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Wage Posting or Wage Bargaining? Evidence from the Employers' Side

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September 2013

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ABSTRACT

Wage Posting or Wage Bargaining? Evidence from the Employers' Side^{*}

Using a representative establishment dataset, this paper is the first to analyze the incidence of wage posting and wage bargaining in the matching process from the employer's side. We show that both modes of wage determination coexist in the German labor market, with about two-thirds of hirings being characterized by wage posting. Wage posting dominates in the public sector, in larger firms, in firms covered by collective agreements, and in part-time and fixed-term contracts. Job-seekers who are unemployed, out of the labor force or just finished their apprenticeship are also less likely to get a chance of negotiating. Wage bargaining is more likely for more-educated applicants and in jobs with special requirements as well as in tight regional labor markets.

JEL Classification: E24, J30, J63, M51

Keywords: wage posting, wage bargaining, hiring, matching, Germany

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1. Introduction

In the last two decades, search and matching models have played an increasingly important role in the analysis of labor markets. These models usually assume one of two mechanisms of wage-setting, either wage posting or wage bargaining.¹ In wage posting the employer defines a job in terms of duties and skills and unilaterally sets the wage *ex ante*, i.e. before he meets job-seekers, and workers search for the best job available. Suitable candidates are offered the job and the corresponding wage as a matter of take-it-or-leave-it. In this non-cooperative setting, the employer is committed not to respond to any counteroffer from a job-seeker. In contrast, in wage bargaining models the employer makes an initial offer but job-seekers can make a counteroffer for a higher wage, and alternating-offer bargaining may best describe the ensuing process. While wage posting is typically assumed in microeconomic analyses along the lines of Burdett and Mortensen (1998), wage bargaining models are most often used in macroeconomic applications (see the survey by Rogerson and Shimer 2011).²

Why should we care about the “right” model (or about the prevalence of these models)? First of all, it should be interesting to know which model of wage setting is actually used by the majority of firms or by certain types of firms. Such empirical evidence could inform theoretical modelling which in recent years seems to get more interested in whether its crucial wage setting assumption is backed by real-world experience. Second, and more specifically, if wage posting is found to prevail in the market then wage posting models, which can be considered as models of monopsonistic competition, should be the preferred choice. This comes with the advantage that many labor market questions (such as the structure of wages) could be dealt with within the simple static textbook model of monopsony – whereas no such simplification is at hand when assuming *ex post* wage bargaining within a matching framework (Manning 2003, 16). Third, empirical evidence about the modes of wage setting may help to explain the so-called Shimer (2005) puzzle that fluctuations in the unemployment rate seem to be much larger than predicted by the standard labor market matching model. One potential mechanism for amplifying the effect

¹ For extended discussions of these and other mechanisms, see Mortensen and Pissarides (1999), Hall and Krueger (2010) and Manning (2011).

² Note that although search and matching can be assumed to be random (and usually are in wage bargaining models), models of “directed search” (e.g., Moen 1997, Michelacci and Suarez 2006) typically assume that there is wage posting. Here, job-seekers observe the posted wages of all employers before they decide on their applications, and then pick the best job available.

of shocks on the labor market are rigid wages. Whether wages are negotiated or posted does play a role for wage rigidity in some models such as Ellingsen and Rosén (2003) where posted wages react more than bargained wages to an increase in the reservation wage resulting from a shock. As bargained wages are more rigid, employment and unemployment show a stronger reaction to shocks. In contrast, if wage posting is more common, the observed excess volatility of unemployment over the business cycle cannot be due to sticky wages. Hall and Krueger (2010, 15) thus argue that “a finding that a substantial majority of jobs were filled at posted wages would be unfavorable for an important branch of modern thinking about unemployment volatility.”

Despite the importance of these wage setting models and their contrasting implications, the evidence on the prevalence of wage posting and wage bargaining is very limited. Hall and Krueger (2010, 2012) survey a representative sample of about 1,300 workers in the US and ask about the wage determination process at the time they were hired into their current or most recent jobs. They find that both forms of wage setting are common in the US labor market. About one-third of the matches are based on wage bargaining, and almost two-thirds on wage posting. While wage bargaining is dominant for more-educated workers, wage posting is more common for public employment, in unionized jobs and for part-time workers. Examining wage posting in job ads in the US, the UK, and Slovenia, Brenčič (2012) detects considerable differences in the incidence of wage posting across the three labor markets, with information about a (non-negotiable) wage offer being most prevalent in job ads in the UK. In all three labor markets employers are less likely to post a wage offer when searching for a skilled worker.

Against this backdrop, our paper contributes to the literature in three ways: Most important, we are the first to provide evidence on the modes of wage determination in the hiring process based on an extensive and representative survey of establishments, in such a way overcoming a serious research deficit identified by Hall and Krueger (2012) who were only able to use information from the workers’ side. Second, by focusing on Germany, we present evidence for an institutional framework of a welfare state that is quite different to the institutional settings which were investigated by Hall and Krueger (2012) and Brenčič (2012). Third, our comprehensive dataset enables us to relate the incidence of individual wage bargaining to firm-specific, vacancy-specific, employee-specific, and environmental variables and to empirically test seven key

predictions from wage posting and wage bargaining models. Before presenting the empirical evidence, we briefly sketch the theoretical background and describe our unique data set.

2. Wage posting versus wage bargaining: differences and implications

For a long time, wage posting and wage bargaining models have lived somewhat separate lives in the micro- and macroeconomic literature, which is rather difficult to explain (Manning 2011, Mortensen and Pissarides 1999, 2619). However, it must be stressed that both wage-setting mechanisms have distinctly different (dis)advantages and implications.³

Major advantages of wage posting for employers are that it saves transaction costs, that it might be regarded as fair by job-seekers, and that posting high wages can be used as a strategy of (highly productive) firms for attracting more workers than less efficient firms and growing accordingly. Moreover, in wage posting the employer can appropriate a large share of the surplus from a match, i.e. the gains from an employment relationship arising in a labor market with search and matching frictions. In an extreme case (the so-called Diamond paradox), the employer captures the entire surplus and the worker is only paid his or her reservation wage. In contrast, in wage bargaining models the surplus is shared after the job-seeker and the employer have been matched, where the sharing often reflects an asymmetric Nash bargain. In this case, workers' outside options including the current labor market situation may be important. These outside options are irrelevant in wage posting models, but it should be noted that the labor market situation could also be taken into account by the employer when setting or adjusting the posted wage. While adjusting the posted wage after each period is possible, the crucial point in wage posting models is the firm's commitment not to consider counteroffers, for instance by denying managers the power to alter the wage.

A major disadvantage of wage posting is that there will be no match with job-seekers whose reservation rates are above the posted wage but whose productivity is even higher. By not

³ Detailed discussions of these two models are provided by Mortensen and Pissarides (1999), Hall and Krueger (2010) and Manning (2011). For theoretical models that explicitly incorporate employers' choice between these two wage setting mechanisms, see, e.g., Ellingsen and Rosén (2003) and Michelacci and Suarez (2006).

bargaining and matching with such candidates, employers thus forego some potential surplus. In contrast, in wage bargaining models no match with a positive surplus would fail to be implemented. By and large, the more heterogeneous workers' skills are, the more attractive is wage bargaining for the employer. However, by reacting to candidates' skills, productivity, and outside options, wage bargaining may result in a higher (average) wage than wage posting.

From this brief comparison, the following seven factors influencing the choice between the two wage-setting mechanisms can be identified and investigated empirically with our data. First, wage posting is less likely to lead to a match with a worker who is overqualified for the job posted whereas such a match is possible in wage bargaining and will lead to a higher wage for the overqualified applicant.

Second, wage posting may involve an adverse selection problem with employers receiving applications from less productive workers who hope to be protected against their productivity disadvantage (see Michelacci and Suarez 2006) and very productive applicants being more likely to reject the non-negotiable job offers (see Ellingsen and Rosén 2003). In contrast, due to search inefficiencies wage bargaining may probably attract too few applicants relative to the level that would maximize the value of a vacancy (Michelacci and Suarez 2006). Empirically this may be tested by looking at firms' difficulties in filling the job opening.

Third, if firms know that less productive workers usually accept a posted wage whereas more productive applicants prefer to bargain their wages (as suggested by Michelacci and Suarez 2006), they are unlikely to start bargaining with applicants who are deemed to be less productive. For our empirical analysis, this suggests that individual characteristics of applicants that go beyond formal qualification and other job-defining attributes and that are regarded as signals of low productivity, such as previous unemployment, should reduce the probability of wage negotiation.

Fourth, theory suggests that wage posting is sensible to use when the job type is public information (see Acemoglu and Shimer 1999). This implies that wage posting should be found more often in firms covered by collective agreements because these publicly known agreements

typically define the skills and duties in various wage groups and set minimum working conditions.

Fifth, posting wages makes only sense when a firm's commitment not to consider counteroffers is credible. This may particularly be the case in the public sector in Germany since here the remuneration of civil servants (*Beamte*) is fixed by law and the pay of other public sector workers is often related to this scale or is laid down in collective agreements, with personnel managers in public authorities mostly being denied the power to alter the wage. Furthermore, as suggested by Michelacci and Suarez (2006), firms that belong to the public sector or are unionized (i.e. covered by collective agreements) are more likely to be constrained to follow the "same job, same pay" principle and thus forced to post wages.

Sixth, wage bargaining may be the appropriate wage-setting mechanism for occupations and jobs with a high dispersion in workers' skills and productivity and where workers' skills are scarce (Ellingsen and Rosén 2003). For our empirical investigation this implies that wage bargaining should be more frequent if the vacancy to be filled requires a high qualification and/or specific skills. Moreover, we should find substantial differences in the use of wage bargaining and wage posting according to branch and occupation (in addition to the public sector effect discussed above).

Seventh, wage bargaining is more likely to occur in tight labor markets since tightness increases workers' reservation wages. Ellingsen and Rosén (2003) show that an increase in reservation wages hurts a firm more if it posts wages than if it bargains because a posted wage has to rise one to one with the reservation wage, whereas a negotiated wage can rise by a smaller amount. As high regional unemployment lowers the reservation wage, we expect it to reduce the probability of wage negotiation. The following empirical analysis will investigate whether these seven factors influencing the choice between both modes of wage setting really show up in practice.

3. Data and Hypotheses

In our analysis, we make use of the German Job Vacancy Survey (for a detailed description, see Kettner and Vogler-Ludwig 2010). This survey started in 1989 and is conducted annually by the Institute for Employment Research (IAB). The sample is randomly drawn from the universe of establishments with at least one employee and is stratified by 23 economic sectors and 7 firm size classes. Among others, the survey includes information on the number of vacancies, on worker flows, and on various firm characteristics. It also contains a number of questions concerning the very last case of a successfully recruited worker, such as gender, age and previous status of the hired worker, the qualification required for this job, the duration of search, and the recruiting channels used by the employer. The 2011 wave of this survey additionally asked establishments whether bargaining about remuneration took place in the last case of successful hiring. To be more specific, our question of interest is: “Did you negotiate with the applicant about remuneration (basic salary and further components if applicable)?” Overall, 9,260 firms answered this specific question (533 cases are missing). Respondents had three choices of answers: “Yes”, “No, fixed offer made by the establishment”, or “No, for other reasons ...”.⁴ In the following, we will only make use of the yes/no distinction and analyze the incidence of wage negotiations.

The strength of our survey data is that they provide information from the employers’ side and contain an explicit question on the incidence of individual wage bargaining and wage posting not available in other datasets. Nevertheless, there are some limitations that should be taken into account when interpreting the results. First, although we know whether bargaining over the wage took place or not in the hiring process, we do not have information on whether the job originally was advertised with a fixed or a negotiable level of pay (or with no specific reference to pay at all). Second, it would also be interesting to know what happened in encounters between applicants and employers that did not result in a hiring, but such a question was not included in the survey. Third, as noted by Hall and Krueger (2012, 59), in sequential bargaining models with full information, employers and applicants respond to counteroffers from the other party, but “in the equilibrium of the sequential bargaining game, one party makes an initial offer and the other party accepts it. No exchange of offers and counteroffers actually occurs.” It thus would be interesting to know whether the firm and/or the applicant thought of making counteroffers but

⁴ Note that the last item “No, for other reasons” (chosen in 223 cases) offers an open answer. We thoroughly analyzed these open answers, and when they meant basically the same as a fixed offer (for instance by referring to a collectively agreed wage or piece rate) we recoded it to “No, fixed offer made by the establishment”. This happened in 213 cases. The other ten cases were defined as missing.

decided against it, but asking such a question may be too difficult in practice. Finally, a limitation of our data is that the wage posting/bargaining question was only asked in 2011 so that we are not able to conduct a panel analysis taking account of firms' unobserved heterogeneity.⁵

In addition to the crucial wage bargaining question, our survey includes a number of questions on firm characteristics, on the characteristics of the last job opening successfully filled, and on the characteristics of the applicant hired for this job (summary statistics of these variables are provided in Appendix Table 1). Starting with firm characteristics, we know whether establishments are bound by a collective wage agreement. In Germany, about one-third of establishments (employing more than 50 percent of workers) are covered by collective agreements negotiated by a sectoral union and an employers association or an individual employer whereas the majority of firms prefer to conclude individual contracts with their employees (see Ellguth and Kohaut 2012). Since according to German labor law the wage rate and the working conditions laid down in collective agreements are minimum standards, firms bound by collective agreements cannot undercut but only improve upon these terms and conditions (for details, see Jung and Schnabel 2011). We therefore expect individual wage bargaining to be less prevalent in jobs covered by collective agreements where bargaining has already taken place at a higher level and where the job type is public information. Using information on the industry in which the firm is active, we can further test whether wage bargaining is less prevalent in branches belonging to the public sector. As discussed above, posting wages only makes sense when a firm's commitment not to consider counteroffers is credible. This may particularly be the case in the public sector in Germany where personnel managers usually do not have the power to alter the wage. We further include establishment size (5 dummy variables) as an explanatory variable and expect larger firms to negotiate less often with their applicants since internal labor markets with fixed positions and wages are more likely to exist in larger firms. We are also able to control for the employment structure of a firm (i.e. the shares of female, part-time and temporary employees) but we do not have theoretical priors for these variables.

⁵ Note, however, that some important explanatory variables discussed and investigated below, such as belonging to the public sector or being covered by a collective agreement, do not change much over the years.

Concerning the characteristics of the job opening to be filled, we can identify part-time and fixed-term jobs. In these two cases of atypical employment we expect firms to make a take-it-or-leave-it offer and not bother with individual bargaining. We also have information about the qualification required for the job and about further requirements such as long-term experience in the occupational field and managerial skills. As wage bargaining models imply that bargaining is more suitable for jobs with a high dispersion in workers' productivity and scarcity in workers' skills, we expect these three variables to be positively associated with the incidence of individual wage bargaining. We also know whether the job opening was filled with an applicant whose qualification or work experience was higher or lower than required. In a wage posting setting this variable should prove to be insignificant since there will be no match with an overqualified worker, but it should play a role in a bargaining setting where such a match is possible. Finally, there is some information on whether the firm experienced difficulties in filling the job opening. For at least two reasons, however, this dummy variable needs to be interpreted cautiously. First, as discussed above, both wage posting (and the adverse selection problem it entails) and wage bargaining (which may result in too few applicants) may create difficulties in filling the job opening, so that our variable is not able to discriminate between both models. Second, it cannot be ruled out that these difficulties are endogenous, i.e. caused by the mode of wage setting chosen.⁶

Coming to the characteristics of the employee hired, we have information on gender, age and previous employment status. While it is difficult to make clear-cut theoretical predictions on the role of gender and age,⁷ the previous status of the newly hired worker should play an important role in a wage bargaining model (whereas the wage is independent of observed worker characteristics in a wage posting model). In particular, applicants who were previously unemployed or out of the labor force can be expected to have a lower bargaining power and thus should be less likely to get a chance to negotiate their wage. The incidence of wage bargaining can also be expected to be lower for applicants who were apprentices before as there usually exist clear starting positions (and wages) for these entrants.

⁶ Therefore it is reassuring that our insights do not change when we drop this variable in a robustness check.

⁷ Although it is sometimes argued that women try to avoid salary negotiations, a natural field experiment by Leibbrandt and List (2012) that takes account of sorting effects suggests that the relationship is much more complex. Moreover, in our case it is primarily the firm and not the individual that decides about bargaining.

To this data on the characteristics of firms, vacancies, and successful applicants stemming from the German Job Vacancy Survey, we merge information obtained from the Federal Employment Agency on the rate of registered unemployment at the level of administrative districts (*Landkreise und kreisfreie Städte* – NUTS3 regions). This is the most disaggregated level for which labor market data are available in Germany. The state of the regional labor market plays an important role in wage bargaining models in that it affects the outside options and relative bargaining positions of applicants and employers. In particular, the lower the unemployment rate, the higher are applicants' reservation wages and the more likely are firms to negotiate wages. In wage posting, employers can also change the entry wage in response to the labor market situation, but this should happen before the wage rate is posted and not during the hiring process.

4. Descriptive Evidence

Tables 1 and 2 provide some descriptive evidence on the incidence of wage bargaining from our regression sample, including a weighting of the data that takes care of the sampling frame (using strata for 23 sectors and 7 firm size classes). They show that wage posting dominates in Germany – in just 38 percent of hirings establishments negotiated with the applicant about remuneration.⁸ Interestingly, this finding is quite similar to that obtained by Hall and Krueger (2012) for the US, where about 37 percent of workers reported that they bargained with their current employers.

(Table 1 about here)

Table 1 makes clear that the incidence of individual wage bargaining varies considerably across industries, ranging from more than 50 percent in the information and communication sector and in professional, scientific and technical activities to less than 9 percent in public administration, defense and social security. This empirical evidence is in line with two theoretical predictions derived above. Wage bargaining is more suitable for jobs and occupations with a high dispersion in workers' productivity, and this is arguably the case in the information/communication sector and in professional and technical activities. In contrast, wage posting only makes sense when a

⁸ Weighted value; note that weights are calculated to be representative for all hirings.

firm's commitment not to consider counteroffers is credible, and this is true in the public sector in Germany.

(Table 2 about here)

Table 2 provides some cross-tabulations with firm, vacancy, and personal characteristics. As expected, in establishments that are covered by collective agreements individual bargaining over the wage is well below average.⁹ Individual bargaining is more frequent in those firms that report difficulties in filling the job opening and in cases where the job requires a higher qualification. Compared to prime-age workers, wage bargaining seems to play a somewhat smaller role for younger employees (aged less than 25 years) and for older workers (above 50 years). Finally, the previous status of the applicant does make a difference. Wage bargaining most frequently takes place with applicants who were employed outside the firm or self-employed. As expected, firms negotiate less often with applicants who are unemployed or out of the labor force, and there is also not much bargaining with apprentices (in particular when they finished their apprenticeship in this firm). The following section will show whether these differences still hold in a multivariate analysis.

5. Econometric Evidence

Table 3 presents the results (marginal effects) of a logit analysis of the mode of wage determination. The dependent variable is a dummy that takes on the value of 1 if the establishment negotiated with the applicant about remuneration in its last successful hiring (and 0 otherwise).¹⁰ By and large, the econometric results are in accordance with expectations and with

⁹ Note that in addition to wages negotiated individually about 43 percent of posted wages are covered by a collective agreement which means that wage negotiations between trade unions and employers on firm or branch level took place prior to the wage posting. In this interpretation of the evidence, the wages of 65 percent of all hirings are the results of some sort of bargaining at one of the three levels.

¹⁰ While the descriptive information on the share of wage negotiations presented in the last columns of Tables 1 and 2 is based on weighted data (taking care of the sampling frame using strata for 23 sectors and 7 size classes), our econometric investigation uses unweighted data but includes the stratification variables (i.e. sector and firm size dummies); for a discussion and justification of this practice, see Winship and Radbill (1994).

the descriptive evidence. Note that our insights do not change when estimating a probit or a complementary log-log model instead.

(Table 3 about here)

Starting with firm characteristics, it can be seen that establishments bound by a collective agreement are significantly less likely to negotiate with their applicants. The probability of negotiation is reduced by more than 15 percentage points in this case, *ceteris paribus*. The incidence of individual wage bargaining also falls significantly with the size of an establishment and with its share of part-time employees. The lower incidence of wage negotiations in larger firms may be a reflection of the existence of internal labor markets with more standardized positions in such firms. Compared to the reference category of machinery and equipment, electrical equipment and motor vehicles – the industry that forms the backbone of German manufacturing – individual wage bargaining is substantially less prevalent in branches belonging to the public sector such as public administration, defense and social security, and education.¹¹ However, in contrast to the descriptive evidence presented in Table 1, firms in the information/communication sector and in professional and technical activities do not play a special role anymore.

Concerning the characteristics of the job opening, we find that firms are less likely to negotiate about wages in part-time jobs and fixed-term employment contracts. In contrast, the probability of negotiation rises significantly with the level of qualification required for the job. Negotiations are also more likely to take place when the job opening to be filled has additional requirements such as long-term experience in the occupational field or managerial skills. Generally, establishments that report difficulties in filling the job opening are more likely to make use of wage bargaining, but as this variable might be endogenous, this finding should be interpreted cautiously. If it is endogenous, then the estimated coefficient would be biased against zero and could be regarded as a lower bound of the true effect.

¹¹ In a separate estimation not reported in Table 3 we made use of a dummy variable that comprises all branches that predominantly belong to the public sector. This dummy proved to be highly statistically significant, indicating that the probability of negotiation was 21 percentage points lower in the public than in the private sector.

As concerns personal characteristics of the applicant, gender and age do not play a statistically significant role for the incidence of wage negotiations, but the previous status of the job-seeker clearly does. Compared to the reference category of applicants who are employed outside the firm, job-seekers who are unemployed or out of the labor force or who are temporary agency workers in this firm are all less likely to be negotiated with. The low incidence of bargaining for these groups of employees probably reflects their low bargaining power. The same can be said for job-seekers who just finished their apprenticeship, but an additional reason may be that there exist clear starting positions (and wages) for this type of entrants.

Finally, there is a negative and statistically highly significant relationship between the state of the regional labor market and the probability of negotiation. This probability is reduced by 1.3 percentage points if the regional unemployment rate is one percentage point higher (this corresponds to a reduction by 2.5 percent based on a probability of negotiation for the reference group of 49.6 percent). This suggests that reservation wages, outside options and the relative bargaining power of the applicant and the employer do play a (minor) role when firms decide whether to post a wage or to start bargaining with job-seekers.

Interpreting our results in terms of the theoretical predictions made from the comparison of wage posting and wage bargaining models in Section 2, we see that most predictions are confirmed by the empirical evidence. In accordance with models of wage bargaining, we find that firms are more likely to negotiate with applicants when these are highly qualified and when the labor market is tight. Also workers' status, expected productivity and bargaining power seem to play a role in that firms are less likely to start negotiations with applicants who are unemployed, out of the labor force or just finished their apprenticeship. In accordance with wage posting models our results indicate that wage bargaining is less likely (and thus wage posting more likely) in branches like the public sector where wage posting firms' commitment to disregard counteroffers is most credible since personnel managers are denied the power to alter the wage here. Wage posting is also found more often when the job type is public information, i.e. in those firms which are covered by collective agreements that typically define the skills and duties in various wage groups and set working standards. But note that there is one theoretical prediction which does not obtain empirical support in our data. Whereas in a wage posting setting there will be no match with an overqualified worker, such a match should be possible in a wage bargaining setting.

However, we do not find a significant relationship between the fact that a job opening was filled with an applicant whose qualification or work experience was higher than required and the incidence of individual wage bargaining.

6. Conclusions

Using a large and representative dataset on German establishments in 2011, this paper has analyzed the incidence of individual wage bargaining in the hiring process and its major determinants. Our empirical evidence indicates that both wage posting and wage bargaining are found in the German labor market, with about 62 percent of hirings being characterized by wage posting and about 38 percent being accompanied by negotiations over the wage. Wage posting dominates in the public sector, in larger firms, in firms covered by collective agreements, and in part-time and fixed-term employment contracts. Similarly, job-seekers who are unemployed or out of the labor force or just finished their apprenticeship are also more likely to receive a take-it-or-leave-it job offer with no chance of negotiating. The incidence of wage bargaining is above-average for more-educated applicants as well as in jobs with special requirements such as long-term experience in the occupational field or managerial skills, and wage bargaining is also more likely in tight regional labor markets.

While our analysis is the first providing evidence from the employer's side, it is interesting to compare our results for Germany with those of Hall and Krueger (2012) from the worker's side in the US. Although the institutional setting in the US is quite different and they use information from a survey of workers while we analyze a survey of establishments, the results broadly point in the same direction. Both studies indicate that wage posting and bargaining coexist in the labor market, with wage posting taking a dominant position. Both analyses also show that the incidence of individual wage bargaining rises with job-seekers' education whereas it is relatively low for part-time workers, in the public sector and in cases where there exists some form of collective bargaining (as for unionized workers in the US and for firms covered by collective agreements in Germany). Major differences are that Hall and Krueger (2012) report a gender gap in wage bargaining not visible in our data, whereas we find that unemployed job-seekers are less likely to

negotiate in Germany which is hardly the case for recent job losers in the US. In addition to Hall and Krueger (2012), our establishment data enable us to detect further relationships between wage bargaining and establishment size, the type of job opening, and the state of the regional labor market.

The prevalence of wage posting in both labor markets, which implies that workers' individual bargaining power is limited and that firms should be able to adjust entry wages to productivity shocks, is a setback to solving the Shimer (2005) puzzle of excess volatility of unemployment over the business cycle. In the German labor market, the flexibility of wages over the business cycle also depends on the effects of collective bargaining and of works councils. Gartner et al. (2013) show that wage adjustments to positive and negative shocks are generally not symmetric and vary across different regimes of industrial relations, but due to lack of data they are not able to relate these different effects to firms' use of wage posting or wage negotiations. The present paper has shown that individual wage bargaining is much less likely if the firm already engages in collective bargaining and is covered by a collective agreement. Future research should try to combine these different levels of wage determination and perform panel analyses in order to obtain a better understanding on the relative importance of different determinants of wage adjustment over the business cycle. Another fruitful avenue of further research might be conducting a combined survey of employers and of all the employees they invited to a job interview (not just those hired), in such a way obtaining a much more complete picture about the relevance of different modes of wage determination in the matching process.

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Table 1: Wage posting and negotiation across industries (number and share of establishments)

Classification of economic activities	wage	wage	share of wage negotiations	
	posting	negotiations	raw	weighted
Agriculture, forestry and fishing	132	69	0.343	0.442
Mining and quarrying	67	35	0.343	0.289
Food; textile, clothes and furniture	177	78	0.306	0.409
Wood, paper and printing	158	81	0.339	0.378
Coke and refined petroleum products, chemicals and plastic products	193	88	0.313	0.330
Basic metals, fabricated metal products	180	111	0.381	0.447
Machinery and equipment, electrical equipment and motor vehicles	147	144	0.495	0.513
Electricity, gas, steam and air conditioning supply	157	60	0.276	0.335
Water supply; sewerage, waste management and remediation activities	175	49	0.219	0.210
Construction	146	87	0.373	0.349
Wholesale and retail trade; repair of motor vehicles and motorcycles	158	109	0.408	0.361
Transportation and storage	171	74	0.302	0.386
Accommodation and food service activities	215	80	0.271	0.337
Information and communication	125	142	0.532	0.545
Financial and insurance activities	146	91	0.384	0.404
Real estate activities	185	100	0.351	0.363
Professional, scientific and technical activities	133	137	0.507	0.642
Administrative and support service activities	175	90	0.340	0.393
Public administration and defense; compulsory social security	502	37	0.069	0.086
Education	398	86	0.178	0.170
Human health and social work activities	428	156	0.267	0.416
Arts, entertainment and recreation	157	53	0.252	0.453
Other service activities	364	101	0.217	0.144
Total	4,689	2,058	0.305	0.384

Source: German Job Vacancy Survey 2011. Regression sample (see Table 3) with 6,747 observations. The survey weights are based on strata for 23 economic sectors and 7 firm size classes.

Table 2: Wage posting and negotiation according to firm, vacancy and personal characteristics

		wage posting	wage negotiation	share of wage negotiations	
				raw	weighted
Collective wage agreement		2,516	708	0.220	0.270
Difficulties in filling the job opening		1,017	656	0.392	0.450
Qualification	Unqualified	619	142	0.187	0.298
	Intermediate qualification	3,319	1,416	0.299	0.371
	Higher qualification	751	500	0.400	0.555
Age	<25	853	266	0.238	0.318
	25-39	2,085	995	0.323	0.417
	40-50	1,182	572	0.326	0.396
	>50	569	225	0.283	0.335
Previous status	Employed outside the firm	2,093	1,197	0.364	0.457
	Unemployed	1,505	496	0.248	0.320
	Temporary agency worker in this firm	142	41	0.224	0.374
	Self-employed	155	79	0.338	0.489
	Apprentice in this firm	147	27	0.155	0.234
	Elsewhere in apprenticeship/education	460	166	0.265	0.238
	Out of labor force (housewife etc.)	187	52	0.218	0.311
Total		4,689	2,058	0.305	0.384

Source: German Job Vacancy Survey 2011. Regression sample (see Table 3) with 6,747 observations. The survey weights are based on strata for 23 economic sectors and 7 firm size classes. “unqualified” means without occupational training; “higher qualification” indicates college or university degree.

Table 3: Probability of wage negotiation – Marginal effects based on a logit model

Explanatory Variables:	dy/dx	Std. Err.	P>z
Collective wage agreement (dummy)	-0.1525	0.017	0.000
Plant size			
< 20	-0.0142	0.017	0.389
20 - 49 (<i>reference</i>)	---	---	---
50 - 199	-0.0918	0.022	0.000
200 - 499	-0.1098	0.030	0.000
500 +	-0.1329	0.035	0.000
Share of female employees	-0.0134	0.038	0.725
Share of part-time employees	-0.1822	0.048	0.000
Share of temporary employees	-0.0199	0.053	0.710
Fixed-term employment contract (dummy)	-0.0588	0.016	0.000
Part-time job (dummy)	-0.1056	0.025	0.000
Required Qualification			
Unqualified	-0.1273	0.025	0.000
Intermediate qualification (<i>reference</i>)	---	---	---
Higher qualification	0.1075	0.018	0.000
Further Requirements			
Long-term experience in occupational field (dummy)	0.0896	0.016	0.000
Managerial skills (dummy)	0.1563	0.019	0.000
Difficulties in filling the job opening (dummy)	0.0919	0.017	0.000
Qualification or work experience is ... than required			
higher (dummy)	0.0523	0.039	0.184
lower (dummy)	-0.0048	0.026	0.854
Female	0.0177	0.017	0.310
Age			
< 25 (<i>reference</i>)	---	---	---
25 - 39	0.0290	0.025	0.240
40 - 50	0.0333	0.026	0.194
51 +	0.0206	0.031	0.506
Previous status			
Employed outside this firm (<i>reference</i>)	---	---	---
Unemployed	-0.1135	0.020	0.000
Temporary agency worker in this firm	-0.1404	0.044	0.001
Self-employed	-0.0345	0.043	0.421
Apprentice in this firm	-0.1681	0.052	0.001
Elsewhere in apprenticeship/education	-0.0935	0.027	0.000
Out of labor force (housewife etc.)	-0.0810	0.042	0.052
Regional unemployment rate	-1.2675	0.312	0.000
Classification of Economic Activities			
Agriculture, forestry and fishing	-0.0995	0.048	0.040
Mining and quarrying	-0.1156	0.067	0.082
Food; textile, clothes and furniture	-0.1248	0.047	0.008
Wood, paper and printing	-0.1301	0.045	0.004

Coke and refined petroleum products, chemicals and plastic products	-0.1607	0.042	0.000
Basic metals, fabricated metal products	-0.0994	0.044	0.025
Machinery and equipment, electrical equipment and motor vehicles (<i>reference</i>)	---	---	---
Electricity, gas, steam and air conditioning supply	-0.1879	0.045	0.000
Water supply; sewerage, waste management and remediation activities	-0.2376	0.047	0.000
Construction	-0.0739	0.050	0.140
Wholesale and retail trade; repair of motor vehicles and motorcycles	-0.0344	0.048	0.476
Transportation and storage	-0.1487	0.048	0.002
Accommodation and food service activities	-0.1555	0.049	0.002
Information and communication	-0.0108	0.048	0.821
Financial and insurance activities	-0.0141	0.047	0.766
Real estate activities	-0.0886	0.042	0.037
Professional, scientific and technical activities	-0.0187	0.047	0.692
Administrative and support service activities	-0.0235	0.047	0.616
Public administration and defense; compulsory social security	-0.3793	0.044	0.000
Education	-0.2642	0.043	0.000
Human health and social work activities	-0.1037	0.043	0.015
Arts, entertainment and recreation	-0.1952	0.054	0.000
Other service activities	-0.1992	0.041	0.000

Source: German Job Vacancy Survey 2011. 6,747 observations; regional unemployment rates are for 409 administrative districts (*Landkreise und kreisfreie Städte* – NUTS3 regions); “unqualified” means without occupational training; “higher qualification” indicates college or university degree. Standard errors clustered at regional level. Marginal effects calculated for the reference group where dummies are zero and the values of the shares and the unemployment rate are at the mean. The probability of negotiation for the reference group is 0.496.

Appendix Table 1: Descriptive Statistics of regression sample

	Mean	Std. dev.
Dependent variable: Wage negotiation (dummy)	0.305	0.460
Explanatory variables:		
Collective wage agreement (dummy)	0.478	0.500
Plant size		
< 20 employees (dummy)	0.282	0.450
20 - 49 employees (dummy)	0.296	0.457
50 - 199 employees (dummy)	0.269	0.443
200 - 499 employees (dummy)	0.090	0.286
500 + employees (dummy)	0.063	0.243
Share of female employees	0.444	0.285
Share of part-time employees	0.217	0.245
Share of temporary employees	0.103	0.166
Fixed-term employment contract (dummy)	0.478	0.500
Part-time job (dummy)	0.130	0.336
Qualification		
Unqualified (without occupational training) (dummy)	0.113	0.316
Intermediate qualification (dummy)	0.702	0.458
Higher qualification (dummy)	0.185	0.389
Long-term experience in occupational field (dummy)	0.542	0.498
Managerial skills (dummy)	0.103	0.303
Difficulties in filling the job opening (dummy)	0.248	0.432
Qualification or work experience is higher than required (dummy)	0.030	0.171
Qualification or work experience is lower than required (dummy)	0.095	0.293
Female (dummy)	0.479	0.500
Age		
< 25 (dummy)	0.166	0.372
25 - 39 (dummy)	0.456	0.498
40 - 50 (dummy)	0.260	0.439
51 + (dummy)	0.118	0.322
Previous status		
Employed outside the firm (dummy)	0.488	0.500
Unemployed (dummy)	0.297	0.457
Temporary agency worker in this firm (dummy)	0.027	0.162
Self-employed (dummy)	0.035	0.183
Apprentice in this firm (dummy)	0.026	0.159
Elsewhere in apprenticeship/education (dummy)	0.093	0.290
Out of labor force (housewife etc.) (dummy)	0.035	0.185
Regional unemployment rate	0.082	0.036
Classification of Economic Activities		
Agriculture, forestry and fishing (dummy)	0.030	0.170
Mining and quarrying (dummy)	0.015	0.122
Food; textile, clothes and furniture (dummy)	0.038	0.191
Wood, paper and printing (dummy)	0.035	0.185
Coke and refined petroleum products, chemicals and plastic products (dummy)	0.042	0.200
Basic metals, fabricated metal products (dummy)	0.043	0.203
Machinery and equipment, electrical equipment and motor vehicles (dummy)	0.043	0.203
Electricity, gas, steam and air conditioning supply (dummy)	0.032	0.176
Water supply; sewerage, waste management & remediation activities (dummy)	0.033	0.179

Construction (dummy)	0.035	0.183
Wholesale and retail trade; repair of motor vehicles and motorcycles (dummy)	0.040	0.195
Transportation and storage (dummy)	0.036	0.187
Accommodation and food service activities (dummy)	0.044	0.204
Information and communication (dummy)	0.040	0.195
Financial and insurance activities (dummy)	0.035	0.184
Real estate activities (dummy)	0.042	0.201
Professional, scientific and technical activities (dummy)	0.040	0.196
Administrative and support service activities (dummy)	0.039	0.194
Public administration and defense; compulsory social security (dummy)	0.080	0.271
Education (dummy)	0.072	0.258
Human health and social work activities (dummy)	0.087	0.281
Arts, entertainment and recreation (dummy)	0.031	0.174
Other service activities (dummy)	0.069	0.253

Source: German Job Vacancy Survey 2011. 6,747 observations; regional unemployment rates are for 409 administrative districts (*Landkreise und kreisfreie Städte* – NUTS3 regions); “unqualified” means without occupational training; “higher qualification” indicates college or university degree.