates have been almost non-existent. One rather obvious economic explanation would be that varying job vacancy rates are due to mismatches between skill requirements and workers' skills. 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: even if the skill structure in job offers is held constant, there are still substantial differences in recruitment success (*Schmidtke* 2001b). Another rather simple economic explanation would be that differences in job vacancy rates are due to wage differentials, but here again the data do not seem to support the hypothesis: c.p. job vacancies are not only observed in low wage firms but also in high wage firms (*Schmidtke/Backes-Gellner* 2002). So, there remains a puzzle which we will try to

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[2] See *Schmidtke* (2001b: 21ff) for details.

solve. We present a new theoretical explanation and empirical evidence to explain interfirm differences in job vacancy rates and show how single firms gain a competitive advantage when recruiting on tight labor markets. We reverse *Michael Spence*'s (1973) original idea of labor market signaling to explain the relative recruitment success of firms. Where *Spence* argues that in job markets the employer is uninformed about the productive capabilities of an applicant and that his decision has to be modeled under uncertainty, we argue that the employee is faced with similar information problems when searching for a job and that his job choice decision may be fruitfully modeled within the same, but reversed framework. The paper is organized as follows. Section 2 lays out the reversed signaling model in close analogy to *Spence*'s original applicant signaling model, which is analyzed in more detail in Section 3. In section 4 we analyze a first condition for employer signaling: an observable characteristic can only become a signal if it is related to those job attributes that are highly valued by potential applicants. In section 5 we study a second condition, i.e. signaling costs have to be negatively correlated with those highly valued job characteristics. We qualitatively reflect the cost correlations between observed and unobserved job characteristics and derive empirically testable hypotheses, which will be tested in section 6. Section 7 summarizes the results and draws some conclusions for human resources management.

2. The model

Spence's analysis starts with the assumption that employers cannot directly observe the marginal product of an applicant prior to hiring. We argue that employees cannot directly observe the job characteristics which they are interested in prior to accepting a job offer (or prior to applying for a job). In *Spence*'s original signaling model the employer does observe a large number of personal data in the form of observable characteristics of the applicant (e.g. education, previous work experience, race, sex) and those observable attributes ultimately

determine his hiring decision. In the reversed signaling model the employee observes a variety of company characteristics and those observable attributes will determine his job/company choice. Based on these simple assumptions *Spence* analyzes the endogenous market process whereby the employer requires and the applicant transmits information which "ultimately determines the employers hiring decision, the offered wages, and in the end the allocation of jobs to people and people to jobs in the market" (*Spence* 1973: 357). We argue that the use of the same assumption in a reversed labor market model will enable us to study the market process whereby the employee requires and the company transmits information which in this case determines the employees job choice, the accepted wage, and the allocation of job vacancies among companies.

In the original applicant signaling model of *Spence* the employer has an expected marginal product for each set of signals which equals the offered wage to applicants with those characteristics. Potential employees are thus confronted with wage schedules that are dependent on signals. In general signals are alterable by the job applicant but there are costs attached to it, the so called signaling costs. An individual applicant will invest in a signal (e.g. education) if there is sufficient return as defined by the offered wage schedule. It is assumed that individuals acquire those signals that maximize the difference between offered wages and signaling costs. Therefore, signaling costs play a key role in signaling situations. *Spence* derives two crucial conditions that have to be met in order to make an observable characteristic a true signal in the sense that it reliably distinguishes applicants with high and low productivity. Firstly, signaling costs have to be negatively correlated with productivity. Secondly, and this is a prerequisite for the first condition, the observable characteristics have to be related to the type of productive capability a job requires. That means, the costs of acquiring a signal can be negatively correlated with one type of productive capability but not with another type. Therefore, it is possible that an observable characteristic is a signal with

respect to some types of jobs but not with respect to other jobs, depending on the special requirements of the job.

In our employer signaling model the employee has an expected utility for each set of signals of a job or a company which determines whether he will accept a job (a company) with those characteristics. Potential employers are thus confronted with acceptance rates that are dependent on a number of observable characteristics, i.e. employers' signals. In general, those signals are alterable by the company but there are signaling costs attached to it. A company will invest in a signal (e.g. establishing formal employee participation procedures if a participatory corporate culture is important to workers) if there is sufficient return as defined by the acceptance rate. It is assumed that companies acquire those signals that maximize the difference between the acceptance rate and the signaling costs. Like in the original model there are two crucial conditions that have to be met in order to make an observable characteristic a signal that reliably distinguishes "good" employers (i.e. employers with highly valued job characteristics) and "bad" employers. A necessary condition is that the observable job characteristics have to be related to those job attributes that applicants attach a high value to. But this is not sufficient. Signaling costs have to be negatively correlated with the value of the jobs offered to ensure a signaling equilibrium. In the next section we will analyze those conditions in more detail and thereby derive empirically testable hypotheses.

3. Analysis of the employer signaling model

Like in the original *Spence* model a necessary condition for effective employer signaling is that observable employer characteristics have to be related to the *job attributes* that are *highly valued by those employees* that an employer wants to recruit for a job, i.e. the job attributes (and the related signals) have to be relevant for the worker's job choice.

There is a large number of studies in social psychology or in human resources management which firstly provide information on job attributes (or company characteristics) that workers find attractive and makes them accept a job (or stay in a job) and secondly, they show that there are substantial differences in those preferences between different groups of workers. Almost all of these empirical studies have one result in common, namely the overwhelming importance of soft characteristics like work atmosphere, participation, corporate culture, career perspectives, personal development or challenging tasks. Thus, soft characteristics seem to be more important for the decision to accept a job offer than e.g. wage or other hard facts like working time (e.g. *CSC Ploenzke* 2000). However, soft characteristics are usually non-observable for potential employees, so for their most important criteria workers are in a situation of asymmetric information and thus have to find a way to obtain credible information before deciding on a job offer. We assume that they use employer signals to solve this problem. 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. An empirical analysis of employer signals therefore has to start with identifying homogenous groups of workers or labor market segments. We argue that three groups of workers should be analyzed separately. The first distinction that has to be made is between blue and white collar workers because a vast amount of empirical studies shows that those two groups of workers differ significantly in all kinds of attitudes (e.g. *CSC Ploenzke* 2000; *Gruber/Gruber/Ribolits* 1993). As a second criterion we use the hierarchical level and distinguish between managerial and other white collar employees because here again a number of studies shows that their preferences for job attributes differ substantially. So, we distinguish "blue collar skilled workers" [3], "white collar skilled workers" and

[3] Because there are hardly any (if at all) blue collar managerial jobs, we will not distinguish among different

"managerial staff" – a distinction which is also consistent with the recruiting divisions typically observed in many human resources departments (at least in big companies). In this paper we will concentrate on blue collar workers, so we will only analyze their preferences in more detail in section 4 and will briefly indicate the differences in preferences in comparison to the two other groups of workers. Since the job attributes that are identified as being highly valued are mainly unobservable they have to be signaled by the employer by observable characteristics. However, an observable characteristic has to meet additional conditions in order to become a signal and effectively attract job applicants, which can be shown by a simple formal signaling model.

According to the reversed signaling model a company will only invest in a signal if it can expect a sufficient return induced by an increased acceptance rate. Profit maximizing companies will acquire those signals that maximize the difference between the increase in benefits due to a higher acceptance rate and the increase in signaling costs. Let us assume a labor market segment with labor shortage, where M homogenous workers are faced with N job offers (e.g. N companies offering one job each), with $M < N$. Thus workers get more than one job offer and accept the offer which yields the highest utility. If for example workers are mainly career oriented they would prefer the job offer with the better career prospects which are unfortunately not directly observable. To keep it simple we also assume that there are only two kinds of jobs, i.e. with low quality q_1 (poor career prospects) and with high quality q_2, so

(1) $q_1 < q_2$

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groups of blue collar workers. Unskilled blue collar workers are excluded from our analysis because companies are not faced with labor shortages in this labor market segment, which is why our signaling model does not apply to this group.

Given these assumptions we first show to which extent workers and employers are interested in taking into account information on quality of the job when deciding upon a job offer. In a second step we analyze the conditions to effectively transmit this quality information via employer signaling.

1. The worker's interest in quality information

Our basic assumption is that accepting a low quality job would result in lower utility $U(q_1) \equiv u_1$ than accepting a high quality job which would yield $U(q_2) \equiv u_2$, so

(2) $U(q_2) > U(q_1)$.

The number of companies offering jobs with quality q_1 is N_1 and with quality q_2 is N_2 (with $N_1 + N_2 = N$). What is the worker's outcome if he has full quality information as opposed to a situation where he does not have any information on quality?

If quality q is not observable and employees have no means of gathering further information employees will end up in a high quality job with probability $\frac{N_2}{N}$ and will end up with a low quality job with probability $\frac{N_1}{N}$. Thus, the expected utility of accepting any job is

(3) $E(U)^{\text{uninf.}} = \frac{N_1}{N} u_1 + \frac{N_2}{N} u_2$.

If on the other hand quality q is observable the worker would always want to get a high quality job with utility u_2 - although he wouldn't necessarily get it. The probability that he gets a high quality job depends on the shortage of high quality jobs, i.e. the number of high quality jobs N_2 in comparison to the number of workers M. If there are even less workers than high quality jobs (severe labor shortage) workers would always choose and get high quality jobs, so they would always end up with utility u_2. If there are at least more workers

than high quality jobs (moderate labor shortage) they would only get a high quality job with probability $\frac{N_2}{M}$ and would have to accept a low quality job with a probability of $\frac{M-N_2}{M}$.

Thus the expected utility in a world of complete information is

$$(4) \quad E(U)^{\text{inf.}} = \begin{cases} u_2 & \text{if } M < N_2 \\ \frac{M-N_2}{M}u_1 + \frac{N_2}{M}u_1 & \text{if } M \geq N_2 \end{cases}.$$

If $E(U)^{\text{inf.}} > E(U)^{\text{uninf.}}$ the worker has an interest in and will use quality information that is credible. This means in very tight labor markets, where the number of workers is even smaller than the number of good jobs ($M < N_2$) workers are always interested in quality information because

$$(5) \quad u_2 > \frac{N_1}{N_1+N_2}u_1 + \frac{N_2}{N_1+N_2}u_2.$$

If the shortage of workers becomes less and less severe, i.e. M raises in relation to (N_1+N_2), the gains of full information decrease more and more, but as long as $E(U)^{\text{inf.}} > E(U)^{\text{uninf.}}$, i.e. if

$$(6) \quad \frac{M-N_2}{M}u_1 + \frac{N_2}{M}u_2 > \frac{N_1}{N_1+N_2}u_1 + \frac{N_2}{N_1+N_2}u_2$$

workers will always be interested in using credible quality information when deciding on a job offer. This is always true as long as $M < N$.

2. The employer's interest in quality information

On the other hand, the company is interested in providing credible quality information if and only if there is an expected return on signaling and if this return is higher than the costs of

providing the signal. The employer's return also depends on the degree of labor shortage within a given labor market segment, which is shown in the following.

Let the company's return be r_v if a job remains vacant and r_o if it is occupied, with $r_o > r_v$. The return depends on the acceptance of a job offer by an employee, so

$$(7) \quad R = R(A) = \begin{cases} r_v & \text{for } A = 0 \text{ (job offer not accepted)} \\ \mathrm{r_o} & \text{for } A = 1 \text{ (job offer accepted)} \end{cases}.$$

In a world without quality information the probability that a job remains vacant or will be occupied is not different for high and low quality jobs, it only depends on the number of workers and the number of job offers $\frac{M}{N} = \frac{M}{N_1 + N_2}$. Thus, the expected return of any job offer is

$$(8) \quad E(U)^{\text{uninf.}} = \frac{M}{N_1 + N_2} r_o + \frac{N_1 + N_2 - M}{N_1 + N_2} r_v$$

In a world with perfect quality information the expected return is of course different. High quality jobs would be filled first, low quality jobs would only be filled if there are more workers than high quality jobs. The acceptance rate for high quality jobs is

$$(9) \quad P_2 = \begin{cases} 1 & \text{if } M \geq N_2 \\ \dfrac{M}{N_2} & \text{if } M < N_2 \end{cases}$$

and for low quality jobs is

$$(10) \quad P_1 = \begin{cases} \dfrac{M - N_2}{N_1} & \text{if } M \geq N_2 \\ 0 & \text{if } M < N_2 \end{cases}$$

Thus, the expected return on a high quality job is

$$(11)\quad E(R)_2^{\text{inf.}} = \begin{cases} r_o & \text{if } M \geq N_2 \\ r_o \dfrac{M}{N_2} + r_v \dfrac{N_2 - M}{N_2} & \text{if } M < N_2 \end{cases}$$

and on a low quality job

$$(12)\quad E(R)_1^{\text{inf.}} = \begin{cases} r_o \dfrac{M - N_2}{N_1} + r_v \dfrac{N_1 + N_2 - M}{N_1} & \text{if } M \geq N_2 \\ 0 & \text{if } M < N_2 \end{cases}.$$

Whenever $E^{\text{inf.}}$ is greater than $E^{\text{unif.}}$ the company generates positive returns by signaling. For high quality jobs this is the case if

$$(13.1)\; r_o > r_o \frac{M - N_2}{N_1} + r_v \frac{N_1 + N_2 - M}{N_1} \quad \text{if } M \geq N_2$$

$$(13.2)\; r_o \frac{M}{N_2} > r_o \frac{M}{N_2} + r_v \frac{N_2 - M}{N_2} \quad \text{if } M < N_2$$

Since by assumption $r_v < r_o$ and $M < (N_1 + N_2)$ the expected return for high quality jobs ($E_2^{\text{inf.}}$) is always higher than the expected return for low quality jobs, so the company has positive returns from transmitting quality information. However, the returns decrease with growing labor shortage $\frac{N}{M}$ (i.e. with decreasing *M* or increasing *N*) because even the good jobs are only filled with very low probability. If, on the other hand, labor shortage becomes less and less severe ($\frac{N}{M}$ decreases), returns to transmitting quality information also decrease because the right hand side of equation (13.1) converges to r_o if *M* increases. So there will be a *corridor of shortness* inside which signaling may pay (depending on the cost of the signal) and outside which it does not.

However, companies with low quality jobs are never interested in sending credible information, because their probability of recruiting a worker always decreases as soon as there

is any information about the true quality of the job, so their return on information about their true quality is always negative. Yet, they would have an interest in "signaling" higher quality than is true if it were possible, but then signaling would not be an equilibrium.

3. Conditions for a signaling equilibrium

It is not difficult to see that a signal will not effectively distinguish one employer from the other unless the costs of signaling are negatively correlated with the true quality of the job. If the costs are not negatively correlated every company will invest in the signal in exactly the same way and they cannot be distinguished on the basis of the signal. So, without this negative correlation there is never a signaling equilibrium, but it is not a sufficient condition. A signaling equilibrium needs a set of worker beliefs that generates acceptance rates, employer signaling decisions, job offers and ultimately new market data that are consistent with the initial beliefs. Any other subjective beliefs will eventually be disconfirmed in the market and are thus not a stable solution.

To see whether a set of observable characteristics creates a signaling equilibrium we can start with a set of conditional probabilistic beliefs for the worker and then determine whether they are in fact confirmed. The decision to accept a job would be dependent on quality q if full information was available:

(14) $A = A(q)$

Since q is not observable the acceptance of a job is based upon beliefs about the quality ($\tilde{q}$). Thus in our case

(15) $A = A(\tilde{q})$.

If workers assume that employers signal their true quality q by a set of observable characteristics x according to

(16) $x = X(q)$

the employees' beliefs on job quality depend on this set of observable characteristics, thus[4]

(17) $\tilde{q} = X^{-1}(x)$.

So the acceptance of a job offer depends on the observable characteristics *x*, i.e.

(18) $A = A(x)$.

As demonstrated by *Spence* in the original applicant signaling model in the employer signaling model there will also be a parameter value $\bar{x}$ in equilibrium above which jobs are accepted and beneath which jobs are rejected because of the employees' assumption of the underlying unobservable quality.

From the employers' perspective this decision rule of the worker determines his profits which depend on the respective acceptance rate that is determined by the set of observable characteristics x, so

(19) $R = R(A(x))$

However, even if a company has positive returns *R* it might still not provide a signal depending on the *costs* of providing the signal ($C = C(x)$). Signaling only occurs if signaling costs are sufficiently negatively correlated with the quality of the job offer because the existence of a separating equilibrium depends on exactly this correlation as shown by *Spence* (1973). *Figure 1a* illustrates this condition with an example. As the signaling costs for the production of $\bar{x}$ for a company with low quality jobs are higher than profits due to a lower acceptance rate, the company chooses not to signal at all, i.e. $x = 0$. Companies with high quality jobs choose $x = \bar{x}$ since in this example the production costs of $\bar{x}$ are lower than the

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[4] Compare *Wilson* (1985: 18) und *Engers* (1987: 669).

profits. As a contrast *figure 1b* shows a pooling equilibrium, i.e. the cost correlation is not sufficient to separate high and low quality firms. If the signaling costs are C_2 for high quality firms and C_1 for low quality firms both types of firms decide not to invest in signaling.

Figure 1a:

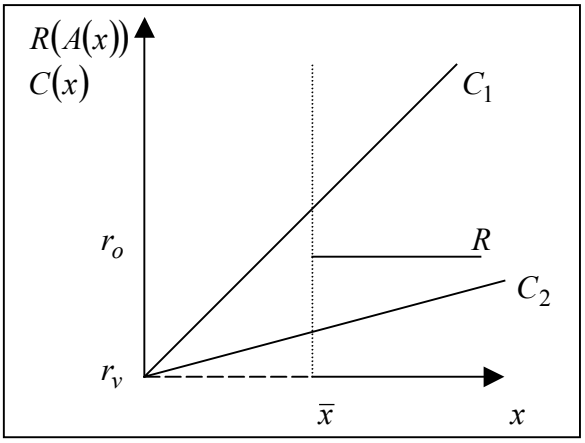
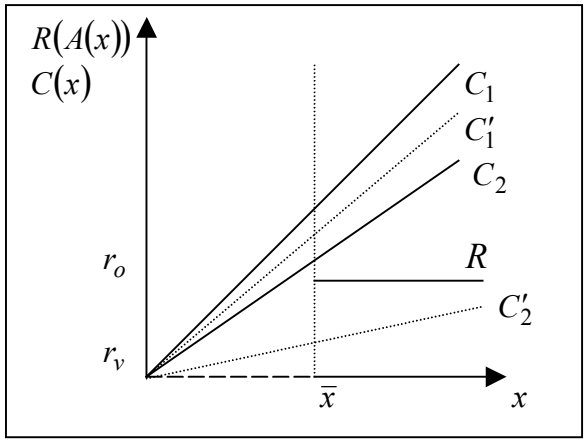


Figure 1b:



So far we did not take into account that there may not only be signaling costs but also signaling returns (apart from a higher acceptance rate). E.g. systematic continuing vocational education and training might be a signal for career prospects because the costs of installing such a system are lower for companies with good career prospects and because continuous training leads to higher direct returns for companies with good career prospects. I.e. signaling returns are higher for firms with high quality jobs than for those with low quality jobs and thereby net costs are lower for companies with high quality jobs. If we take continuing vocational education and training as an example it is reasonable to assume that the returns on systematic training are higher for firms with high career prospects and flexible tasks because it is more likely that they will use the new skills of their workers more efficiently. Thus, the existence of a separating equilibrium actually depends on net costs, i.e. the cost of producing the signal minus immediate returns. It is worth noting that if we take such direct returns into account the range for signaling equilibria is extended as is illustrated in *figure 1b* by the cost

curves C_2' and C_1'. The cost curves are shifted downward but to a different degree depending on the non-observable quality.

If and only if it is not profitable for an employer to imitate signals of a higher quality level a signaling equilibrium is guaranteed, because if this criterion is met, employer signaling creates a stable feedback loop. Companies having high quality jobs produce the respective observable characteristics. Their jobs are more likely to be accepted by workers because of their prior beliefs upon the correlation of observable characteristics and true quality. Given the acceptance rate of workers the company generates more or less return on signaling and thereby decides to signal in the next period. Workers having accepted a job offer learn about the true value of the non-observable quality and can thus adjust their conditional beliefs, which in turn influences their job decision in the next period.

In the following sections we empirically test the model and its implications for differences in job vacancy rates. In order to do so, we firstly have to study workers' preferences within well specified (homogenous) labor market segments (Section 4). In Section 5 we analyze observable company characteristics that meet the signaling criteria we developed in chapter 3 and are thus potential employer signals. Whether these observable characteristics reduce job vacancy rates as implied by the employer signaling model is tested in Section 6.

4. Job qualities that have to be signaled for blue collar workers

To analyze workers' preferences and the job characteristics that are highly valued when workers decide upon a job offer we use the 12th wave of the German Socio-economic Panel (GSOEP)[5], which provides a vast amount of information on working conditions, job

[5] The data used are provided by the DIW, Berlin. For a description of the data see *SOEP Group* (2001).

characteristics and job satisfaction. Since workers have not been asked directly about their highly valued job characteristics we use 'job satisfaction' as a proxy to estimate the value of different job characteristics, which implies that we assume stable preferences before and after entering a company or accepting a job. In our estimations 'job satisfaction' is the dependent variable and different job and company characteristics are the independent variables. Since job satisfaction is measured on a scale from 0='completely unsatisfied' to 10='completely satisfied', we use ordered probit-estimates. To preselect the independent variables we used a variety of previous studies on preferences of blue-collar workers[6] and job satisfaction[7]. The results are summarized in *table 1*.

Table 1: Job satisfaction of skilled blue-collar workers

Variable	**B**		**S.E.**
Non-observable job and company characteristics (dummy variables)			
Work atmosphere (superior)	0,6419	***	0,1100
Work atmosphere (co-workers)	0,5719	**	0,2899
Autonomous workplace	0,0596		0,1277
Challenging/interesting tasks	0,5199	**	0,2439
Career prospects	0,4415	***	0,1404
Physical exertion	-0,0309		0,1312
Psychological exertion	-0,0941		0,1138
Performance evaluation	-0,0218		0,1034
Job security	0,2491	***	0,0967
Working time			
Regular weekly working time	-0,0209	*	0,0112
Flex-time system (dummy)	-0,0236		0,1026
Overtime	0,0237		0,0148
Unpaid overtime (dummy)	0,5474		0,3703
Wage			
Net-wage (log.)	0,0002	***	0,0001
Fringe benefits (dummy variables)			
Company pension	-0,0936		0,1168
13th (14th) wage	0,1658		0,1494
Christmas bonus	0,1256		0,1365
Profit-sharing / bonuses	-0,0032		0,1802
Special vacation bonus	-0,0381		0,1151

[6] See *Gruber* et al. (1993) and *Reich* (1995).

[7] E.g. see *Wiswede* (1995).

Company size (in comparison to < 20 employees)			
20-199 employees	0,0036		0,1289
200-1999 employees	0,0316		0,1508
≥ 2000 employees	0,0928		0,1672
Industry (in comparison to construction)			
Agriculture / Fishing	-0,3999		0,3576
Energy	-0,2979		0,3083
Manufacturing	-0,0116		0,1146
Wholesale and retail trade	0,2408		0,2184
Transport	0,1113		0,2395
Financial Intermediation	1,7609	**	0,8966
Services	-0,1060		0,2711
Company Location			
East/west	-0,2565		0,4878
Others			
Skill adequate tasks	0,0263		0,1160
Temporary contract (dummy)	-0,4230		0,3540
Sex (dummy)	-0,5519	***	0,1973
Age	-0,0070		0,0060
Disabled (dummy)	-0,1417		0,1949
Tenure	-0,0069		0,0064

*(0,10); **(0,05); ***(0,01)
Pseudo-R^2: 0,06 ; χ^2: 113,04***; N = 517

What we find is that job satisfaction increases with wage whereas fringe benefits do not affect job satisfaction of blue collar workers and increased working hours reduce it. Furthermore, a number of non-observable characteristics play an important role for job satisfaction. It is significantly positively correlated with a good work atmosphere and job security, with career prospects and with challenging or interesting tasks. On the other hand, increased flexibility does not affect job satisfaction of blue collar workers significantly. If we compare the results of blue collar workers and white collar workers and managerial staff there are a few substantial differences, which can be summarized as follows.[8] The higher the skill level is the less important are observable characteristics like wage and working time and the more important are career perspectives and challenges on the job.

[8] For more details see *Schmidtke/Backes-Gellner* (2002).

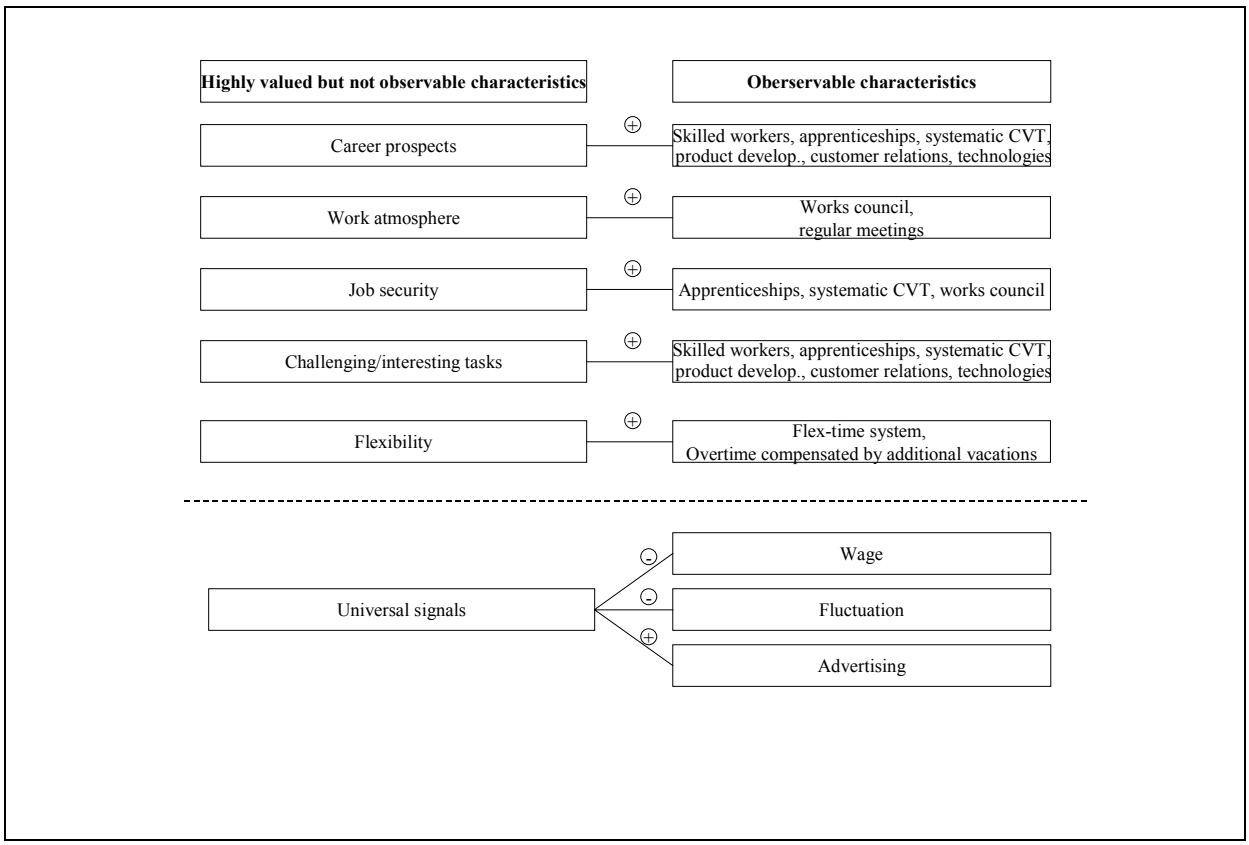
5. Observable characteristics that are potential signals

Given the job characteristics identified in section 4 we have to analyze which observable job or company characteristics could act as potential signals for the non-observable but highly valued job characteristics of blue collar workers. As shown in Section 3 this mainly depends on the negative cost correlation (and the corridor of shortness in a given labor market segment). Since we concentrate on just one labor market segment, namely blue collar workers, we can concentrate on analyzing the correlation between the cost of producing specific signals and the true quality of the job a company offers. So, we have to identify job or company characteristics that are produced with lower (net) costs if the unobserved quality of the job is higher et vice versa. Since it is impossible to get precise information on the cost functions of producing all kinds of signals we use well founded assumptions on the correlation between the true value of a job and the cost to produce certain signals,[9] which are summarized in *table 2*. We assume for example that works councils are a potential signal for job security because one of their main goals is to secure the jobs of their clientele and therefore the costs of having to deal with a works council are lower if a company offers safer jobs anyway. On the contrary, for companies with low job security it would pay to take measures to avoid works councils. To take a second example, we assume that the provision of a formalized continuing vocational training program only pays for companies who offer plenty of career opportunities because continuous skill development only pays if the new

[9] See *Schmidtke* (2001b) for details.

skills are matched with new jobs with higher skill requirements.[10] Other potential signals are derived analogously; they are summarized in *figure 2*.

Figure 2: Potential signals for blue collar workers



Additionally, there are some observable job or company characteristics that can be regarded as universal signals as they are correlated with all highly valued but non-observable qualities. These are wage, fluctuation and job advertising. Contrary to what is usually assumed in our model wage is assumed to be a negative signal because high quality firms can afford to pay lower wages as they do not need to compensate for low quality jobs. At the same time low quality firms have to pay higher wages in order to attract applicants. Advertising is assumed

[10] See *Sadowski* (1980: 81) who stresses the interpretation of training as signal for career advencements and job security.

to be a positive signal as firms can only afford to invest in advertising if they keep their promises, i.e. the investments act as a kind of bond. The effect of universal signals depends on the possibilities to control for the relevant, i.e. highly valued job and company characteristics. Employees search for information about special characteristics. Thus they try to use non-ambiguous signals. Only if there are no direct signals they use universal signals. If the non-ambiguous signals used by the employees are fully included in the analysis, i.e. if sufficient control is possible, the universal signals should no longer have a significant effect on vacancy rates.

If there is reversed signaling and if our assumptions on cost correlations between highly valued job attributes and observable company or job characteristics are adequate, we should observe that companies with those characteristics (listed in the second column of *table 2*) have lower job vacancy rates than companies without those characteristics. So we expect for example that the existence of a works council reduces job vacancy rates because it signals job security or other favourable job attributes. However, we do not expect that all potential signals have to have significant effects on job vacancy rates in order to be consistent with the reversed employer signaling model. Firstly, as already argued by *Spence* (1973) some signals might never have entered a feedback loop and secondly, for some signals the costs might be too high to meet the given corridor of shortness in the blue collar labor market segment.

6. Empirical Results

To test our hypotheses we use a dataset with 740 companies that was collected in 1999 with a special focus on skilled workers and competitiveness of firms.[11] It contains a large number of

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

variables that are well suited to test our hypotheses like number of job openings, job vacancies, job and company characteristics, wages, fringe benefits, product policies etc.[12] Since we want to study differences in job vacancy rates we first exclude all companies that did not have any job openings during the year of study. So all the companies in the sample (N=507) had at least one job opening, that could either be occupied or remained vacant by the end of the year. Since we are interested in studying job vacancy rates we use the number of vacant jobs divided by the number of jobs (both for blue collar workers) as dependent variable. As independent variables we use all the variables that were identified as potential signals in section 5 (see *figure 2*) and some additional control variables. One important control variable is "job openings". It is defined as number of job openings to total number of jobs in a company.

As the vacancy rate is censored and varies only between a lower and an upper limit we use a two-limit tobit model in our estimations,[13] of which the results are given in *table 2*.

Table 2: Tobit Estimation of the job vacancy rate for skilled blue-collar workers

Variable	**B**		**S.E.**
Workplace industrial relations (dummy variables)			
Regular shop-floor meetings	-5,8657		13,8663
Informal participation in important company decisions	-3,1570		9,3320
Works council	-23,0158	*	12,3849
Collective wage agreement	4,9876		10,0226
Investment in human capital (dummy variables)			
Apprenticeships	-22,5571	**	10,2728
Continuing vocational training	-19,3456		29,2434
Skill structure of workforce			
Percentage of blue-collar workers	-0,7477	***	0,2208
Frequency of recruitment of misqualified workers	6,4581	*	3,4236

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

[13] See *Schmidtke/Backes-Gellner* (2002) for more details.

Image			
Closeness of customer relations (1 to 5)	3,9315		6,7957
Market leadership in product development (1 to 5)	-10,0433	*	5,7371
Market leadership in using new technologies	4,8613		5,0063
Sales per employee (log.)	-3,0842		5,9680
Company age	-0,1187		0,1265
Fluctuation (quota)	-0,6343		0,5287
Working time patterns			
Regular working time above collective agreement (dummy)	-0,1757		8,5254
Flexibility of working time system ('1 = flexible' to '4 = inflexible')	0,4651		3,2890
Paid overtime (dummy)	16,9347	*	9,1271
Unpaid overtime (dummy)	31,0184	*	18,7428
Overtime compensated by additional vacation days	-2,2209		8,9122
Wage			
Wages above regional level (dummy)	-2,3223		8,9360
Fringe benefits			
Company pension (dummy	5,0441		10,4602
Bonuses (dummy)	-8,8627		10,7622
Stock ownership plan (dummy)	9,7598		13,2251
Additional vacation days (dummy)	-6,4363		16,0271
Company car (dummy)	17,3778		15,2056
Loans (dummy)	-17,2347		11,0543
Number of other fringe benefits	3,7759		4,9346
Company size			
Number of employees (log.)	-4,3231		4,9540
Number of hierarchical levels	-3,8907		6,7152
Company location			
West/east	19,5623	*	11,3358
Industry (in comparison to construction)			
Manufacturing	0,5131		14,4239
Trade	-29,3727	*	16,5881
Transport	-137,7384		.
Professional Activities	-47,2103	*	27,1652
Other services	-22,0415		19,6029
„Job Advertising" (dummy variables)			
Advertising in regional newspaper	16,8815		10,4345
Advertising in professional journals	4,5201		9,4844
Advertising in World Wide Web	-2,1000		11,7791
Visibility in the labor market	-36,8735	***	12,9609
Others			
Job openings	0,1501		0,2882
Constant	97,9778		79,8298

*(0,10); **(0,05); ***(0,01)
Pseudo-R^2: 0,11; χ^2: 67,00**; N = 168

The table indicates that there is no significant effect of regular shop-floor meetings and informal participation in decision making. The same is true for collective wage agreements. However, as expected, the existence of a works council reduces the vacancy rate significantly. Companies with works councils are faced with lower vacancy rates than companies without.

As expected apprenticeship training lowers job vacancies significantly. Since skilled blue-collar workers by definition already acquired an apprenticeship they do not have a direct personal advantage if a company engages in apprenticeship training, so this is a strong support for our signaling hypothesis. Apprenticeship training is seen as a signal for some other highly valued job characteristics that are not observable but are guaranteed by the existence of apprenticeship training since it only pays if a company offers these highly valued jobs in the first place. The share of skilled workers also reduces vacancy rates significantly but employment of misqualified workers increases the vacancy rate. The existence of a systematic continuing vocational education and training system as potential signal for career prospects, challenging tasks and job security does not have a significant effect although the coefficient points in the expected direction[14].

As expected there is a significant effect of the existence of market leadership in product development as a signal for career prospects and challenging tasks. There is no effect of the universal variables 'wage' and 'fluctuation' indicating a very well suited model specification (the control of unobservable qualities by observable characteristics is sufficient).

Company size and return per employee do not influence the vacancy rate but being located in the eastern or western states of Germany does. The higher vacancy rates of West-German companies are mainly a result of an overall higher labor shortage in West-Germany. Last but not least overall labor market visibility has a negative effect on vacancy rates which may be

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[14] The absence of significance may be explained by insufficient possibilities to differentiate between different systems or types of further education. According to results of a corresponding estimation on the basis of the IAB-Betriebspanel systematic further education reduces vacancy rates significantly (*Schmidtke/Backes-Gellner* 2002).

explained by the fact that companies suffering recruiting problems increase their labor market activities and are thus more visible.

7. Conclusions

The results of our tobit estimates of job vacancy rates support the hypothesis that inter-firm differences in job vacancy rates can be explained by applying a reversed signaling model. Previous studies on workers preferences already indicated that non-observable job characteristics are very important for worker's job or company choice. However, it has never been analyzed how these characteristics are credibly communicated and thus how companies having these favourable job characteristics are able to turn them into lower job vacancy rates. We argued that they are communicated via observable characteristics that are reliable signals of the unobserved job quality. To explain inter-firm differences in job vacancy rates for blue-collar workers we first showed which job attributes are highly valued by blue-collar workers and second analyzed which observable job or company characteristics are potential signals, meaning that net costs of providing those characteristics are sufficiently lower for companies with high quality jobs than for those with low quality jobs. Our empirical estimates of job vacancy rates showed that a great number of those potential signals are effective signals in the sense that workers prefer jobs with those observable characteristics. Thus, companies which provide those characteristics have lower job vacancy rates than other companies. The advantage of explaining job vacancy rates with a reversed signaling model is that it helps to identify variables which would otherwise not be considered to be 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 already finished an apprenticeship and cannot expect direct positive returns. However, with the reversed signaling model it is obvious that and why they could still be important.

It is worth noting that those non-observable characteristics are more important than wages and fringe benefits since they have significant effects on job vacancy rates whereas wages and fringe benefits become insignificant as soon as the influence of the non-observable job attributes is controlled. Therefore, the puzzles that were found in previous empirical studies and that have not been consistently explained so far, can be solved by applying the reversed signaling model we propose. Employers signal the unobservable quality of their jobs by observable characteristics that reliably signal their quality. For human resources management this in turn means that those observable characteristics should not only be evaluated by the returns they generate within their own policy field (apprenticeships e.g. should not only be evaluated by the increased productivity of apprentices), but also by their effect within other personnel policy fields (i.e. by the reduction of the job vacancy rate due to an improved acceptance rate when recruiting on tight labor markets).

Thus, given a certain labor market shortage for skilled workers single companies can improve their individual position and ensure acceptance rates above average by using signals to communicate a higher job quality.

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