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JOB QUEUES AND WAGES*

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This paper uses job applications data to investigate the relationship between job queues and wage differentials. The main finding is that openings for jobs that pay the minimum wage attract more job applicants than jobs that pay either slightly more or slightly less than the minimum wage. This spike in the job application rate distribution suggests that ex ante rents generated for employees by an above market-level minimum wage are not completely dissipated by reductions in nonwage benefits. In addition, we find that highly unionized firms, large firms, and firms in high-wage industries tend to receive relatively many job applicants for openings.

> Protected-sector jobs can be readily identified because so many people want them. Companies paying wages higher than market levels for equivalent skills and working conditions tend to have very low labour turnover and long lists of applicants waiting for an opening to arise. Unprotected-sector companies tend to have more normal (i.e. higher) labour turnover and shorter waiting lists of applicants . . . [Harberger, 1971, p. 563].

In a labor market where workers seek rents, employers that offer a supra competitive wage would face a queue of job seekers. The presence of this job queue would encourage employers to reduce their compensation to the market-clearing level. Interference in the wage-setting process from government regulation (e.g., an enforced minimum wage law) or from union bargaining power could prevent the forces of labor market competition from lowering wages to eliminate excessive job queues. In addition, efficiency wage, expense-preference, and insider-outsider models suggest that some firms or managers may find it in their interests to maintain above market-clearing wages even in the face of queues of qualified job applicants. This paper examines establishment-level

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data on job application rates to draw inferences about the relationship between job queues and wage differentials.[1]

A government-enforced minimum wage law provides a natural experiment to examine the relationship between wage premiums and job queues. A binding minimum wage requires some employers to pay an above market wage rate. Unless affected firms cut fringe benefits, raise effort requirements, upgrade hiring standards, and let working conditions deteriorate by enough to offset the legal minimum wage, jobs for which firms are constrained to increase wages to meet the legal minimum wage will confer rents to workers. A finding that jobs that are constrained to offer the minimum wage tend to have longer queues of job applicants than they would have in the absence of such an intervention would support the joint hypothesis that firms do not extract all rents generated by the minimum wage, and that job applicants respond to the presence of these rents. In this paper we provide empirical evidence on this issue.

We also examine the impact of a firm's industry, size, and extent of unionization on its application rate. Many researchers have documented the existence of large interindustry wage differentials and of a positive relationship between employer size and pay.[2] In a textbook competitive labor market model, wage differentials for observationally equivalent workers must reflect either compensating differentials for nonwage job attributes or unmeasured differences in workers' productive abilities. As a result, in a perfectly competitive labor market one does not necessarily expect any systematic relationship between wages and job application rates.[3]

1. The approach of examining relative application rates to determine whether earnings differentials among jobs are nonmarket clearing has a venerable tradition in labor economics. In their classic study of the relative wages of doctors and dentists, Friedman and Kuznets [1945] rely heavily on a comparative analysis of application rates to medical and dental schools. Given that the preliminary training required for the two professions is virtually identical, Friedman and Kuznets [p. 124] conclude that their finding that "more than four times as many persons applied annually for admission to American medical schools as for admission to American dental schools" is sufficient alone to establish that "at existing levels of remuneration, prospective practitioners consider medicine more attractive than dentistry." And Lewis [1963] uses a similar approach to examine the importance of entry barriers into the medical profession as well as the relative earnings of doctors and dentists.

2. For recent evidence see Dickens and Katz [1987a,b], Krueger and Summers [1987, 1988], and Brown and Medoff [1989].

3. Unqualified workers may apply for high-wage jobs and give the misleading appearance of a job queue even in a market-clearing situation. We return to this issue below.

On the other hand, alternative models predict that employers will offer rents above the marginal worker's alternative wage to reduce turnover, facilitate recruiting, and increase effort (see Salop [1979], Katz [1986], and Stiglitz [1986]). To the extent that the benefits of paying high wages vary by industry or firm size, these models predict that firms in high-wage industries and large firms will attract more job applicants than firms in low-wage industries and small firms. Demonstrations of a comparatively lower quit rate in high-wage industries [Pencavel, 1970] and large firms [Brown and Medoff, 1989] provide some evidence of the presence of rents, although these findings may also be attributable to specific human capital and omitted worker quality variables. Moreover, while studies of turnover provide evidence of ex post rents, the relationship between the number of job applicants per opening and wage differentials provides a more direct test of ex ante rents.

The prediction that ex ante rents can persist in some jobs has been challenged on theoretical grounds. The basic idea behind this critique is that if there are queues for jobs because they pay ex ante rents, workers will be willing to pay to obtain these jobs [Becker and Stigler, 1974; Carmichael, 1985]. Murphy and Topel [1987] argue that even if explicit job purchases are somehow precluded, firms that pay wage premiums to prevent worker shirking could find alternative ways to extract ex ante rents from queuing workers. This line of reasoning has also been applied to the minimum wage. Wessels [1980a,b], Hashimoto [1981], Mincer [1984], and others contend that firms constrained to pay the legal minimum wage have an incentive to reduce fringe benefits and erode working conditions until rents are completely dissipated. However, Dickens, Katz, Lang, and Summers [1989] argue that profit-maximizing firms may choose not to extract all surplus from workers if such actions reduce morale and productivity. Firms may not reduce nonwage benefits to fully offset a minimum wage increase because turnover, recruitment, and morale costs could rise by more than the direct savings from cutting benefits. An examination of evidence on job queues may help resolve this debate.

The paper is organized as follows. In Section I we analyze the conditions that determine whether firms will fully dissipate rents conferred on workers by a binding minimum wage. In addition, we discuss the relationship between job application rates and wage differentials. In Section II we describe the micro-level data on job applications and firm characteristics that we use in our empirical work. Empirical results concerning the minimum wage are presented in Section III. The main finding is that firms that pay the minimum wage receive more applicants for their job openings than firms that pay either slightly more or slightly less than the minimum wage. In Section IV we estimate the impact of employer size, extent of unionization, and industry affiliation on job applications.

I. Minimum Wages, Job Queues, and Rent Dissipation

The standard analysis of an above market-level minimum wage ignores the possibility that employers may respond to the minimum wage by lowering other forms of compensation and assumes that workers are equally productive [Stigler, 1946; Ehrenberg and Smith, 1988]. Thus, the standard model predicts that workers who obtain jobs for which the minimum wage is binding are unambiguously made better-off since their total compensation rises by the mandated increase in wages. The minimum wage reduces the number of jobs in the covered sector because employers' labor costs are increased. Although the welfare of workers in the uncovered sector may increase or decrease because of a minimum wage, the model predicts covered jobs will attract more job seekers than uncovered jobs [Mincer, 1976].

Many economists have argued that the standard analysis is incomplete because firms have an incentive to offset mandated minimum wage increases by altering nonwage forms of compensation, such as fringe benefits, job training, and working conditions. Firms can cut nonwage benefits and continue to attract their desired number of qualified employees until total compensation is lowered to the market-clearing level. This logic suggests that firms should dissipate all rents generated by the minimum wage. Thus, the main impact of a minimum wage would be to induce an affected firm to inefficiently alter the composition of its compensation packages rather than increase the level of total compensation [Wessels, 1980 a,b].

For example, suppose that the value that a worker places on compensation is given by $w + V(b)$, where w is the wage rate, b is the firm's *expenditures* on nonwage compensation, and $V(\cdot)$ is an increasing, concave function with $V'(0) > 1$. In the absence of a minimum wage, cost-minimizing firms will choose w^* and b^* such that $V'(b^*) = 1$ and $w^* + V(b^*)$ is the market-clearing compensation level. If the government imposes a binding minimum wage

$\omega > w^*$, passive firms that offered compensation level $\omega + V(b^*)$ would attract more workers than they desired to hire. As a result, firms would have an incentive to cut benefits until they eliminate queues for their jobs at a new market-clearing level, $b^{**} < b^*$. At the new equilibrium, employees would be willing to accept a dollar lower wage for a dollar more spent on nonwage benefits (because $V'(b^{**}) > 1$), but the minimum wage precludes such a trade. In this case the extraction of rents induced by a minimum wage is inefficient because workers lose more than firms gain.

A. Why Not Full Offset?

We present four potential reasons why firms may not choose to, or may not be able to, fully dissipate the increase in compensation generated by a minimum wage.[4] The first reason is related to efficiency wage models of the labor market. In these models, firms choose to pay above market-clearing compensation because the presence of ex ante rents improves net labor productivity. When wages and benefits are imperfect substitutes, many efficiency wage models predict that firms will not fully offset a minimum wage because reductions in net productivity will outweigh direct cost savings on employee benefits.[5]

We illustrate the efficiency wage model by considering an example based on turnover.[6] Since turnover (quitting) is assumed to impose costs on firms, they have an incentive to discourage it. Paying more generous compensation is one way to reduce turnover. The fraction of workers who leave their employer per period depends negatively on the ratio of the value of their compensation to their opportunity costs. For simplicity, we assume that workers' opportunity costs are fixed and normalized to one. The quit rate is given by the function $Q(w + V(b))$, where $Q' < 0$ and $Q'' > 0$, and $V(b)$ is defined as before.[7] We denote the firm's net cost of turnover per worker by T. In this situation, a firm will choose w and b to minimize cost per efficiency unit of labor, $w + b + TQ(w + V(b))$.

4. Because our empirical analysis is unable to distinguish among these four alternatives, we provide only a brief discussion.

5. Furthermore, the minimum wage may essentially define what is viewed by employees as a "fair" compensation level. Attempts by firms to extract the rents generated by the minimum wage may create a sense of injustice that damages labor relations and harms net productivity. In this case, employers may find it optimal to fall short of fully offsetting nonwage benefits to counteract the minimum wage.

6. Wessels [1980b, p. 74] discusses a similar example.

7. We abstract from dynamic considerations following Johnson and Layard [1986].

Rearranging the first-order conditions to this problem yields

$$Q'(w^* + V(b^*)) = -1/T \qquad \text{and} \qquad V'(b^*) = 1.$$

At the unconstrained optimum, a \$1 increase in either wages or in benefits reduces turnover costs by \$1.

If a minimum wage $\omega > w^*$ is imposed on the firm, it will now choose benefits b^{**} so

$$Q'(\omega + V(b^{**}))V'(b^{**})T = -1.$$

It can easily be shown that benefits will not be reduced by enough to fully offset the rents to workers generated by the minimum wage. Suppose, to the contrary, that there is full offset so the firm sets $b < b^*$ such that $\omega + V(b) = w^* + V(b^*)$. For this choice of b, $Q'(\omega + V(b))V'(b)T < -1$ since $Q'(\omega + V(b))T = -1$ and $V'(b) > 1$. In this situation the firm would increase benefits since it would find that a \$1 increase in benefits would reduce turnover costs by more than \$1. Thus, the firm will respond to a minimum wage by increasing the compensation differential it pays workers relative to their opportunity costs, leading to longer queues of applicants for minimum wage jobs.[8]

The second reason for incomplete offset relates to the possibility that managers may pursue objectives other than profit maximization. If managers have (utilitarian) objective functions that depend positively on their employees' utility as well as on profits, rents created by a minimum wage may not be fully dissipated. In this situation managers may not totally offset a wage increase generated by the minimum wage because to do so may exact a great toll from workers but only raise profit by a small amount.

The third reason for less than full offset involves possible nonnegativity constraints—the amount of adjustments to unregulated aspects of compensation may not be large enough to offset the minimum wage. In particular, fringe benefits are typically a small component of compensation in low-wage jobs. However, it is likely that resourceful employers will be able to find unregulated margins from which to extract rents.

Finally, many nonwage conditions of work are workplace public goods, affecting workers above the minimum wage as well as minimum wage workers. Thus, firms may find it unprofitable to alter working conditions (e.g., they will not turn off the heat in the

8. More generally, the same result holds in a variety of efficiency wage models in which the net productivity of labor depends continuously on the compensation differential.

winter) because of negative externalities for workers not affected by the minimum wage.

In fact, there exists some evidence indicating that firms adjust at least some nonwage components of compensation in response to a binding minimum wage. Wessels [1980a,b] finds that a small proportion of retail stores reported that they reduced fringe benefits in response to the New York state minimum wage law of 1957. Similarly, Alpert [1986] finds evidence of modest reductions in fringe benefits in response to large increases in the minimum wage in the restaurant industry in the 1970s. In addition, Leighton and Mincer [1981] provide some evidence of reduced on-the-job training and lower wage growth in response to increased minimum wages for workers with less than a high school education. Although these studies indicate that some nonwage offsets appear to take place, they cannot answer the question of whether firms completely offset the minimum wage.

B. Job Application Rates and Wages with Homogeneous Workers

Data on job applications may be used to help determine whether wage differentials represent rents. We first consider a labor market with identical workers and with firms that differ in the compensation they provide. We assume that the utility individuals derive from a job is given, as above, by $U = w + V(b)$, and that individuals maximize expected utility. A highly stylized application process is considered to illustrate the relationship between job queues and the wage structure.

At the beginning of each period, firms announce their number of job openings and the corresponding compensation package (i.e., w and b). Individuals must apply in person for job openings and therefore can apply to only one job opening per period. If more than one worker applies for a job, the firm is assumed to randomly select an employee from those who applied. Thus, the probability of being selected for a job (p) is the inverse of the application rate.

The net expected benefit of applying to any job opening must be equalized across job openings in equilibrium.[9] For any two jobs, i

9. Montgomery [1991] formally analyzes the mixed-strategy equilibrium for job applicants in a model of this type. Even when applicants can make multiple applications, the basic equilibrium condition that the expected value of applying to an opening is constant across openings still holds so long as workers are not able to apply to all job openings in the economy. If workers cannot apply to all openings, high compensation jobs will receive more applicants than low compensation jobs. Lang [1991] analyzes in detail the issues that arise when workers can simultaneously apply to more than one firm and receive more than one offer.

and j, the following equation will hold:

$$p_i[w_i + V(b_i)] = p_j[w_j + V(b_j)].$$

A direct result of this equilibrium condition is that the application rate will be positively related to the attractiveness of the compensation package. It should be clear from this condition, however, that firms that offer higher wages will not necessarily attract more applicants than other firms because differences in nonwage conditions may offset wage differentials. A finding that high-wage jobs attract longer queues of job applicants is evidence that these jobs provide ex ante rents rather than compensating wage payments for nonwage aspects of jobs.

C. Heterogeneous Labor with Nonrandom Selection

If individuals differ in their productive capacities, and if employers make job offers to applicants on the basis of their perceptions of workers' abilities, the analysis becomes more complicated. Our purpose here is only to present a heuristic discussion of these effects.

It is probably reasonable to assume that workers have an imprecise estimate of their own ability relative to the labor force, and that prospective employers have an imperfect but positively correlated measure of each applicant's ability. A final assumption is that there is a positive correlation between the applicant's reservation wage and ability.

An increase in total compensation in this situation potentially has three distinct effects on the application rate. First, a job candidate's expectation of being rated the most highly qualified applicant and therefore of being selected for the job is diminished. This occurs because individuals with a higher reservation wage and therefore greater expected ability will apply for the job [Weiss, 1980; Nalebuff and Stiglitz, 1982]. The average quality of the job queue increases.[10] In the extreme case, if employees know with certainty who the most qualified applicant for the job will be, only that individual will apply for the job.

The second effect occurs because an increase in a job's wage, holding all else constant, makes it a more attractive alternative

10. Krueger [1988] presents evidence that the average quality of applicants for federal jobs is higher in periods when the federal wage is high relative to the average wage in the private sector.

than other jobs, and therefore worth applying for, even though the chance of ultimately being selected is reduced. This is the effect that is discussed in the model above in the case of homogeneous labor.

Finally, some workers may find it in their interest to apply for high-wage jobs even though they lack the required training and skills to perform those jobs adequately. Since employers have only an inaccurate measure of job seekers' abilities, there is a nonzero probability that unqualified workers will succeed in being selected for high-wage jobs. As a result, high-wage jobs may attract many unqualified applicants. If this is quantitatively an important effect, the job application rate cannot be used to identify ex ante rents without further knowlege of the abilities of job applicants.

II. Data

The data we use are from the Employment Opportunity Pilot Project (EOPP) Survey. We focus solely on the 1982 follow-up wave because it contains specific information on the demographic characteristics and starting salary of selected job applicants, as well as information on the vacant position. The unit of observation is the last job filled by a firm.[11] The surveyed firms are located in 28 geographic sites, with a disproportionate number of sites in southern and midwestern states. Twelve of the sites are SMSAs, and the remainder are county groups. Employers were contacted by phone between February and June of 1982, and the person who "handles the hiring activity" for the company for the area contained within the geographic site was asked to answer the questionnaire. The survey deliberately oversampled low-wage firms.

The strength of the survey is that it contains information on the recent hiring activities of firms. Specifically, the person responsible for hiring was asked several questions concerning the last position filled by a "new employee" prior to August 1981, including the number of applicants for the position, the occupational category of the position, the starting salary, and the new worker's demographic characteristics (age, sex, training, work experience,

11. We note that this sampling scheme may generate a nonrandom sample of jobs because within firms the higher turnover jobs are more likely to be sampled. However, this sampling scheme is unlikely to greatly influence our results because the sample should overrepresent short-term jobs for all firms, and thus it is not clear that the unobservable variables that determine turnover will be correlated with the wage rate in this sample.

and education).[12] The designers of the survey intended that the question concerning the number of persons who applied for the last position filled should measure the number of individuals formally applying for the position.[13] An application typically would require a worker to submit a written application form; casual inquiries over the phone or personal visits that do not involve a written application are not classified as job applications. In situations where multiple employees are hired for the last position filled, we divide the number of applicants by the number of workers hired.

In addition to questions on recruitment and employee characteristics, the survey contains information on several aspects of the employer, including firm and establishment size, industry, proportion of workers covered by a union contract, and geographic location. The establishment size variable is defined in a nonstandard way. Instead of asking for the size of an individual establishment, the establishment size question solicits the combined size (number of employees) of all the establishments of a particular firm that are located within the geographic site. As a result, establishment size in this data set is a conglomeration of typically defined establishment size and firm size measures. In our empirical estimates, we use both firm size and establishment size variables.

We restrict the sample to observations with a complete set of relevant variables. In addition, the sample only contains jobs that were filled by individuals between the ages of 16 and 65, and that paid more than $1 per hour to start. Finally, we have eliminated from the sample 40 restaurant jobs that paid a subminimum wage because workers in these jobs are likely to receive unreported tips. These procedures yield a sample of 1,333 observations.

A. Application Rates and Unemployment

Because job application rates have rarely been used in labor market analyses, we first attempt to crudely gauge the validity of the EOPP application variable as a measure of labor market conditions. For this purpose, we regress the log of the average application rate in a site on the 1980 local unemployment rate for

12. Three-quarters of the firms in the survey hired their most recent employee in 1981; 15 percent hired their most recent employee in 1980; 7 percent hired their most recent employee in 1979; and 3 percent hired their most recent employee in 1978. The survey also contains a small number of firms whose most recent outside hire was prior to 1978, but these observations were dropped from the sample because the accuracy of the retrospective information is likely to become less accurate with time.

13. Personal communication from John Bishop of Cornell University.

our sample of 28 sites (cities and county groups).[14] Results of estimating this regression (with standard errors in parentheses) are presented below:

$$\text{(1)} \quad \ln\begin{pmatrix}\text{applications}\\ \text{per last}\\ \text{opening}\end{pmatrix} = \underset{(0.850)}{3.954} + \underset{(0.329)}{0.710} \ln(UR) \qquad R^2 = 0.15.$$

The relationship between the site level job application rate and the unemployment rate is positive and statistically significant.[15] While we do not put a structural interpretation on this equation, it suggests that the application rate is correlated with the characteristics of the local labor market. As the fraction of the labor force that is unemployed increases, more applications are received by firms in the area.

III. Empirical Evidence on Queues for Minimum Wage Jobs

The number of job applicants for minimum wage jobs relative to the number of applicants for other jobs provides a test of whether the surplus created by the minimum wage for low-wage workers is fully offset by changes in working conditions. If firms fail to completely offset the compensation increase created by a minimum wage, then a greater number of applicants will apply to firms paying the minimum wage than to uncovered or noncomplying firms paying a subminimum wage.

In addition, if, prior to the imposition of a minimum wage, jobs that pay slightly more than the eventual minimum wage are as equally desirable as jobs below the minimum wage (i.e., because of differences in working conditions), then jobs that raise their wage to meet the minimum will attract more applicants than those just above the minimum as long as nonwage benefits are incompletely offset.[16] In this equalizing differences equilibrium, a binding minimum wage will increase the desirability of minimum wage jobs relative to jobs that pay more than the minimum wage, and thus

14. We calculated average application rates for each site from our EOPP sample. City and county level unemployment rates for 1980 are from U. S. Bureau of the Census [1982].

15. Since other characteristics of firms and the labor force might affect the relationship between applications and unemployment, we also estimate equations that include average firm size and a dummy variable for being in an SMSA. The results are not significantly changed by including these variables.

16. This argument assumes that firms that are not constrained by the minimum wage do not respond to increases in compensation at minimum wage firms by equally increasing their total compensation.

generate a spike in applications at the minimum wage relative to *both* jobs that pay more than the minimum wage and jobs that pay less than the minimum wage.

Table I reports the means and standard deviations of several

TABLE I
MEANS (STANDARD DEVIATIONS) BY STARTING HOURLY WAGE RATE FOR SUBSAMPLE OF WORKERS WITH WAGE RATE LESS THAN $5 PER HOUR[a]

	Subsample		
Variable	Less than minimum wage	Minimum wage	More than minimum wage
Log applications per opening	1.28	1.59	1.40
	(1.07)	(1.20)	(1.16)
Applications per opening	6.60	11.49	9.18
	(9.19)	(26.06)	(20.43)
Male	0.40	0.42	0.48
	(0.49)	(0.50)	(0.50)
Age	24.57	24.11	26.68
	(10.94)	(8.62)	(8.90)
High school graduate	0.67	0.71	0.80
	(0.48)	(0.45)	(0.40)
College graduate	0.05	0.05	0.11
	(0.21)	(0.21)	(0.32)
Years of relevant experience	0.43	0.87	1.94
	(0.93)	(1.77)	(3.99)
Hours of on-the-job training	49.78	45.85	68.26
	(81.84)	(92.79)	(109.18)
Weekly hours > 35	0.30	0.53	0.74
	(0.46)	(0.50)	(0.44)
Temporary job	0.16	0.13	0.11
	(0.37)	(0.34)	(0.31)
Seasonal job	0.11	0.06	0.05
	(0.32)	(0.23)	(0.21)
Establishment size	24.59	43.96	46.34
	(67.11)	(85.37)	(152.13)
Proportion union	0.01	0.03	0.07
	(0.07)	(0.14)	(0.23)
White collar	0.57	0.42	0.50
	(0.50)	(0.49)	(0.50)
Vacancy duration[b]	7.75	12.19	15.31
	(1.04)	(1.57)	(32.51)
Sample size	63	192	691

a. Sample includes all workers who earn between $1 and $5 per hour. The sex, age, and education questions pertain to the worker who was hired for the job.

b. The number of days between when the employer started looking for someone to fill the opening and the time the new employee started work.

variables disaggregated by whether the starting wage for the job is less than, equal to, or greater than the legal minimum wage that was in effect in the year the position was filled.[17] We restrict the sample to jobs with starting wages of less than or equal to $5 per hour to concentrate on low-skill jobs. Fortunately, the survey provides a disproportionately large sample of low-wage jobs: 192 jobs openings in the sample paid newly hired workers the prevailing legal minimum wage, and 63 job openings paid a starting wage below the prevailing legal minimum wage. Jobs that pay less than the minimum wage are either not covered by the minimum wage provisions of the Fair Labòr Standards Act (FLSA), or are in violation of the Act. Our examination of the detailed industries and occupations of the jobs that pay less than the minimum wage indicated that most of them are likely to be covered by the law.[18]

Table I shows that workers who are hired into minimum wage jobs are on average less educated, younger, less experienced, and more likely to be female than workers who are hired into low-paying jobs that pay more than the minimum wage, while workers with starting wages less than the minimum wage have similar personal characteristics and training to workers whose starting wage equals the minimum wage. These summary statistics suggest that workers whose starting wage is less than the minimum wage may be fairly close substitutes for workers whose starting wage equals the minimum wage, but workers whose starting wage exceeds the minimum wage have different skills and qualifications than workers who earn the minimum wage or less have. Furthermore, establishments offering jobs with starting wages less than the minimum wage are smaller on average than those paying exactly the minimum wage or those above the minimum wage.

Most importantly for our purposes, the table indicates that the number of applicants per job opening is greater for positions that pay exactly the minimum wage to start than for positions that initially pay *either* more or less than the legal minimum wage. The

17. Congress raised the minimum wage six times in the 1970s. The 1977 amendments to the FLSA scheduled increases in the minimum wage for each year from 1978 to 1981. Increases in the minimum wage over this time period roughly kept pace with inflation. As a result, in years covered by our sample (1978–1981), increases in the minimum wage were expected and scheduled in advance, which should have facilitated nonwage offsets by employers.

18. Firms with very low revenues are exempted from the minimum wage provisions of the FLSA. Since we lack information on firm revenues, we cannot determine definitively whether jobs paying less than the minimum wage are covered by the law. The implied rate of noncompliance with the minimum wage in this sample, however, is similar to estimates presented by Ashenfelter and Smith [1979].

pairwise comparisons of the difference in the mean log application rate between the subsample of workers whose starting wage rate equals the minimum wage and each of the other two groups are both statistically significant at the 0.05 level in one-tail tests. Moreover, these differences in application rates are not due to outliers. The median number of applicants per job opening for jobs that paid exactly the minimum wage was five as compared with four in both jobs that paid less than the minimum wage and jobs that paid more than the minimum wage.

In addition, we find that an apparent "spike" in application rates at the minimum wage exists when we limit our sample to jobs that pay within 25 cents of the minimum wage. On average, 6.68 applicants applied per job opening that paid within 25 cents less than the minimum wage; 11.49 applicants applied per job opening that paid exactly the minimum wage; and 10.93 applicants applied per job opening that paid within 25 cents more than the minimum wage.[19]

In Section I the application process was considered in a simple static framework, but the actual application process is more complicated and takes place in a dynamic setting. The number of applications received for an opening is likely to depend on how long the job is left on the market. On the other hand, job openings that offer ex ante rents are likely to receive many applicants soon after they are announced and therefore are likely to be filled rapidly. The EOPP survey provides only a crude proxy for vacancy duration: the length of time elapsed between when the employer started looking for someone to fill the opening and the time the new employee started work. An important shortcoming of this vacancy duration question is that the length of time between when a new employee is hired and when he or she actually begins work may increase with the skill requirements of the position (e.g., the academic job market ends in February or March but new assistant professors do not officially begin work until September).

Table I indicates that, unlike the application rate, the mean of our vacancy duration proxy appears to rise continuously with the wage. Minimum wage jobs do not appear to have unusually short vacancy durations according to this measure. Longer vacancy durations at high-wage jobs may arise because employers spend

19. The findings are similar when the sample includes all jobs that pay within 50 cents of the minimum wage. On average, 7.58 applicants applied per job opening that paid within 50 cents less than the minimum wage and 9.48 applicants applied per job opening that paid 50 cents more than the minimum wage.

TABLE II
APPLICATION DIFFERENTIALS FOR MINIMUM WAGE AND SUBMINIMUM WAGE JOBS[a]
(SUBSAMPLE OF WORKERS WITH WAGE RATE LESS THAN $5 PER HOUR)

Other independent variables	Minimum wage effect[b]	Subminimum wage effect[c]	R^2
1. Occupation dums. (8), hours of formal training, hours of informal training, age, sex, experience, high school dum., college dum., full-time dum., weekly hours betw. 20 and 35 dum., seasonal job dum., temporary job dum., year dums. (4), log duration of vacancy	0.226	0.013	0.127
	(0.098)	(0.152)	
2. Row 1 plus 27 site dums.	0.228	0.013	0.168
	(0.099)	(0.156)	
3. Row 2 plus proportion union	0.245	0.030	0.172
	(0.099)	(0.156)	
4. Row 3 plus 4 firm size dums. and log plant size	0.230	0.101	0.195
	(0.098)	(0.156)	
5. Row 4 plus 35 industry dums.	0.260	0.119	0.216
	(0.101)	(0.163)	

a. Dependent variable is ln (applications per last job filled). Sample size is 946. Standard errors are in parentheses. Regressions also include a constant.
b. Estimated coefficient for a dummy variable that equals one if the worker's starting wage equaled the minimum wage that was in effect in the year the worker was hired, and zero otherwise.
c. Estimated coefficient for a dummy variable that equals one if the worker's starting wage was less than the minimum wage that was in effect in the year the worker was hired, and zero otherwise.

more time screening applicants at jobs with the high skill requirements.[20] The positive relationship between our "vacancy duration" measure and wages may also reflect the greater time between when an employee is hired and when he or she starts work in high-wage jobs.

Table II presents OLS regressions to examine whether the job application differential at the minimum wage remains after controlling for a variety of independent variables. The dependent variable in the regressions is the natural log of the number of applicants for the last position filled by an outside hire. We include a dummy variable that equals one if the job pays the minimum wage and zero otherwise, and another dummy variable that equals one if the job

20. If higher wages are exogenously imposed on a firm through a minimum wage, the firm might attempt to offset the minimum wage by setting more stringent hiring criteria and spending more time evaluating applicants.

pays a subminimum wage and zero otherwise. We attempt to control for employer search intensity by including the vacancy duration proxy variable described above. Although this is an ad hoc solution to the temporal problem, the results are similar when we include this variable in linear or quadratic form, when we treat it as an endogenous variable and instrument for it with industry dummy variables, or when we exclude it from the regression entirely. The sample consists of jobs that start at less than $5 an hour; parallel results for the entire sample are in Appendix 1.

The regressions show a statistically significant, positive differential in the application rate between jobs that pay the minimum wage and jobs that pay more than the minimum wage. On the other hand, the difference in the application rate between jobs that are above the minimum wage and those that are below the minimum wage is not statistically significant. According to the point estimates, jobs offering the minimum wage attract between 22.6 percent and 26 percent more applications than jobs that offer a starting wage that exceeds the minimum wage, and between 21 percent and 14 percent more applications than jobs that pay starting wages that are less than the minimum wage. The application differentials fall when employer size variables are added to the regression, but are not very much influenced by the inclusion of other independent variables, such as industry affiliation or union coverage. Employer size has an important effect on these results because workers who earn a subminimum wage tend to work in relatively small establishments, and results presented below show that the application rate is lower in small firms, all else equal.

The finding that more workers apply for minimum wage jobs than for jobs paying a greater wage suggests that the excess supply of applicants for minimum wage jobs does not merely reflect an upward sloping applicant-wage profile. Moreover, since firms that are constrained to pay the minimum wage may be able to cut back on direct recruiting activities (e.g., advertising job openings) and still attract applicants, our estimates of the minimum wage application differential may understate the queue for minimum wage jobs. Overall, these results suggest that employers do not fully offset rents from the minimum wage by reducing fringe benefits or eroding working conditions.

IV. The Wage Structure and Job Applications

This section examines the relationship between application rates and several employer characteristics. We begin by focusing on the interindustry wage structure. It is well-known that industry status has an important influence on workers' wages, and that the industry wage structure is stable over time. However, the interpretation of these facts is not clear. If interindustry wage differentials are equalizing differentials for nonwage aspects of work, then we would not expect to find a systematic relationship between application rates and wages at the industry level. On the other hand, if differences in wages across industries represent ex ante rents to workers, then job openings in high-wage industries should attract relatively many applicants.

To test whether jobs in high-wage industries offer wages above market-clearing rates, we assume that once occupation, education, geographic location, and other variables are held constant, a firm's industry does not directly influence the number of applications the firm receives for its available job openings; instead, industry is allowed to indirectly affect applications by affecting wages. Under this exclusion restriction a test of whether interindustry wage differentials are rents is equivalent to testing whether using industry dummy variables as instruments for the wage rate in an application equation yields a positive estimate of the application rate-wage elasticity. Moreover, the industry exclusion restriction is testable because there are many industry dummies to estimate only one parameter.

Other firm characteristics, such as employer size and union status, have also been found to affect wages. Many economists have interpreted wage differentials based on union status and employer size as ex ante rents. Because it is not clear a priori whether firm size and unionization affect the application rate independent of their influence on wages, we initially present results with and without including employer size and union status among the explanatory variables. In subsequent results, however, we exclude union status and firm size from the application equation and use these variables as instruments for the wage.

Specifically, we assume the following structural model of the log of job applications per opening, A, and the log of the starting wage rate, W:

$$A = W\alpha_W + X\alpha_X + \epsilon_A \tag{2}$$

$$W = A\beta_A + Z\beta_Z + X\beta_X + \epsilon_W \tag{3}$$

$$\text{plim } Z'\epsilon_A = 0, \tag{4}$$

where α_W is the elasticity of job applicants with respect to the starting wage rate, Z is an $N \times K$ matrix of K mutually exclusive industry dummy variables, β_Z is a $K \times 1$ vector of industry wage differentials, and X is an $N \times q$ matrix of explanatory variables with parameter vector β_X. The ϵ_i, $i \in (A,W)$, are $N \times 1$ vectors of residuals, and there are N observations. A positive estimate of α_w would support the interpretation that interindustry wage differentials represent ex ante rents to workers.

A simultaneous system is posited because in a standard demand and supply framework the wage rate affects the number of applicants received, while the number of applicants simultaneously affects the offered wage. Even if the starting wage is predetermined and unresponsive to the number of job applicants, another reason for instrumenting for the wage rate in the application equation is that unobserved, omitted variables in the application equation will affect the starting wage rate, which will lead to spurious correlation between W and ϵ_A. For example, a university bookstore may attract more applicants at any given wage than a remote bookstore and may therefore choose a low wage policy.

A. Results

Results of estimating equation (2) by two-stage least squares (2SLS) are reported in Table III. Although the equations in the table include alternative sets of X's, each specification is identified solely by the exclusion of industry dummy variables. Appendix 2 contains OLS estimates of the same equations. The 2SLS results indicate that the job application rate tends to increase with the starting wage rate; however, this relationship becomes statistically insignificant once employer size and union coverage are included.[21] The point estimates of the elasticity of applications with respect to wages range from 0.14 to 0.49.

The specification tests reported in the bottom of Table III test the assumption of the orthogonality of the industry dummies and the error term in the application equation, and also summarize results of Hausman tests of simultaneity between the starting wage and application rate. The Generalized Method of Moments (GMM) error-orthogonality test involves regressing the two-stage

21. By contrast, the OLS equations typically find a small and statistically insignificant negative impact of wages on the job application rate. This difference may result from simultaneity bias, which is indicated by the Hausman test in column (1) of Table III.

TABLE III
2SLS ESTIMATES OF THE DETERMINANTS OF JOB APPLICATIONS USING INDUSTRY DUMMY VARIABLES AS INSTRUMENTS FOR THE WAGE RATE[a]

Independent variable	Mean [SD]	Equation[b] 1	2	3
Intercept	1.00	−2.104	−1.264	−0.521
	[0.00]	(1.499)	(1.743)	(1.750)
Log (wage)	1.54	0.492	0.337	0.144
	[0.39]	(0.264)	(0.304)	(0.313)
Minimum wage (1 = yes)	0.14	0.315	0.304	0.249
	[0.35]	[0.113]	[0.114]	[0.114]
Log (vacancy duration)	2.07	0.225	0.230	0.227
	[1.27]	(0.026)	(0.026)	(0.026)
Proportion union	0.11	—	0.310	0.123
	[0.28]		(0.148)	(0.147)
Log (estab. size)	2.82	—	—	0.133
	[1.50]			(0.025)
Firm size:				
50–99	0.07	—	—	0.043
	[0.26]			(0.118)
100–499	0.03	—	—	0.216
	[0.17]			(0.073)
500–1,999	0.07	—	—	0.154
	[0.26]			(0.127)
>2,000	0.03	—	—	0.127
	[0.17]			(0.186)
Demographic:				
Male (1 = yes)	0.56	−0.042	−0.019	0.015
	[0.50]	(0.090)	(0.093)	(0.093)
Age	26.99	−0.004	−0.004	−0.002
	[9.13]	(0.003)	(0.004)	(0.004)
Experience	28.96	−0.001	−0.001	−0.000
	[53.70]	(0.001)	(0.001)	(0.001)
High school grad	0.76	−0.049	−0.031	−0.030
	[0.43]	(0.107)	(0.108)	(0.107)
College grad	0.13	−0.202	−0.167	−0.165
	[0.34]	(0.146)	(0.150)	(0.147)
Occupation dummies (8)		Yes	Yes	Yes
Hours training:				
Formal	10.00	0.0021	0.0021	0.0020
	[44.62]	(0.0007)	(0.0007)	(0.0007)
Informal	54.74	−0.0001	−0.0001	−0.0000
	[91.55]	(0.0003)	(0.0003)	(0.0003)
Full time	0.72	0.176	0.186	0.166
	[0.45]	(0.103)	(0.103)	(0.101)
Hours 20 to 35 (1 = yes)	0.16	0.218	0.213	0.224
	[0.37]	(0.121)	(0.120)	(0.118)

TABLE III
(CONTINUED)

Independent variable	Mean [SD]	Equation[b] 1	2	3
Temporary job	0.10	−0.293	−0.289	−0.241
(1 = yes)	[0.30]	(0.107)	(0.106)	(0.105)
Seasonal job	0.05	−0.116	−0.114	−0.048
(1 = yes)	[0.22]	(0.145)	(0.144)	(0.142)
σ_ϵ		1.116	1.109	1.088
χ^2 statistic for GMM specification test of industry exclusion restrictions (DF = 33)		43.46	45.46	40.26
Prob. value for Hausman test of simultaneity between starting wage and applications		0.045	0.108	0.247

a. Asymptotic standard errors are in parentheses. Sample size is 1,333. Mean of log (applications) is 1.452 [1.175]. Industry is measured at the two-digit Census level.
b. Each equation also includes 27 site dummy variables and 4 year dummy variables.

least squares residuals on the industry dummy variables and included regressors; N times the R^2 from this regression asymptotically follows a chi-squared distribution (see Newey [1985]). A weak relationship between the residuals and instruments would indicate that the equation is properly specified. The reported chi-squared test of the null hypothesis that industry is properly excluded from equation (2) accepts at the 0.10 level in all cases. In addition, Hausman tests for endogeneity of the wage in the application equation (which are based on the assumption that industry dummy variables are valid instruments for the wage) indicate a simultaneous relationship between applications and starting wages when employer size is not partialed-out.

Figure I presents a plot of industry application differentials against industry wage differentials with the OLS line drawn through the points.[22] Each set of differentials is obtained from a reduced-form regression of log applications or log wages on industry dummy variables and the included variables used in column (3)

22. The OLS regression through these points can be shown to give a consistent estimate of the elasticity of applicants with respect to wages. This estimator is an instrumental variables estimator, although it differs from two-stage least squares.

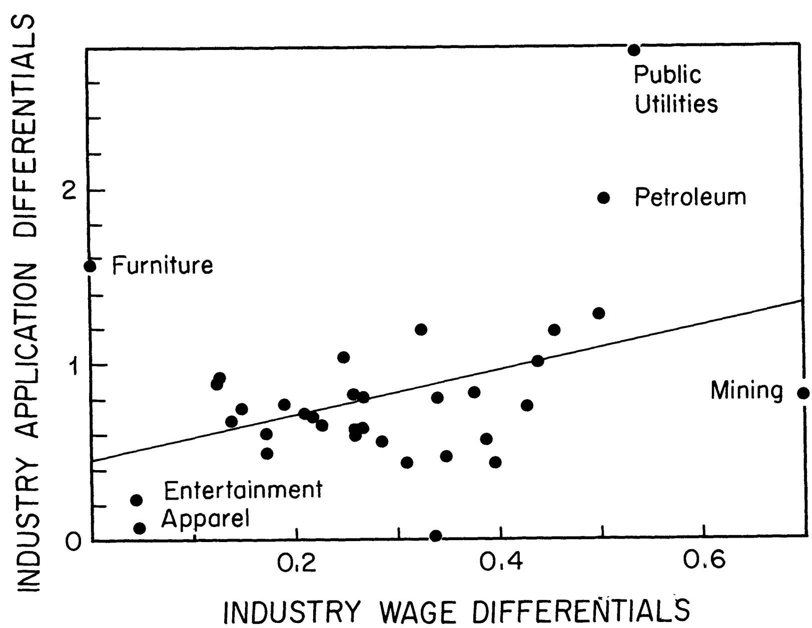

FIGURE I
Plot of Reduced-Form Coefficients

of Table III (i.e., including employer size, union coverage, and other X-variables).[23] Extreme points are identified in the plot.

The plot reveals a linear relationship between application differentials and wage differentials. Some high-wage industries such as public utilities and petroleum have extremely high application rates, while low-wage industries such as apparel have relatively low application rates. Although too much should not be made of individual points in the plot because of sampling error in estimating the wage and application differentials, it is interesting that the mining industry lies far below the fitted line. In spite of the high wages paid to miners, relatively few applicants apply for each job opening in the mining industry. This finding is consistent with the obvious interpretation that a significant element of the high

23. The omitted industry in each of these regressions is given a value of zero for both wages and applications.

average wage in the mining industry is a compensating differential for disagreeable work.

A dummy variable indicating whether a job offers the minimum wage is included among the X's. Consistent with our previous findings, the results indicate that minimum wage jobs attract from 28 percent to 37 percent more job applicants after allowing for the normal application-wage gradient. The minimum wage is found to have a greater effect on applications in the equations that have a larger estimated wage elasticity because a greater wage elasticity implies that minimum wage jobs should attract even fewer applications.

The estimates also indicate that the personal characteristics of the hiree, such as age, sex, and education, are insignificantly related to the application rate. On the other hand, characteristics of the job itself tend to have a significant effect. Jobs with more formal training, permanent jobs, and full-time jobs receive more applicants than other jobs, all else equal.

The length of time a job is on the market may have two opposing effects on the observed job application rate. First, if duration is set exogenously, jobs that are left on the market longer will receive more applicants because potential employees will have a greater window in which to apply for the job. Second, if the duration of job vacancies responds to the actual flow of applicants, jobs that receive many applicants as soon as they are put on the market will be filled quickly. As a consequence, simultaneity problems will bias the estimate toward a negative relationship between vacancy duration and the number of applicants. As mentioned previously, the duration of employer search can only be measured indirectly in this data set by the time elapsed between when the job came on the market and when the new employee began work.

Table III indicates that this measure of the vacancy duration has a substantial, positive effect on the job application rate. This finding suggests that jobs that are on the market longer tend to attract more job applicants, even though firms may choose to fill a position right away if that position received a large number of applicants.[24] To address the potential simultaneity problem, we

24. We note that the positive effect of the vacancy duration on applications may have an alternative interpretation. Because the proxy variable measures the time between when the job was first posted and when the employee began work, this variable may pick up other characteristics of the firm, such as scheduling flexibility. Holding other aspects of jobs constant, jobs that give more lead time to start may attract more applicants.

have also estimated the equations in Table III using industry dummies as instruments for both the wage and the vacancy duration. These estimates (which are not reported here but which are available on request) suggest that simultaneity bias reduces the effect of vacancy duration since the coefficient on vacancy duration approximately doubles when it is treated as an endogenous variable. The estimated wage elasticity and minimum wage effect, however, are hardly changed when we treat vacancy duration as an endogenous variable.

B. Unionization and Employer Size

Columns 2 and 3 of Table III show that establishments that are more highly unionized and larger establishments tend to receive relatively many job applicants, holding the starting wage and other factors constant.[25] The effect of unionization, however, is greatly attenuated if employer size is included in the equation. Although the positive effect of unionization and employer size on applicants suggests that these variables have an influence on the application rate beyond their effect on wages, the union and employer size effects could still be due to the presence of ex ante rents in these jobs if the starting wage is a poor measure of ex ante rents. For example, holding the starting wage constant, large firms may provide ex ante rents in the form of fringe benefits and working conditions.

Because it is not clear a priori whether employer size and (especially) unionization influence the application rate directly (X's) or indirectly by influencing compensation, Table IV presents results of estimating application rate equations using various combinations of union status, employer size, and industry as the Z vector in equation (3). These estimates are presented to explore the robustness of the applicant-wage elasticity.

The first column of Table IV uses the proportion of workers in the establishment that are unionized as an excluded instrument (Z variable) for the wage rate. Because there is only one exclusion restriction, this equation is just identified. The results indicate that wage differentials due to unionization are associated with increased job applicants. The application rate-wage elasticity with

25. This finding is consistent with results reported in Barron and Bishop [1985]. In addition, Brown and Medoff [1989] find that looking at only a sample of minimum wage jobs, large employers report more applicants per job opening than small employers.

TABLE IV

2SLS ESTIMATES OF THE DETERMINANTS OF JOB APPLICATIONS USING ALTERNATIVE INSTRUMENTS[a]

Independent variables	Equation[b] 1	2	3	4	5	6[c]
Intercept	−6.870	−3.559	−22.518	−4.276	−4.391	−1.379
	(2.207)	(1.381)	(4.954)	(1.475)	(1.381)	(1.419)
Log (wage)	1.351	0.754	4.170	0.883	0.904	0.299
	(0.393)	(0.242)	(0.889)	(0.259)	(0.242)	(0.253)
Minimum wage (1 = yes)	0.512	0.375	1.159	0.405	0.409	0.275
	(0.135)	(0.111)	(0.248)	(0.115)	(0.112)	(0.110)
Log vacancy duration	0.215	0.222	0.180	0.221	0.220	0.224
	(0.028)	(0.026)	(0.040)	(0.027)	(0.027)	(0.026)
Log (estab. size)	—	—	—	—	—	0.137
						(0.002)
Male (1 = yes)	−0.188	−0.087	−0.665	−0.109	−0.112	−0.010
	(0.106)	(0.089)	(0.190)	(0.091)	(0.090)	(0.088)
Age	−0.006	−0.005	−0.011	−0.005	−0.005	−0.002
	(0.004)	(0.004)	(0.006)	(0.004)	(0.004)	(0.004)
Experience	−0.002	−0.001	−0.007	−0.002	−0.002	−0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
High school grad	−0.138	−0.076	−0.427	−0.090	−0.092	−0.048
	(0.117)	(0.108)	(0.179)	(0.109)	(0.109)	(0.105)
College grad	−0.368	−0.253	−0.914	−0.278	−0.282	−0.197
	(0.163)	(0.146)	(0.266)	(0.148)	(0.147)	(0.143)
Occupation dummies (8)	yes	yes	yes	yes	yes	yes
Hrs. formal training	0.0020	0.0021	0.0018	0.0021	0.0021	0.0020
	(0.0007)	(0.0007)	(0.0010)	(0.0007)	(0.0007)	(0.0007)
Hrs. informal	−0.0000	−0.0001	0.0004	−0.0001	−0.0001	−0.0000
	(0.0003)	(0.0004)	(0.0005)	(0.0003)	(0.0003)	(0.0003)
Full time (1 = yes)	0.118	0.158	−0.072	0.149	0.148	0.155
	(0.110)	(0.104)	(0.162)	(0.105)	(0.105)	(0.101)
Hours 20–35 (1 = yes)	0.204	0.214	0.156	0.212	0.211	0.224
	(0.128)	(0.122)	(0.180)	(0.123)	(0.123)	(0.119)
Temporary job (1 = yes)	−0.267	−0.285	−0.180	−0.281	−0.280	−0.239
	(0.112)	(0.108)	(0.160)	(0.109)	(0.109)	(0.105)
Seasonal job (1 = yes)	−0.110	−0.114	−0.093	−0.113	−0.113	−0.045
	(0.152)	(0.114)	(0.214)	(0.147)	(0.148)	(0.142)
χ^2 Overident. statistic [DF]	—	47.2	1.37	75.9	77.0	34.6
		[34]	[4]	[38]	[39]	[35]
σ_ϵ	1.169	1.123	1.452	1.131	1.132	1.087
Z-vector	union	union and ind. dums.	5 emp. size vars.	5 emp. size vars. and ind. dums.	5 emp. size vars., union and ind. dums.	union and ind. dums.

a. Asymptotic standard errors are in parentheses. Sample size is 1,333. Mean of log (applications) is 1.452 [1.175]. Industry is measured at the two-digit Census level.

b. Each equation also includes 27 site dummy variables and 4 year dummy variables.

c. This equation also contains four firm-size dummy variables.

this estimation strategy is 1.35. A comparison of this estimate with those that use industry dummies as instruments in Table III indicates that the application response to wage differentials associated with unionization is greater than the application response to interindustry wage differentials of comparable magnitude. This suggests that union wage differentials may reflect ex ante rents to a greater extent than interindustry wage differences.

In column 2 we use industry dummies and the extent of unionization as excluded instruments for the wage rate. This approach leads to a smaller, but more precisely estimated application-wage elasticity.

In column 3 we use the log of establishment size and four firm size dummies as the Z's. The application-wage elasticity obtained from this estimation strategy is quite large, exceeding four. However, the dramatic change in the estimated coefficients for a number of the other variables in the model (e.g., minimum wage and the education variables), and the large mean square error of the equation make us doubt the plausibility of a specification that excludes size from the regressors (X's) to use it as a Z variable. Furthermore, the tests of the overidentifying restrictions in the equations in columns 4 and 5 which use industry and union along with size as Z's reject at conventional significance levels.

These results lead us to believe that employer size belongs directly in the application equation, although it may be appropriate to exclude industry and unionization from the application equation. As a consequence, column 6 includes employer size variables in the application equation. The wage elasticity is identified by the exclusion of industry dummy variables and unionization. In this equation the wage elasticity of the application rate is smaller than it was in the previous equations, about 0.30, and only slightly larger than its standard error. The minimum wage dummy, however, continues to have a substantial and statistically significant effect on applications even after controlling for employer size and the wage rate.

We note again that establishment size has a large influence on applications even after controlling for the starting wage rate. There are at least four plausible explanations for the significant establishment size-application relationship that exists even after wages are held constant. First, large firms are more visible and better known by job seekers compared with small employers. As a result, there may be better information about job openings at larger firms. Second, if there are fixed costs in applying to firms, it may be advantageous for job seekers to apply to large firms because the same applications may be used for multiple openings. Third, large firms may maintain a greater inventory of applications in their files compared with small firms. There is some indirect evidence for this explanation in the EOPP survey because we find that large employers are more likely than small employers to report that they interviewed applicants who had previously applied for positions in their firm. Finally, there may be nonwage aspects of work such as fringe benefits and favorable working conditions that make large firms more attractive employers than small firms.

V. Conclusion

Our examination of application rates for job openings indicates that jobs that offer the minimum wage attract more applicants than jobs that pay either slightly more than the minimum wage or slightly less than the minimum wage. This differential in applications for minimum wage jobs supports the view that the minimum wage confers rents to low-wage workers, suggesting that workers who obtain minimum wage jobs are made better-off by the minimum wage law. In addition, this finding casts doubt on models of the minimum wage which predict that employers will fully offset the effects of a minimum wage by reducing fringe benefits, cutting on-the-job training, and eroding working conditions. Since employers do not appear to extract all rents created by the minimum wage, there is reason to suspect that employers might not completely extract rents in other employment contexts as well.

We also find evidence of a positive but statistically insignificant relationship between interindustry job application differentials and interindustry wage differentials. In addition, we find that large establishments attract many more applicants than small establishments do, even after controlling for the starting wage rate. Several possible explanations of a positive relationship between employer size and the job application rate were presented. Finally, the estimates indicate that relatively many workers apply for available jobs in unionized firms, but this result is statistically insignificant once employer size is included in the equation.

Compared with the effects of employer size and union status on the number of job applicants, being in a high-wage industry does not seem to have a very large effect on a firm's job application rate. Wage differentials associated with a firm's industry have about one-third as large an effect on the application rate as the wage differential associated with unionization. This finding suggests that a larger proportion of the interindustry wage structure than previously believed may be attributable to compensating wage differentials for nonwage conditions of work. An alternative explanation for the relatively small effect of industry wage differentials on job applications is that potential job applicants may choose not to queue for jobs that pay a wage premium because they perceive that "connections" and favoritism are as important in determining who is hired for jobs in high-wage industries, or because they perceive themselves as unqualified for such jobs.

This paper represents an initial attempt to study the relationship between job application rates and wage differentials using micro data. There are several important directions for future research. First, data on the average quality of job seekers can be brought to bear on the issue of whether observed application differentials represent queues of qualified workers. Second, additional modeling of, and controls for, employer search behavior (e.g., advertising and search time) in data sets that have requisite information would strengthen analyses of application data. And

APPENDIX 1:
APPLICATION DIFFERENTIALS FOR MINIMUM WAGE AND SUBMINIMUM WAGE JOBS[a]
(FULL SAMPLE)

Other independent variables	Minimum wage effect[b]	Subminimum wage effect[c]	R^2
1. Occupation dums. (8), hours of formal training, hours of informal training, age, sex, experience, high school dum., college dum., full-time dum., weekly hours betw. 20 and 35 dum., seasonal job dum., temporary job dum., year dums. (4), log duration of vacancy	0.186 (0.096)	−0.029 (0.151)	0.126
2. Row 1 plus 27 site dums.	0.198 (0.096)	−0.030 (0.155)	0.156
3. Row 2 plus proportion union	0.235 (0.096)	0.000 (0.154)	0.164
4. Row 3 plus 4 firm size dums. and log plant size	0.227 (0.095)	0.070 (0.153)	0.191
5. Row 4 plus 35 industry dums.	0.263 (0.097)	0.094 (0.157)	0.217

a. Dependent variable is ln(applications per last job filled). Sample size is 1,333. Standard errors are in parentheses. Regressions also include a constant.

b. Estimated coefficient for a dummy variable that equals one if the worker's starting wage equaled the minimum wage that was in effect in the year the worker was hired, and zero otherwise.

c. Estimated coefficient for a dummy variable that equals one if the worker's starting wage was less than the minimum wage that was in effect in the year the worker was hired, and zero otherwise.

APPENDIX 2:
OLS ESTIMATES OF THE DETERMINANTS OF JOB APPLICATIONS[a]

Independent variable	Equation[b] 1	2	3
Intercept	0.543	1.159	1.172
	(0.661)	(0.677)	(0.669)
Log (wage)	0.015	−0.102	−0.163
	(0.105)	(0.109)	(0.108)
Minimum wage (1 = yes)	0.205	0.214	0.185
	(0.097)	(0.097)	(0.096)
Log (vacancy duration)	0.231	0.236	0.232
	(0.026)	(0.026)	(0.026)
Proportion union	—	0.444	0.209
		(0.118)	(0.122)
Log (estab. size)	—	—	0.137
			(0.025)
Firm size:			
50–99	—	—	0.059
			(0.117)
100–499	—	—	0.246
			(0.171)
500–1,999	—	—	0.168
			(0.125)
> 2,000	—	—	0.146
			(0.184)
Demographic:			
male (1 = yes)	0.038	0.054	0.067
	(0.080)	(0.079)	(0.078)
Age	−0.003	−0.003	−0.001
	(0.004)	(0.004)	(0.004)
Experience	−0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)
High school grad	−0.004	0.015	0.001
	(0.103)	(0.103)	(0.102)
College grad	−0.110	−0.080	−0.106
	(0.138)	(0.137)	(0.135)
Occupation dummies (8)	Yes	Yes	Yes
Hours training:			
Formal	0.002	0.002	0.002
	(0.001)	(0.001)	(0.001)
Informal	−0.0002	−0.0002	−0.0001
	(0.0003)	(0.0003)	(0.0003)
Full time	0.208	0.215	0.186
	(0.101)	(0.100)	(0.099)
Hours 20 to 35 (1 = yes)	0.227	0.217	0.228
	(0.120)	(0.119)	(0.118)

APPENDIX 2:
(CONTINUED)

Independent variable	Equation[b] 1	2	3
Temporary job (1 = yes)	−0.308	−0.298	−0.247
	(0.106)	(0.105)	(0.104)
Seasonal job (1 = yes)	−0.118	−0.116	−0.048
	(0.144)	(0.143)	(0.142)
σ_ϵ	1.102	1.096	1.080
R^2	0.155	0.165	0.192

a. Standard errors are in parentheses. Sample size is 1,333. Mean of log(applications) is 1.452 [1.175].
b. Each equation also includes 27 site dummy variables and 4 year dummy variables.

finally, the reasons why employers seem to only partially extract rents created by the minimum wage need to be identified and tested directly.

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