ONLINE JOB BOARDS AS AN EMPLOYER RECRUITMENT TOOL

BY

VERA BRENČIČ AND JOHN B. NORRIS*

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* Vera Brenčič (contact author; vbrencic@ualberta.ca) is Assistant Professor in Economics Department at University of Alberta. John B. Norris is Ph.D. graduate of Management Department at Purdue University.

Abstract

In addition to offering employers an opportunity to advertise their job openings online, the online job boards provide tools that facilitate online job application and job applicant screening. In this paper we examine the online job boards' potential to improve matching between workers and employers. We start by documenting that the size of online job boards has increased considerably in the U.S., Canada, and Europe. Drawing on descriptions of job openings we collected from an online job board Monster.com between 2004 and 2006, we find that: a) the online search tools offered by Monster.com for free are more likely used by employers who indicate active engagement in search or have access to a better online search technology; and b) holding observable vacancy and employer attributes constant, employers who use the search tools tend to keep their job openings online for a longer period of time.

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1. Introduction

As residential and commercial Internet adoption rates increased in the U.S., the Internet has become a valuable search tool for employers and job searchers (Forman et al., 2002; Nielsen/NetRatings, 2004; Forman, 2005). In the U.S., about 14 percent of unemployed workers and 7 percent of employed workers searched for jobs online in 1998. In 2003, the percent was up at 38 and 14 percent, respectively (Stevenson, 2008). The Global 500 Survey reveals that the percent of surveyed companies with their own corporate career website rose from 29 in 1998 to 94 in 2003 (iLogos, 2003). Drawing on recruiting activities of a U.S. manufacturing firm, Hadass (2004) finds that between 1995 and 1998 the firm recruited one percent of all new hires via the Internet. The percent rose to 20 in 2002.

While these basic statistics suggest that the Internet is becoming an integral part of the employers' and job searchers' search, little is know about the role the Internet plays in matching workers to jobs. The uncertainty about the Internet's role, in part, stems from the low costs associated with its use. The reduced costs of search, Autor (2001) notes, may result in excess job applications and lower quality of the applicant pool as the net gains of applying for the job increase for all job searchers including those who are not a good fit for the job.[1] Moreover, while the Internet may improve access to easily verifiable worker attributes, obtaining information about hard-to-verify attributes online may remain difficult. Clearly, the Internet's effectiveness also depends on the extent the job searchers and employers had adopted technology that allows them to exploit fully the benefits the Internet offers.[2]

[1] Kaydo (1999, page 13), for instance, notes: "The best – and arguably the worst – aspect of online recruiting is that it's so easy for applicants to apply for any job they're remotely interested in or qualified for."
[2] Drawing on the Harte Market Intelligence Survey, Forman et al. (2002) find that while the average rate of basic Internet adoption among U.S. establishments with 100 or more employees was in excess of 89 percent in 2000, the average rate of Internet adoption to enhance business processes was only 13 percent.

Recent studies that pertain to the job searchers' Internet use reveal several interesting insights. Kuhn and Skuterud (2004), for instance, find that the Internet use does not improve or may even be detrimental to the unemployed worker's chances of finding a job. Stevenson (2006), on the other hand, finds that employed workers who use the Internet are less likely to transition to unemployment compared to employed workers who do not use the Internet to search for jobs. Both studies use the Current Population Survey. Drawing on recruiting activities of a single manufacturing firm in the U.S. between 1995 and 2002, Hadass (2004) finds that new hires recruited via the Internet experience shorter tenure compared to those recruited via personal contacts but similar tenure to those recruited via newspaper ads.

In this paper we are interested in assessing the online job boards' role in facilitating the employers' and job searchers' search. The online job boards can best be described as an electronic version of the newspapers' classified ad section. Employers turn to online job boards to advertise detailed descriptions of their vacancies to millions of potential job applicants who visit the job boards' online sites each month and to peruse through online resume banks. Job searchers, on the other hand, submit their resumes to online resume banks and search for jobs posted on online job boards.[3] Importantly, the online job boards provide novel search tools that improve different aspects of the employers' and job searchers' online search. The online job boards' potential to improve matching could therefore be considerable.

This paper offers two contributions to understanding the role the online job boards play in matching jobs and workers. In the first part of the paper, we document that the use of the online job boards has increased considerably in recent years. This finding suggests that the online job boards have a potentially important role in matching workers and jobs. We proceed

[3] An online job board CareerBuilder.com, for instance, offered a venue for job posting at the time of its establishment in 1995. In 2000, the job board started offering job searchers an opportunity to submit resumes to an online resume bank. Monster.com has been offering the two services from its beginnings in 1994.

to describe novel services and search tools the job boards offer in an attempt to assess: a) the job boards' potential to impact different aspects of the search process; b) advantages online search offers over traditional offline search; and c) who is likely to benefit most from using the online job boards. In our analysis we draw on data collected by the Bureau of Labor Statistics, the Conference Board, and the Weddle's guides to online recruitment sites.

In the second part of the paper we examine the employers' actual use of search tools that the online job boards offer free of charge. These search tools include links an employer can provide in an online job posting that facilitate online job application, online dissemination of a job posting via social networks, and that screen qualifications of job applicants who apply to a job online. Since these tools are unique to online search they are one possible reason why search outcomes differ across those who search online and those who use traditional methods. Our analysis of the online job boards' impact on matching relies on the following argument. If the search tools improve different aspects of search, as suggested by the online job boards, we expect that: a) the tools are more likely used when the benefits the tools purportedly offer are greater; and b) the use of tools improves the employers' online search outcomes.

This latter line of inquiry draws on three vacancy datasets we collected by retrieving job openings' descriptions that were posted on an online job board Monster.com between 2004 and 2006. Based on descriptions of vacancies that employers posted online, we can infer the employers' use of online search tools offered by Monster.com as well as vacancy and employer characteristics. After the initial data collection we followed each vacancy for 16 weeks, which is approximately twice the duration a vacancy is paid to be posted on Monster.com. We use

the employer's decision not to repost a vacancy on Monster.com after the initial eight-week posting had been exhausted as an indication of successful search.[4]

We find that not all employers use the online search tools offered by Monster.com even though their use is free of charge and purportedly improves search. The online search tools are more likely used when employers indicate active engagement in search or have access to a better online search technology. Relatively small differences exist in the likelihood the online search tools are used across vacancies with different vacancy attributes. Controlling for observable vacancy and employer attributes, employers who use the online search tools are more likely to renew their online vacancy postings after the initial eight-week online postings become exhausted compared to employers who do not use the tools. This latter finding suggests that: a) the online search tools are ineffective in shortening the employers' search; or b) employers that use the online search tools are negatively selected on unobservables.

2. Introduction to online job boards

2.1. Recent trends in online job board use

The online job boards offer two key services: they provide employers and job searchers an opportunity to post their vacancies on an online job board and submit their resumes to an online resume bank, respectively. To document changes in the online job board use we draw on data that record changes in the number of online vacancy postings and online resumes.

In Graph 1 we plot several indices that depict monthly changes in the number of vacancies in the U.S. by drawing on data provided by the Bureau of Labor Statistics (BLS), the Conference Board, and Monster.com. While the BLS' Job Openings and Labor Turnover Survey (JOLTS) series depicts changes in the stock of vacancies at over 16,000 establishments

[4] The actual duration of employers' search in the U.S. is relatively short. The average vacancy duration is 13 days in the 1980 EOPP survey, 17 days in the 1982 EOPP survey, and 30 days in the 1993 Upjohn survey (Barron et al., 1997). In all three surveys the employers were asked how long it took them to find the most recent new hire.

since December 2000, the Monster Employment Index series tracks job openings posted at over 1,500 online job boards and career recruitment sites since October 2003. In addition, two series collected by the Conference Board are depicted. The Online Help-Wanted index series tracks changes in the number of job ads at over 1,200 online job boards since May 2005, while the Help-Wanted index series tracks changes in the number of jobs advertised in 51 major newspapers across the U.S. since 1951 (the series is normalized to 100 in 1987).[5]

<Insert Graphs 1 through 4>

Both the JOLTS index series and the two index series that depict changes in the stock of online job postings indicate a positive trend.[6] The Online Help-Wanted index series tracks quite closely the JOLTS vacancy index. To the contrary, the newspaper-based Help-Wanted series does not appear to exhibit a positive trend between the end of 2003 and the beginning of 2008. This observation is consistent with employers substituting away from posting job ads in newspapers to posting ads on online job boards. A similar pattern is reported in Hadass (2004). Using data on recruiting activities of a manufacturing firm in the U.S., Hadass finds that between 1995 and 2002 the firm hired an increasingly larger proportion of new recruits through the Internet and a smaller proportion of new recruits through newspaper ads.[7]

Graph 2 further suggests that an increase in the number of job openings posted on online job boards is not limited to the U.S. In the graph two series are depicted in addition to the U.S. Monster Employment Index. Both series are published by Monster.com. The two

[5] The Conference Board's Online Help-Wanted Index draws on the number of unduplicated ads. Ads are identified as duplicates based on the comparison of key job attributes across ads. These attributes are the company's name, job title, and location. Technical appendix suggests that two out of three job ads are duplicates (The Conference Board, 2007). It is unclear how duplicated ads are treated in the Monster Employment Index.
[6] One of the largest online job boards, Monster.com, sells 60-day online postings. Hence, if employers keep their vacancies online for a prepaid period, the monthly index series likely overstates the stock of active online job postings. Other big online job boards like CareerBuilder.com and HotJobs.com offer 30-day online postings.
[7] Kroft and Pope (2007) find, at MSA level, a negative association between the growth in the number of jobs posted on Craigslist online job board and the growth in the number of newspaper classified job advertisements.

series track changes in the number of online job postings at selected job web sites in Canada and Europe. While the period is relatively short, the graph nevertheless suggests a notable increase in the number of online job postings in Europe and Canada between 2005 and 2008.

To infer the job searchers' use of the online job boards we draw on Graphs 3 and 4. The two graphs depict the number of unique visitors and the number of posted resumes for five online job boards: Monster.com, CareerBuilder.com, HotJobs.com, Workopolis.com, and America's job bank.[8] The data were obtained from the annual Weddle's guides to recruitment web sites. The five selected online job boards have experienced, at different rates, an increase in the number of posted resumes and the number of unique visitors they hosted between 2000 and 2006.[9] Overall, Graphs 1 through 4 provide some support for contention that the job searchers' and the employers' use of online job boards increased in recent years.

2.2. Costs of using online job boards

While the job searchers' use of online job boards is typically free of charge, the employers have to pay a fee to post a vacancy online or to obtain access to an online resume bank. Graphs 5 and 6 report changes in the fees selected online job boards charged employers between 2000 and 2006. Interestingly, the online job boards increased the vacancy posting fees and shortened the duration of a vacancy's online posting. The opposite change occurred for a resume bank access fee that either remained unchanged or has decreased.

In 2000, for instance, an employer could post a vacancy on Monster.com for 90 days for a $251-300 fee according to the Weddle's guides to online recruitment sites. The fee

[8] Cappelli (2001, page 142), for instance, notes: "Monster.com is the largest job board, roughly twice the size of any of the next largest board – JobsOn-line.com, CareerBuilder, Headhunter.net, and HotJobs.com." In 2001 Headhunter.net was acquired by CareerBuilder.com.

[9] As reviewed in the next section, online job boards differ in the length of time resumes submitted by job searchers are stored in the resume bank. In an instance the job boards offer storage indefinitely, as is the case with CareerBuilder.com and HotJobs.com, annual data on the stock of online resumes over-states the job searchers' active reliance on the online job boards.

increased to $365 in 2004 and to $395 in 2006. The duration of a vacancy's online posting dropped from 90 in 2000 to 60 days in 2001.[10] While the vacancy posting fee for a 30 day posting ranged between $101 and $150 in 2000 at CareerBuilder.com and HotJobs.com, the fee increased in 2002 to between $151 and $200 at CareerBuilder.com and to between $201 and $250 at HotJobs.com. Both job sites have offered 30-day postings since 2000.[11] Despite the increase, the cost of online vacancy posting remains relatively low compared to alternatives. Whaley (2001), for instance, estimates the cost of placing a newspaper job ad at $5,000.

<Insert Graphs 5 through 7>

The resume bank access fee has also changed over time. In 2000, for instance, Monster.com charged $5,000 for a three-month long access and $10,000 for a year long access. The annual fee dropped to $9,400 in 2001.[12] Workopolis.com went from charging $1,000 for a month long access in 2001 to $1,300 in 2002. By 2006, the fee dropped to $995. Changes also occurred in terms of how long resumes are stored in the resume bank. Weddle's guides reveal that while Monster.com offered resume storage for 365 days over the last several years, CareerBuilder.com, for instance, switched from offering 365 day long resume storage in 2000 to offering resume storage indefinitely. HotJobs.com also offers indefinite storage.

In Graph 7 we plot monthly changes in the BLS Producer Price Index (PPI) for several sectors between 2002 and 2008: employment services (5613), employment placement agencies (561310561310), and Internet recruiting services (5613105613102).[13] The employment

[10] These are estimates since the job posting fees tend to depend on the job's location. In addition, online job boards offer discounts for purchases of several job postings.
[11] The Canadian online job board Workopolis.com switched from offering 21-day postings to offering 30-day postings in 2006.
[12] Recent review of online job boards' fee schedules suggests that the resume bank access fee tends to be a function of not only duration of access but also the number of viewed resumes and the radius of search, measured by the location of job searchers whose resumes an employer wants to access.
[13] The employment services industry consists of three segments: employment placement agencies, temporary help services (temporary staffing agencies), and professional employer organizations (BLS, 2008).

placement agencies pertain to establishments that are primarily engaged in listing employment vacancies and in referring or placing applicants for employment. The fees the online job boards charge for their services represent only a subset of the prices contained in the Internet recruiting services PPI. Graph 7 suggests that an increase in the costs of recruiting services is quite pronounced in the sector of Internet recruiting services compared to sectors that include other recruiting services in addition to those offered on the Internet.

2.3. Benefits of using online job boards

In addition to providing the employers an opportunity to post their vacancies online the online job boards offer, free of charge, search tools that facilitate the employers' online search at the extensive and the intensive margins; i.e., tools that affect the job applicant arrival rate or improve screening of job applicant qualifications, respectively.[14] These tools take the form of links an employer can provide in a vacancy's online posting (see Exhibit 1 for an example of an online job posting). Since these tools are unique to online search, the tools' potential to improve the matching process identifies the advantages online search offers over traditional offline search. We next review the benefits and costs of using these online search tools.

When posting a vacancy online an employer has an option to provide in a vacancy's description the *Apply now* link (*Apply* link). By clicking on the link a job searcher can apply to a job online. Since the *Apply* link's use is cheap, fast, and easy, the provision of the link is expected to increase the number of applicants and hence facilitate the employer's search at the extensive margin. The link's provision is also likely to increase the speed of the applicant arrival. The downside to providing the link might be its adverse effect on the quality of the applicant pool. Namely, because the link's use is so easy and cheap the link's provision

[14] Online job boards also offer search engines job searchers can use when searching through job openings posted on an online job board. In this paper we focus on the search tools online job boards offer employers.

increases the net gains of applying to a job even for workers who may not be a good fit for the job and would not have applied for the job had they faced higher application costs. In addition, to apply to a job online the job searchers must have a resume in the Monster.com resume bank (see Exhibit 2). This resume pool is likely adversely selected as better workers are more likely picked out of the resume bank by employers who purchased access to the resume bank.

Another link an employer can provide in a vacancy's online description is the *Send this job to a friend* link (*Send* link). The *Send* link enables a job searcher to email a job opening's description to a friend by simply clicking on the link and providing the friend's email address (see Exhibit 3). Hence, the link provides an employer with access to a pool of potential job applicants beyond those who search for a job online by perusing through online job postings. The link therefore, similarly to the *Apply* link, facilitates the employer's search at the extensive margin. We expect the link to be more likely provided when the benefits to a large applicant pool or a fast applicant arrival are greater. Since active job searchers are believed by some to be an adversely selected pool of job applicants (Autor, 2001), the *Send* link's provision may also identify an employer's attempt to access high quality passive job searchers.

<Insert Exhibits 1 through 4>

When posting a vacancy online an employer can select from preset requirement menus to describe his vacancy in terms of the vacancy's career level, minimum education, and relevant work experience (see Exhibit 4). In addition, an employer can provide his own, more detailed, description of a vacancy.[15] If an employer who uses the requirement menus also provides the *Apply* link, the online job applications the employer receives from the job applicants inform the employer whether the applicants satisfy the employer's hiring

[15] Monster.com does not restrict the length of a job description. *Yahoo!* HotJobs.com, on the other hand, restricts the job description to 32,000 characters while CareerBuilder.com to 15,000 characters.

requirements. The employer's use of the requirement menu and the *Apply* link facilitates search at the intensive margin as it improves the precision of the signal about match quality.

3. Employers' use of online job boards: Theoretical framework

In the next section we use three vacancy datasets to study the employers' use of search tools offered by online job boards. Since these tools are unique to online search they are one possible reason why search outcomes differ across those who search online and those who use traditional offline search methods. Understanding what determines the use of online search tools and how their use is linked to search outcomes can provide us with some insight into the online job boards' impact on matching workers to jobs. If the search tools improve search we expect that: a) the tools are more likely used when the benefits the tools purportedly offer are greater; and b) the use of search tools improves the outcomes of the employers' online search.

The theoretical framework we use to understand the employer's decision regarding the use of an online search tool is Barron et al. (1997). In the model the employer's search is characterized by two decisions. First, the employer decides on the stopping rule that determines the expected number of applicants the employer considers prior to extending a job offer (extensive margin). The employer's second decision pertains to the precision of the signal about the job applicant's qualifications the employer chooses to obtain (intensive margin). Hence, the employer selects search tools to affect the number of applicants who apply for a job. Upon the applicants' arrival the employer may either use tools to screen the applicants or not in order to decide which applicant is the best fit for the job.

The search tools the online job boards offer affect different aspects of the employers' hiring process. While the *Apply* and the *Send* links affect the size of the applicant pool, the combined use of the requirement menu and the *Apply* link screen job applicants. A key insight

of the model is that more selective employers engage in more search at the extensive and intensive margin. According to Barron et al. (1997), vacancy characteristics such as on-the-job training, required human capital, and low vacancy costs identify the degree of an employer's selectiveness. Hence, we expect that these vacancy characteristics are positively associated with the online search tools' use if the search tools improve the two aspects of the employer's hiring process. To the extent that the use of online search tools has a negative effect on the quality of the applicant pool we expect that these vacancy characteristics will not affect (or will be negatively associated with) the employer's use of online search tools.

Presumably the employers use the online search tools in an attempt to improve the outcomes of their search. One such outcome the employers may try to affect is the duration of their search. The link between the online search tool's use and subsequent duration of the employer's search, however, is hard to predict. For instance, while the provision of the *Apply* link or the *Send* link may result in a faster applicant arrival that may not imply that the use of the search tools will result in shorter duration of a vacancy's online posting as the quality of the job applicants may be low. Hence, while the two links may shorten the recruiting stage of an employer's search they may considerably prolong the selection period. To the extent that the use of online search tools has a negative effect on different stages of the employer's search the relation between the search tools' use and duration of search remains an empirical question.

4. Employers' use of online job boards: Evidence from Monster.com

4.1. Data collection

We collected data by retrieving descriptions of job openings that were posted on Monster.com during a three-year period, between 2004 and 2006.[16] On July 10th 2004 we retrieved job descriptions for a stock of job openings that were posted on Monster.com on that

[16] This job board was chosen since it is one of the largest online job board sites (Autor, 2001; Cappelli, 2001).

day. From the list of 261 U.S. cities or regions, job listings for positions located in ten cities were retrieved.[17] In a separate retrieval job openings assigned to one of the 11 of the 67 job categories were also collected.[18] In 2005 we relied on the same collection criteria. The main difference compared to 2004 is that in 2005 we collected a flow of job openings that were posted on Monster.com between April 30th and July 7th. Similarly to the 2005 collection, the 2006 data record a flow of new vacancies that were posted on Monster.com between June 26th and July 8th. In 2006, however, we imposed no restrictions on the jobs' location or industry.

During the three data retrievals information could not be retrieved for some job postings. These postings were dropped from the samples. We further restricted the samples to postings with an at least 600-character long description. In the 2004 and 2005 data collections some postings appeared in both city-based collection and industry-based collection, thus reducing the total number of unique postings in our data. These three criteria reduced the 2004 sample size from 80,988 to 69,413 unique job postings, the 2005 sample size from 196,799 to 172,219 unique job postings, and the 2006 sample from 142,618 to 137,678 job postings.

The initial data collection amounted to retrieving text from each vacancy's online site. Hence, each observation in the data is a text file from which the vacancy's characteristics and the employer's use of search tools were identified in two steps. First, for each vacancy characteristic or online search tool a list of search words that identify the attribute of interest was constructed (refer to the Appendix). Second, a program searched through each file to infer whether any of the search words could be found in a vacancy's description. Summary statistics

[17] The ten cities were selected to represent different regions in the U.S. The list of cities includes: Chicago, Cincinnati, Detroit, Boston, Atlanta, Dallas, Charlotte, Miami, Seattle, and San Francisco.
[18] The industries represented in the sample are: banking, insurance, finance and economics, financial services, biotechnology and pharmaceutical, certified nursing assistants, registered nurses, manufacturing and production, Internet and E-commerce, information technology, administrative and support services. The eleven industries were selected to represent industries with either fastest or slowest projected job growth for the period between 2004 and 2014 (Hecker, 2005).

for some of the key vacancy and employer characteristics are reported in Table 1. For a full list of control variables we include in econometric models refer to the Appendix.

<Insert Table 1>

After the initial data collection we checked, on a weekly basis, whether each vacancy was still listed on the online job board.[19] We ran these checks for 16 weeks, which is approximately twice the length of the 60-day period for which employers pay for posting a job opening on Monster.com. The week a vacancy is identified to have been withdrawn from the job board is set to equal the week when accessing the vacancy's website resulted in the following message: "We're sorry. This job has been removed from the site and is no longer available for viewing." We use this information to construct a measure of an employer's online search outcome; i.e., the duration of a vacancy's online posting.

We expect that for most employers search takes less than 60 days as reported in the literature that draws on survey data for the U.S.[20] An employer who successfully completed his search will not pay a posting fee for another 60-day online posting. Hence, the employer's decision to renew a vacancy's online posting likely contains some information about how successful the employer's search has been. After 16 weeks, 4.3, 3.8, 9.5 percent of vacancies remained posted on Monster.com in the 2004, 2005, and 2006 samples, respectively.

4.2. Employers' use of Monster.com search tools

Graphs 8 through 15 depict a fraction of vacancies for which employers used any one of the online search tools offered by Monster.com for the three samples we collected. In

[19] A job posting has a unique identification number that is part of the job's online address. This feature allowed us to track each vacancy over time. For instance: http://jobview.monster.com/getjob.asp?*JobID=66945149*&Job Title=Social+Workers&rad=20&rad_units=miles&cnme=new+york&brd=1&cy=us&vw=b&AVSDM=2008-01-04+13%3a00%3 a00&pg=1&seq=1.

[20] In the surveys employers are asked how long it took them to find the most recent new hire. Burdett and Cunningham (1998) report the mean vacancy duration in their sample from the 1980s to be 20 days. DeVaro (2005), drawing on vacancy data from the mid 1990s, reports the mean vacancy duration between 1.2 weeks for positions for which union referrals were used to 5.6 weeks for positions for which recruitment agencies were used.

addition, we report how frequently traditional contact methods (e.g., phone number, fax, postal address) are provided. Despite the fact that the online search tools can be used free of charge and purportedly improve the employers' search, the graphs suggest that not all employers use the tools. Hence, the use of online search tools may entail costs that for some employers outweigh the benefits the tools offer. A search tool that is most frequently used is a *Send* link. In particular, the link is provided for between 69.3 to 77.5 percent of the vacancies. Only for between 31.8 to 48.7 percent of the vacancies the *Apply* link provision could be identified.

<Insert Graphs 8 through 15>

Information about traditional contact methods is provided less frequently in an online job description. A phone number tends to be provided in about 9.2 to 12.6 percent of all online vacancy postings. Information about the fax number and postal address is provided more frequently, in about 18.8 to 26.8 percent of online vacancy postings. While a considerable portion of employers in our sample do not specify education or work experience requirement, we find that of those who do a big portion opts to use tools that improve inference or screening of job applicants' qualifications.[21] While about one third of the vacancies for which we could identify education requirement also provide the *Apply* link and hence allow for screening of job applicants' attained education, about two thirds of vacancies for which we could identify work experience requirement allow for screening of the job applicants' work experience.

In Table 2 we report the correlation matrix for the search tools to infer how the search tools are bundled together. While panel A reports simple correlation coefficients, panel B reports correlation of error terms across different search tools obtained from estimation of a

[21] The sample in the graphs that depict proportion of vacancies for which either education or work experience screening was chosen is restricted to vacancies for which either of the two required qualifications could be identified; i.e., approximately 60 percent of the full sample for education screening and approximately 38 percent of the full sample for work experience screening.

multivariate probit model where we control for worker requirements as well as vacancy and firm attributes. In particular, following a similar approach in DeVaro (2005), we estimate:

$$Prob\left(search\ tool\ \ j=1\right)=\Phi\left(\beta_j' X\right), \tag{1}$$

where j identifies the use of search tool j, Φ denotes the standard normal cumulative distribution function, β_j a vector of coefficients in the j^{th} equation, and X a vector of explanatory variables (i.e., worker requirements, firm and vacancy characteristics).

<Insert Tables 2 through 4>

The sign of the correlation coefficients suggests that the online search tools are not substitutes in that the use of one search tool is not associated with a less likely use of another search tool. Importantly though, some online search tools are more likely bundled together than others. The provisions of the *Apply* and *Send* links are highly positively correlated, while the provisions of traditional contact methods (i.e., phone, fax, address) are strongly correlated with each other but not as much with other search tools. We next turn to determinants of online search tools. In Table 3 summary statistics pertain to online search tools' use for different groups of vacancies. Several observations in Table 3 are quite interesting in light of predictions that pertain to determinants of online search tools in Barron et al. (1997).

First, employers who indicated that they are in a hurry to fill a vacancy are more likely to use online search tools that increase the speed of applicant arrival and are less likely to use tools for job applicants' screening. The average number of contact methods is greater in the sample of vacancies that have to be filled immediately compared to the full sample. The same applies to the proportion of jobs with the *Apply* or *Send* link. A smaller portion of vacancies have screening tools in the sample of immediate jobs compared to the full sample. These findings are expected as employers with immediately available jobs likely face higher costs of

continuing with search, are expected to be less selective, and have more to gain from a faster job applicant arrival. Hence, any adverse effects the online search tools may have on the quality of the applicant pool are likely outweighed by the benefits of fast applicant arrival.

The second finding pertains to vacancies that offer training. Employers who offer on-the-job training face greater gains of an increase in the applicant arrival since by seeing many applicants they can reduce the probability of a hiring mistake and therefore increase the expected gains to training. For the same reason, to avoid a hiring mistake, these employers are more likely to screen job applicants' qualifications. Hence, if the online search tools increase the applicant arrival and improve screening we expect the tools to be more likely used when a vacancy an employer is trying to fill entails on-the-job training. Table 3 suggests otherwise. This finding may indicate that: a) hard-to-verify worker attributes may be the attributes employers who offer training are more interested in screening than education or work experience; or that b) the tools' adverse effect on the quality of the applicant pool outweighs any benefits the tools offer when employers care most to find a good match.

The third result pertains to employers who are trying to fill vacancies that entail high educational attainment. If human capital and ability are complementary inputs and distribution of ability is fixed, employers with vacancies that entail higher educational attainment face a distribution of possible match values that has a greater variance. For this reason, these employers are more selective and face greater gains to continuing with search. If the search tools offered by Monster.com facilitate the employers' search at the extensive and intensive margins we expect the tools to be more likely used when employers are searching for a worker with high attained education. The results in Table 3 are not consistent with this prediction.

On the other hand, employers who indicated that they are actively engaged in search or those who provided a link to other job opportunities more likely use search tools. This latter finding suggests that employers who regularly search for workers online by posting their vacancies on an online job board may have access to a better online search technology, enjoy greater gains to online search tools' use, and hence are more likely to use online search tools. To the contrary, we find that vacancies that were posted by recruitment agencies or vacancies with a link to an employer's corporate website tend to less likely make use of online search tools. One explanation might be that for such vacancies employer or recruitment agency specific tools are more likely used in place of the tools offered by Monster.com.

When we estimate simple binary probit models for each search tool and control for observable vacancy and employer characteristics we find that online recruitment and screening tools offered by Monster.com are more likely used when employers indicate active engagement in search or have access to better online search technology.[22] Relatively small differences exist in the likelihood the online search tools are used across vacancies with different vacancy attributes (for the 2006 sample refer to Table 4, for the 2004 and 2005 samples see Brenčič and Norris, 2008). Overall, the results suggest that the online search tools are more likely used when fast applicant arrival is important, employers engage in active search or have access to technology that allows them to better exploit the benefits the online search tools offer.

4.3. Employers' withdrawals of job vacancies from Monster.com

If the online search tools improve search we expect that employers who use the tools will less likely repost their vacancies online compared to employers who do not use the tools.

[22] When estimating determinants of employers' use of screening tools we restrict the sample to job postings for which we were able to identify a qualification requirement either from the requirement menu or from the employer-provided job description. If we were to use all observations we would compare employers who chose to screen for a qualification requirement to those who did not because they did not specify the requirement. Such a comparison may not be informative on account of heterogeneity in employers' reporting (writing) style.

Table 5 provides some preliminary insights. Table 5 depicts the average number of weeks a vacancy has been posted on an online job board for the full sample and for the samples of vacancies for which any one of the online search tools was identified to be in use. Since the 2004 sample consists of vacancies with different retrospective duration of online posting we restrict our analysis of Table 5 to patterns we observe for the two most recent data collections.

The mean online vacancy duration tends to be longer for a sample of vacancies for which online search tools were used. The opposite is the case for vacancies for which traditional contact methods were provided in the online vacancy postings. Moreover, vacancies that fall in the bottom 5th percentile of the sample based on the number of search tools (i.e., vacancies for which none of the tools are used) tend to experience shorter online duration compared to vacancies that fall in the top 5th percentile (i.e., vacancies for which six tools are used). For instance, while vacancies in the bottom 5th percentile remain posted online on average for 4.8 and 6.4 weeks, vacancies in the top 5th percentile remain posted online on average for 6.6 and 6.9 weeks in the 2005 and 2006 samples, respectively.

<Insert Tables 5 through 7>

We next estimate a probit model with a dependent variable taking value one if a vacancy has been reposted for another 60-day online posting and zero if a vacancy was withdrawn from the job board prior to or at the time of the first 60-day posting exhaustion. Consistent with a model of employer sequential search, Table 6 suggests that more selective employers (e.g., those who are not in a hurry to fill a vacancy, offer on-the-job training, or require high education) tend to more likely repost their vacancies. Variables that measure employer attributes are also important in explaining the pattern of vacancies' withdrawal from the online job board. Vacancies posted by recruitment agencies, for instance, tend to be

associated with a longer online duration. Recruitment agencies may keep a vacancy posted online even if a worker was found as they always find it beneficial to have access to job applicants for potential consideration for other positions with similar requirements.

The next series of probit models we estimate essentially differ in terms of which search tool variable is included in the model in addition to control variables for observable worker requirements, vacancy and employer characteristics (see Table 7). We estimate:

$$Prob\left(online\ job\ posting\ renewed = 1\right) = \Phi\left(\alpha\ search\ tool\ \ j + \gamma' X\right), \qquad (2)$$

where *j* identifies the use of a search tool (i.e., *Apply* link, *Send* link, email, phone, fax, or address provision, education or work experience screening), Φ is the standard normal cumulative distribution function, α is a coefficient of main interest, and *X* is a vector of explanatory variables (i.e., worker requirements, firm, and vacancy attributes).[23]

Each entry in Table 7 pertains to an estimate from a probit model that measures association between the use of a search tool and the likelihood a vacancy's online posting is renewed. All in all, the table reports results from 24 different probit models. The results are in line with those reported in Table 5 even when we control for observable vacancy and employer characteristics. In particular, in the two most recently collected samples vacancies with traditional contact methods are less likely reposted compared to vacancies with no information on traditional search methods. The provision of the *Send* link also makes it less likely that a vacancy will be reposted on the job boards. To the contrary, vacancies with an e-mail address, the *Apply* link, or screening mechanisms are more likely re-posted for another 60 days.[24]

[23] When an indicator variable measures an employer's decision to screen a job applicant's qualification we restrict the sample to jobs for which a required qualification was identified.

[24] Since we do not control for the employers' use of other online or offline search tools, the identified association measures the effect of online search tool on online vacancy duration when all other online and offline search tools adjust optimally to the use of the online search tool (Kuhn and Skuterud, 2005, page 223).

These results may suggest that the online search tools are ineffective in terms of improving the employers' search outcome; i.e., the speed of completing the search. For instance, the provision of the *Apply* link may result in larger applicant pool or faster applicant arrival but the quality of the applicant pool may be so low that it ends up prolonging the employers' search. The positive association between the provision of the *Send* link and the likelihood of a vacancy's withdrawal is consistent with our conjecture that the link provides access to passive job searchers who may be of higher quality. The positive association between the employer's use of screening tools and the duration of a vacancy's online posting might arise on account of the fact that the tools do not improve the employers' inference of harder-to-verify attributes that might be most important in the employers' hiring decisions.

If the online search tools are ineffective, why do employers use them? Despite their ineffectiveness some employers may nevertheless use the tools since they are offered for free or because the employers are unaware of the tools' ineffectiveness. It is also possible that the search tools generate benefits on other dimensions that we cannot measure. These unobserved benefits may outweigh the prolonged search the use of search tools entails. Alternatively, the results may suggest that the employers and the job searchers are simply not yet accustomed to using the online search tools effectively. This explanation is consistent with our finding that employers who frequently use online job boards more likely use the online search tools.

The second explanation for the results may be that the online search tools indeed are effective in shortening the employer's search but that the results are contaminated by the measurement error or (and) selection bias. For instance, the measure of an employer's online search outcome may simply contain no information about the duration of the employer's search. The results in Table 6 suggest that vacancies with characteristics that have been found

in related literature to be associated with longer vacancy duration tend to be posted online for a longer period of time. This pattern suggests that the measure of a vacancy's online duration may contain some information about the duration of the employer's search.

Results that pertain to determinants of online search tools' use suggest that the online search tools are positively selected on the observables. In particular, employers who actively engage in search and those with access to a better online search technology more likely use the online search tools. If the online search tools are used by employers who are also positively selected on the unobservables, our results understate the true adverse effects of online search tools' use. On the other hand, if the search tools are more likely used when longer vacancy's online posting is expected on account of unobservable vacancy or employer attributes (e.g., the employer's private information about the prospects of filling the vacancy) the results overstate true detrimental effects (or mask true beneficial effects) of the online search tools' use.

5. Concluding remarks

Recent studies suggest not only that employers and job searchers increasingly rely on the Internet when searching for workers and jobs, respectively, but also that those who use the Internet experience quite different labor market outcomes compared to those who do not. However, we know relatively little about the reasons why such differences occur. In this paper we are interested in assessing the online job boards' role in matching job searchers and job openings. Drawing on new data collected from Monster.com job board we explore the employers' use of online search tools, offered by Monster.com, that aim to facilitate two aspects of matching: online job application and job applicants' screening. These tools are unique to online search and hence identify one potential source of difference in the matching process between those who search online and those who use traditional search methods.

The results in this paper suggest that the gains to online search tools offered by the online job boards may not be uniform across all employers and vacancies. In particular, the biggest beneficiaries of the online job boards appear to be employers who have access to a better online search technology. Importantly, how actively employers engage in search can also help explain the likelihood the search tools are used. Hence, in future research care has to be taken to account for heterogeneity in active engagement in search and access to search technology when assessing the Internet's role in the labor market. The results also suggest that vacancies for which search tools were used are more likely to be re-posted on a job board compared to vacancies for which search tools were not used. This finding suggests that: a) the online search tools are ineffective in shortening the employer's search; or b) employers who use the online search tools are negatively selected on unobservables.

The paper's results complement existing literature in three respects. First, the results pertain to the employers' use of the Internet as part of the employers' recruitment efforts. In this respect the paper is similar to Haddas (2004) who documents recruiting activities, of which one is online recruiting, for a single manufacturing firm in the U.S. between 1995 and 2002. Also related to out paper is a study by Eriksson and Lagerström (2006, 2007). While in our paper we explore the employers' use of online job boards, Eriksson and Lagerström explore the employers' use of an online resume bank administered by the Swedish Employment Office.

Second, this paper documents search activities the employers pursue online by examining the employers' use of online search tools offered by the online job boards. In this respect the analysis is similar to Nakamura et al. (2007) who draw on a novel survey of online job searchers to document activities job searchers pursue while searching online. Mellet (2005), on the other hand, examines the job searchers' online activities by drawing on over

30,000 queries job searchers submitted while searching for jobs on a French online job board Keljob.com. Third, our results indicate that the gains of using the online job boards and the search tools they offer depend on employer and vacancy characteristics. As such the paper's results relate to Kuhn and Skuterud (2004) and Stevenson (2006) whose findings suggest that the job searchers' gains to Internet use may depend on the job searchers' employment status.

The data and therefore the paper's analysis have drawbacks that offer opportunities for interesting future research. Most notably, the data only provide information about the employers' use of one search method, an online job board. We do not observe other aspects of the employers' online search nor do we observe the employers' offline search activities. In our analysis we also rely on only one outcome of an employer's online search, the timing of a vacancy withdrawal from an online job board. Future data collections could therefore extend on our analysis by obtaining other outcome measures such as match quality as well as measures of employers' parallel use of online and offline search methods.

Finally, the findings in this paper suggest that the online job board industry has undergone notable changes in recent years. In particular, preliminary analysis of several large online job boards indicates that the online job boards differ in their fee schedules and the services they offer. In addition, the services and fees have changed quite considerably over a span of just a few years. This paper abstracts from considering the reasons for and the implications of such changes. Nevertheless, these findings suggest that: a) these changes have to be accounted for when constructing different measures of online recruiting such as the size of online job boards and online resume banks; and b) a more comprehensive analysis of the online recruiting industry may offer further interesting insights that can improve our understanding of the role the Internet and the online job boards play in a labor market.

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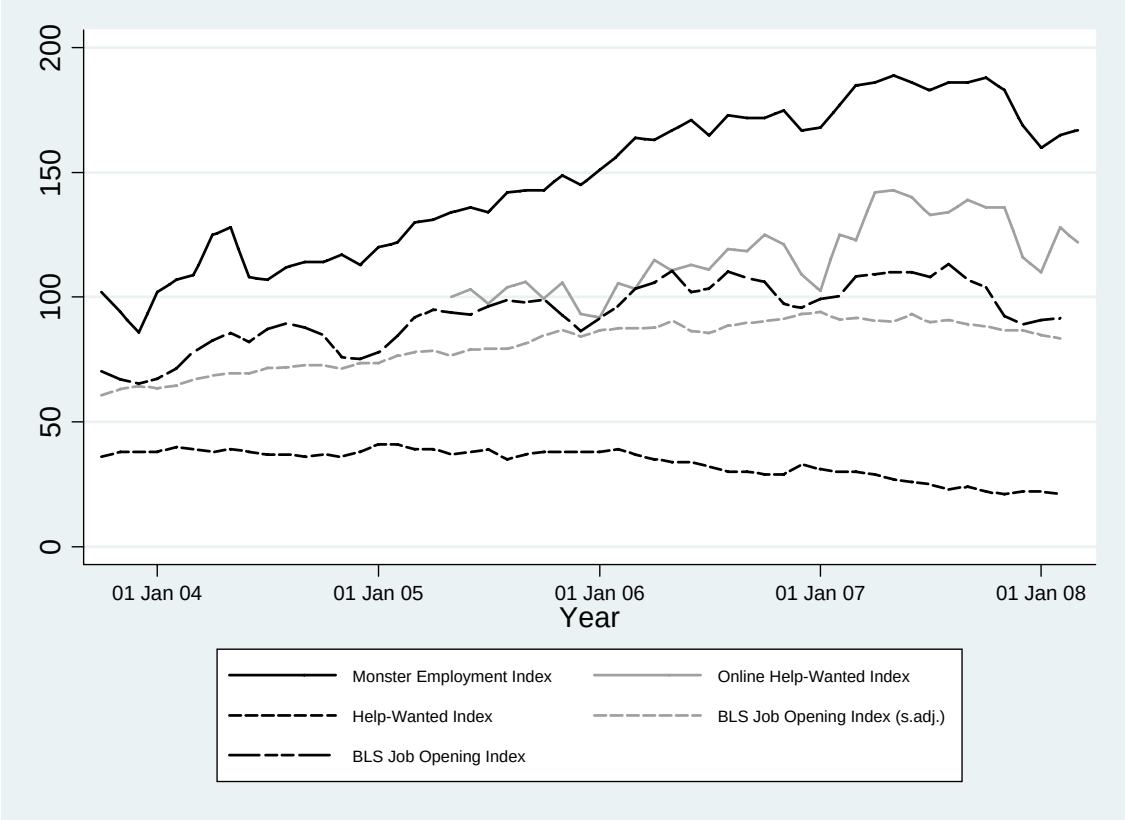
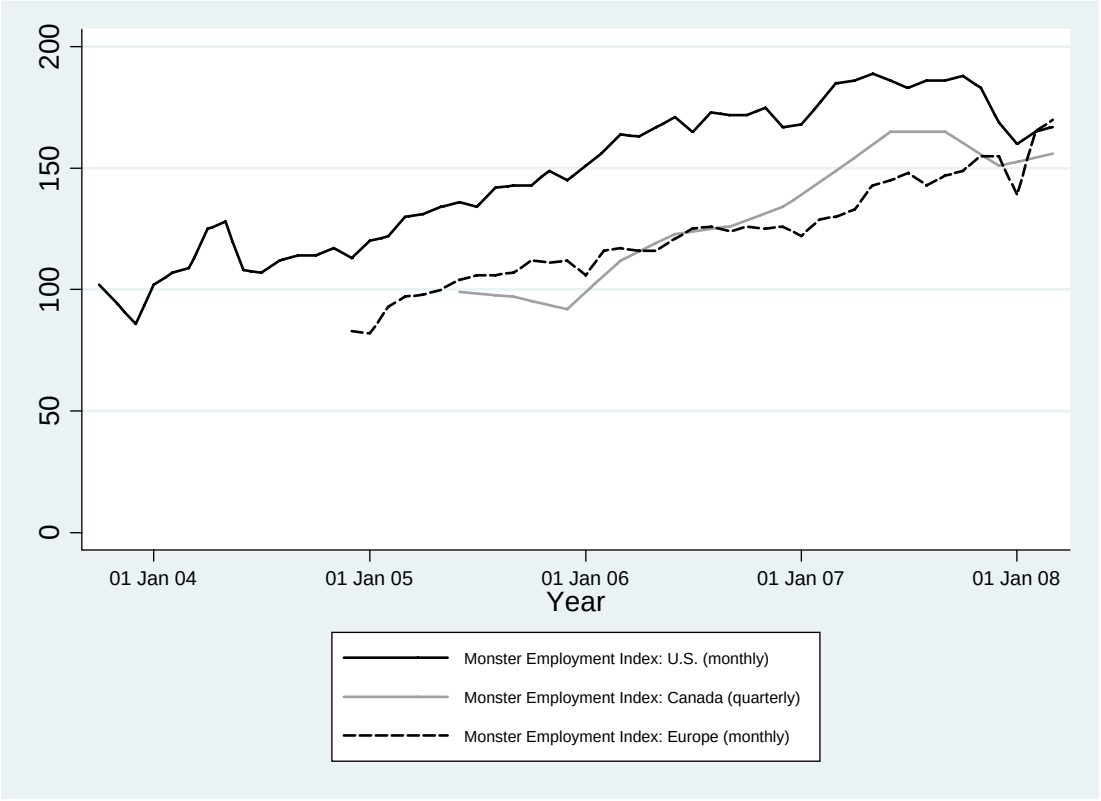
GRAPH 1: Job vacancies in the U.S.



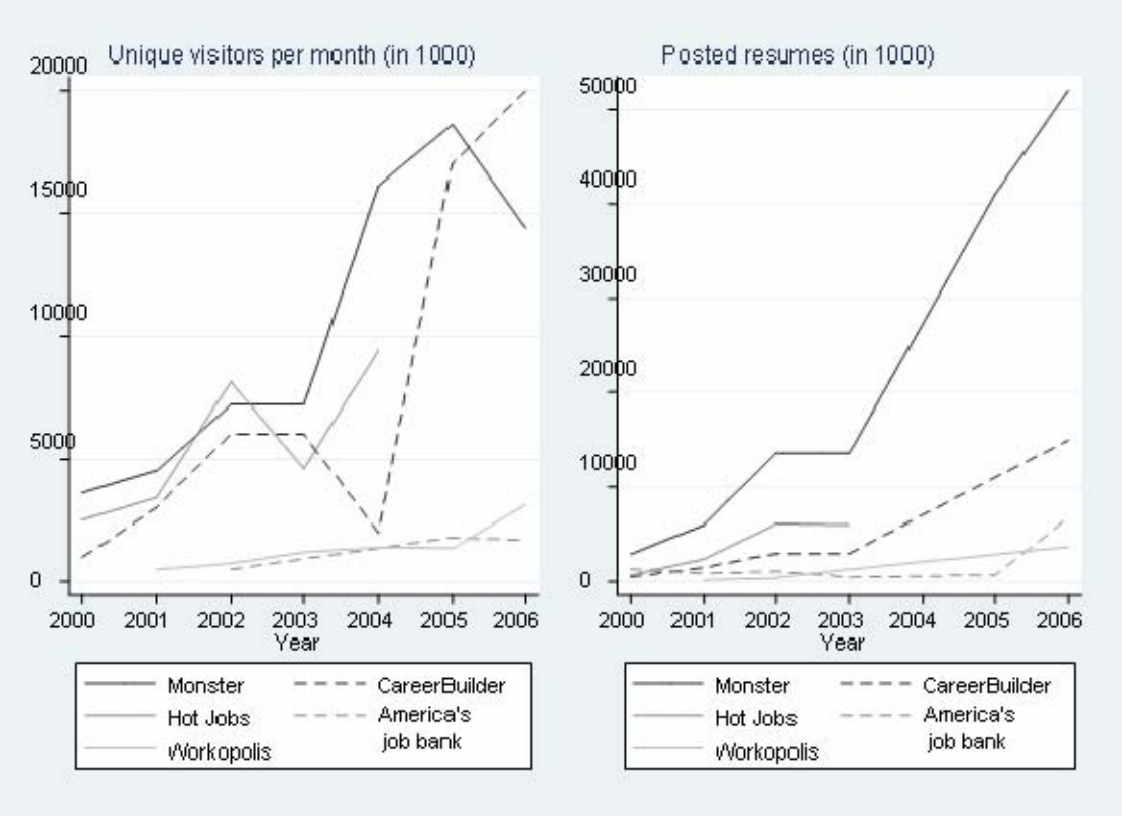
Notes: Monster Employment Index tracks job openings posted at over 1,500 online job boards and career recruitment sites since October 2003. The series is seasonally adjusted. The Bureau of Labor Statistics' Job Openings and Labor Turnover Survey (JOLTS) index series depicts changes in the stock of vacancies at over 16,000 establishments on the last business day of each month since December 2000. To be counted in the JOLTS series a vacancy has to exist, the job can start within 30 days, and an employer actively recruits outside his establishment to fill the vacancy. In the graph seasonally adjusted and non-adjusted series are depicted. The Conference Board's Online Help-Wanted index series tracks changes in the number of job ads at over 1,200 online job boards (duplicated ads inferred from comparison of company name, job title, and location are excluded) since May 2005, while the Help-Wanted index series tracks changes in the number of jobs advertised in 51 major newspapers across the U.S. since 1951 (the series is normalized to 100 in 1987). Source: the Bureau of Labor Statistics, the Conference Board, and Monster.com.

GRAPH 2: Online job vacancies in the U.S., Canada, and Europe



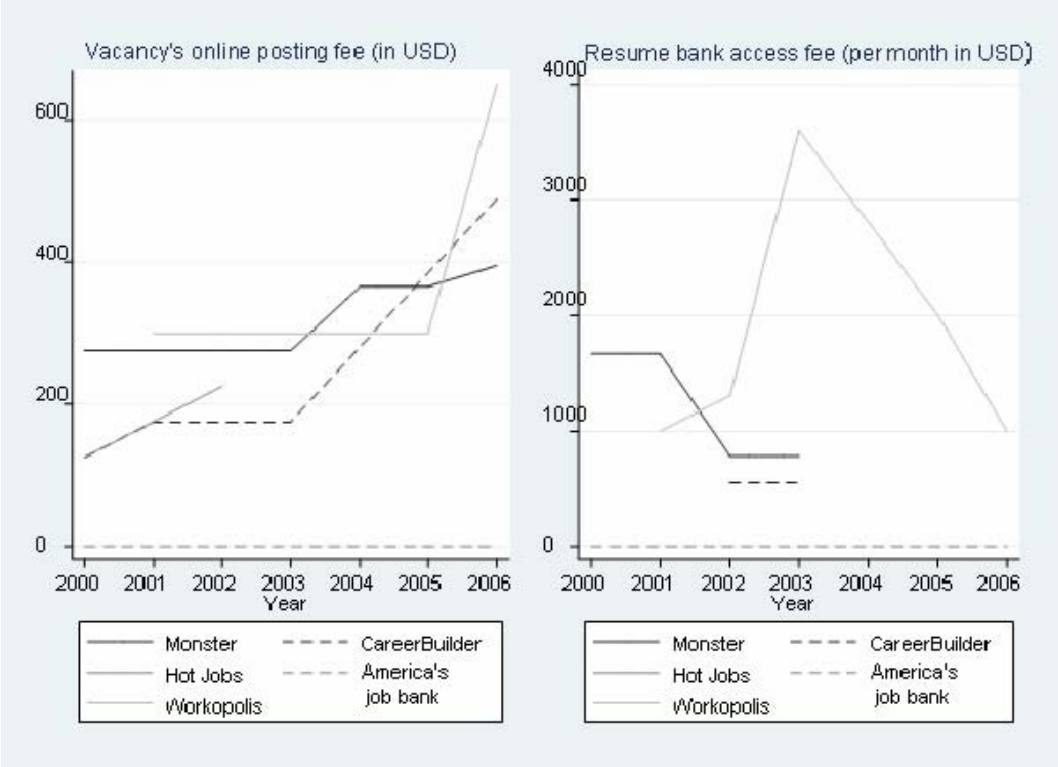
Notes: Monster Employment Index tracks job openings posted at over 1,500 online job boards and career recruitment sites in the U.S. since October 2003. The series is seasonally adjusted. The Monster Employment Index Canada is based on online job postings culled from Monster Canada as well as a number of other recruitment web sites considered representative of employer activity nationwide. The Index is reported quarterly since April 2005. The Monster Employment Index Europe is based on review of millions of employer job opportunities culled from a large representative selection of corporate career sites and job boards (more than 1,400 web sites), including Monster, since December 2004. Source: Monster.com.

GRAPHS 3 and 4: Job searchers' use of online job boards



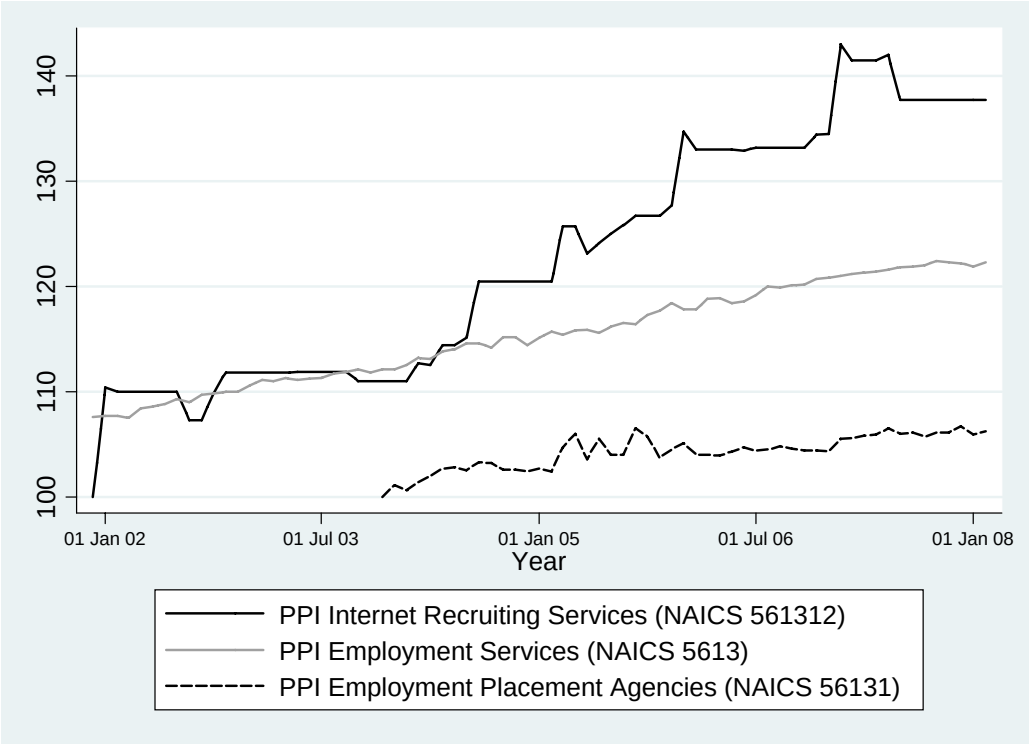
Notes: Data on the number of resumes is not comparable across selected job boards since the job boards store resumes for different lengths of time. Monster.com and America's job bank offer 365 day resume storage. CareerBuilder.com switched from offering 365 day long resume storage in 2000 to offering resume storage indefinitely. HotJobs.com offers indefinite storage. Monster.com was founded in 1994. CarrerBuilder.com was activated in 1995, while *Yahoo!* HotJobs in 1997. America's job bank was activated in 1995 by the U.S. Department of Labor ad NYS Department of Labor. Unlike other selected job boards, the America's job bank is a non-profit job board. Workopolis was activated in 2000 by Bell Globemedia, Toronto Star Newspapers, Gesca Ltd. and covers primarily Canadian market. Source: Weddle's Guides to Employment Web Sites.

GRAPHS 5 and 6: Online job board fees



Notes: The fees reported in Graphs 5 and 6 are estimates. A vacancy posting fee depends on location of a job. In addition, online job boards offer discounts for purchases of several job postings. Resume bank fees depend on the number of accessed resumes and the radius of search. Monster.com was founded in 1994. CarrerBuilder.com was activated in 1995, while *Yahoo!* HotJobs in 1997. America's job bank is a non-profit job board activated in 1995 by the U.S. Department of Labor ad NYS Department of Labor. Workopolis was activated in 2000 by Bell Globemedia, Toronto Star Newspapers, Gesca Ltd. and primarily covers Canadian market. Source: Weddle's Guides to Employment Web Sites.

GRAPH 7: Producer price indices (PPI) for recruitment services



Notes: Employment Services (5613) industry group includes establishments classified in the following industries: Employment Placement Agencies (NAICS code 56131), Temporary Help Services (NAICS code 56132), and Professional Employer Organizations Services (NAICS code 56133). Employment Placement Agencies pertains to establishments that are primarily engaged in listing employment vacancies and in referring or placing applicants for employment. The individuals referred or placed are not employees of the employment agencies. Temporary Help Services or temporary staffing agencies provide employees to other organizations on a contract basis and for a limited period of time, to supplement the workforce of the client. Professional Employer Organizations are engaged in providing human resources management services to staff client business. Source: The Bureau of Labor Statistics.

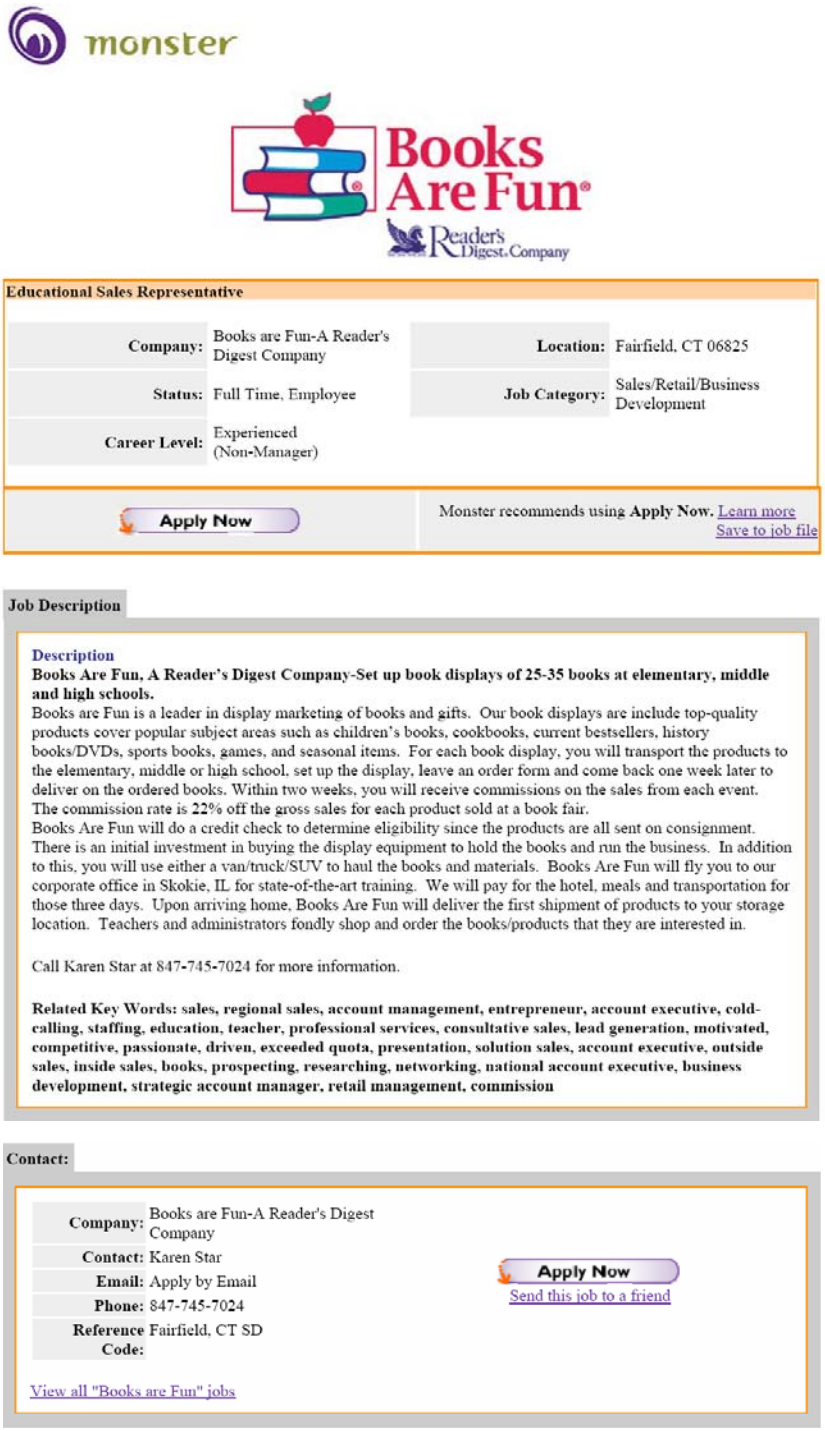


EXHIBIT 1: A job posting on Monster.com

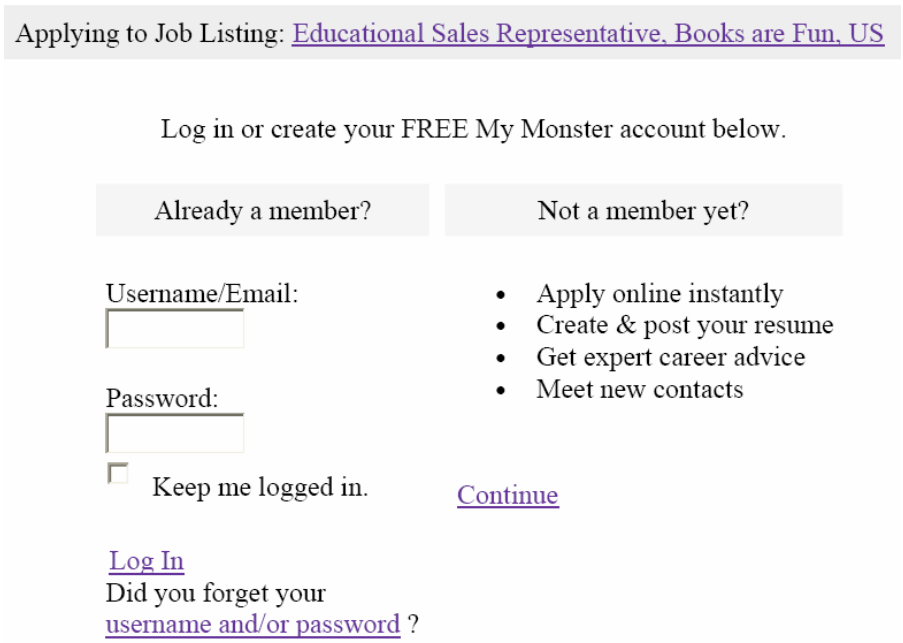


EXHIBIT 2: *Apply Now* link
Source: Monster.com

Company Name: Books are Fun-A Reader's Digest Company
Job Location: US-CT-Fairfield
Job Title: Educational Sales Representative

Send this Job to:

!

Enter the email address of the recipient. Multiple addresses need to be separated by commas.

Subject of Email:

Please choose an appropriate subject for the email, or leave blank and a default one will be used.

Additional Comments:

Enter your Email Address:

!

This is only used for mail delivery, and will not be used for any other purpose.

Send Clear

EXHIBIT 3: *Send this job to a friend* link
Source: Monster.com

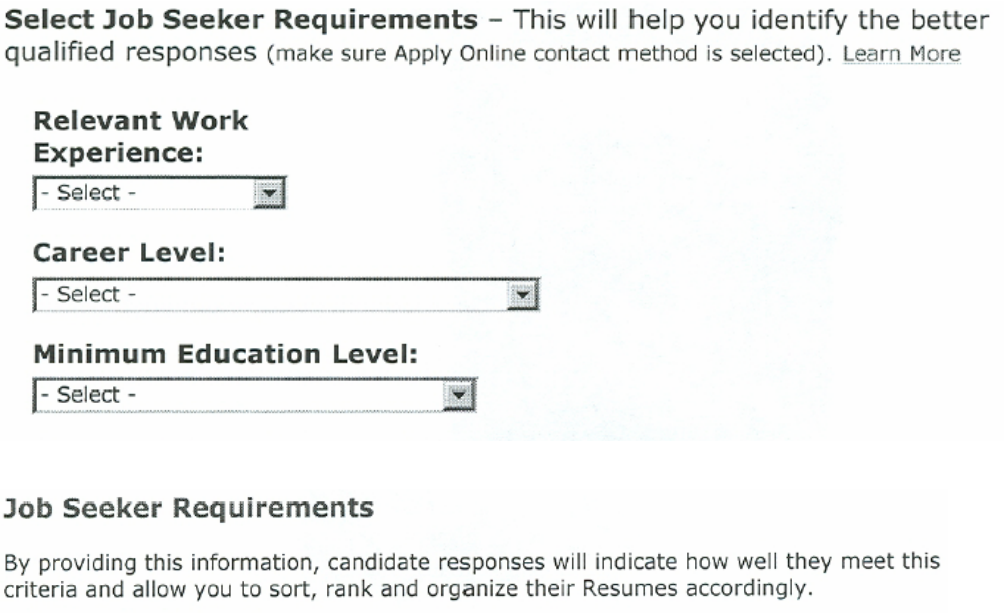


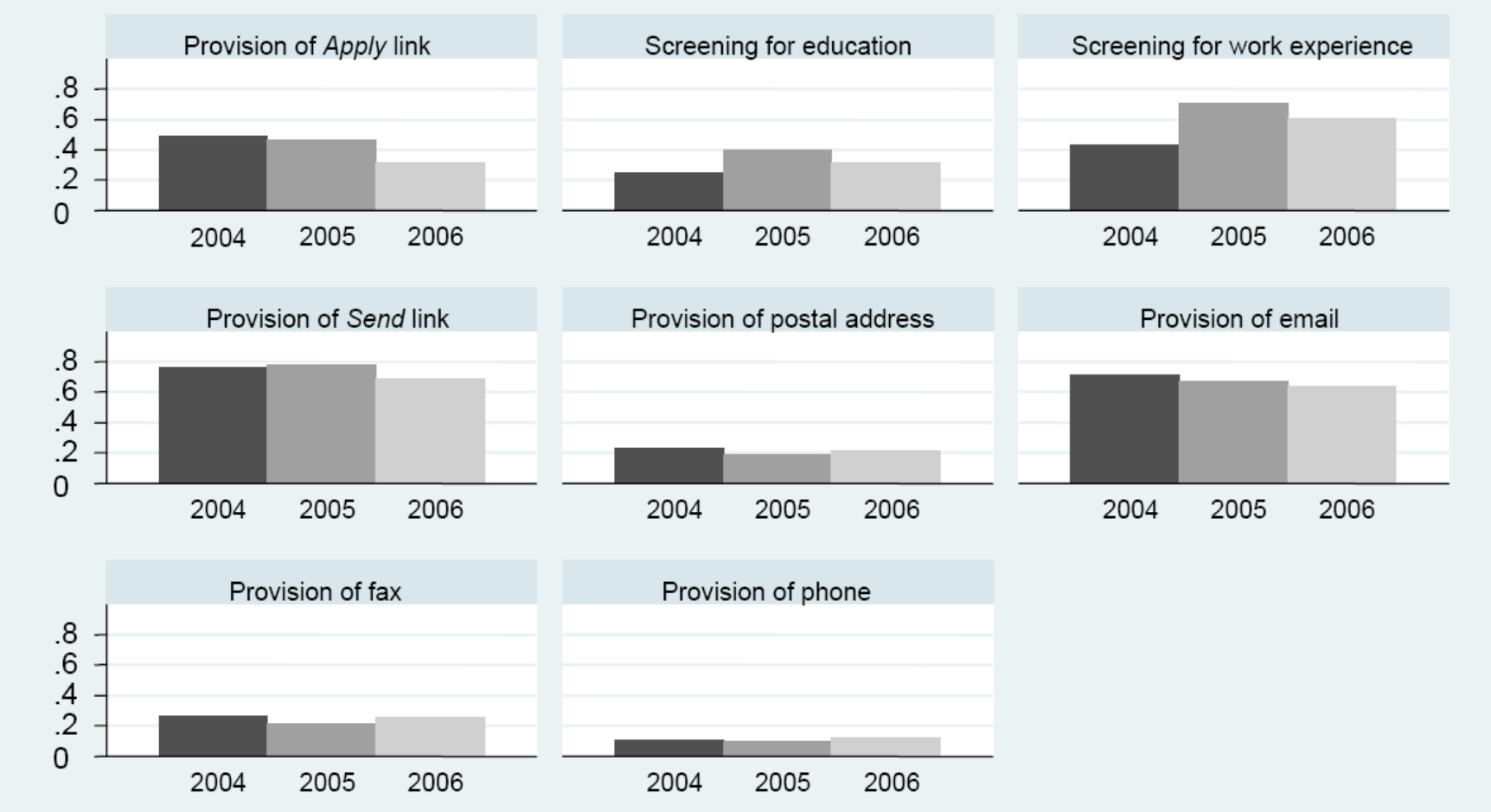
EXHIBIT 3: A portion of an online vacancy form
Source: Monster.com

TABLE 1: Summary statistics

Data:	Job postings retrieved from Monster.com		
	2004	2005	2006
Variable name:	Sample means	Sample means	Sample means
Online search tools' use			
1 if *Apply now* link provided	0.487	0.459	0.318
1 if *Send this job to a friend* link provided	0.764	0.775	0.693
1 if screening for education	0.150	0.241	0.177
1 if screening for work experience	0.162	0.266	0.192
1 if email information provided	0.715	0.667	0.637
1 if phone number provided	0.105	0.092	0.126
1 if fax number provided	0.268	0.216	0.256
1 if address provided	0.226	0.188	0.213
Vacancy characteristics			
1 if immediately available position	0.143	0.145	0.164
1 if on the job training offered	0.283	0.258	0.354
1 if high school degree required	0.117	0.127	0.144
1 if College degree required	0.451	0.442	0.383
1 if Post-BA degree required	0.024	0.024	0.022
1 if missing education requirement	0.408	0.407	0.451
Required work experience in years	1.534	1.549	1.185
1 if missing work experience requirement	0.621	0.624	0.686
Number of "skill" in a job description	1.382	1.486	1.522
Employer characteristics			
1 if posted by recruitment agency	0.270	0.287	0.313
1 if link to employer's other job opportunities	0.759	0.752	0.616
1 if link to corporate website	0.489	0.492	0.368
1 if currently active search	0.097	0.098	0.116
1 if multiple openings posted in a single posting	0.151	0.188	0.202
Number of characters in a job description/1,000	2.430	2.488	2.698
Vacancy's outcomes			
Duration of vacancy's online posting (in weeks)	5.886	6.177	6.627
1 if vacancy renewed for additional 60 days	0.081	0.224	0.148
Number of observations	69,413	172,219	137,678

Notes: The 2004 sample consists of a *stock* of vacancies that were posted on Monster.com on July 10th and were located in one of the ten selected cities (Chicago, Cincinnati, Detroit, Boston, Atlanta, Dallas, Charlotte, Miami, Seattle, San Francisco) or were assigned one of the 11 selected job category (banking, insurance, finance and economics, financial services, biotechnology and pharmaceutical, certified nursing assistants, registered nurses, manufacturing and production, Internet and E-commerce, information technology, administrative and support services). The 2005 sample consists of a *flow* of new vacancies in ten cities or 11 industries posted on Monster.com com between April 30th and July 7th. The 2006 sample consists of a *flow* of new vacancies posted on Monster.com between June 26th and July 8th regardless of location or industry.

GRAPHS 8 through 15: Employers' use of Monster.com search tools



Notes: Graphs depict a fraction of vacancies for which employers used any one of the online search tools offered by Monster.com for the three samples we collected. In addition, the frequency of provision of traditional contact methods is also depicted (e.g., phone number, fax, postal address). The sample in the graphs that depict proportion of vacancies for which either education or work experience screening was chosen is restricted to vacancies for which either of the two required qualifications could be identified; i.e., approximately 60 percent of the full sample for education screening and approximately 38 percent for work experience screening. The three samples are not comparable due to differences in the sample design. The 2004 sample consists of a stock of vacancies posted on July 10th in one of the ten selected cities or assigned to one of the 11 job category. The 2005 sample consists of a flow of new vacancies posted between April 30th and July 7th in one of the ten selected cities or assigned to one of the 11 job category. The 2006 sample consists of a flow of vacancies that were posted on Monster.com between June 26th and July 8th regardless of location or industry.

TABLE 2
PANEL A: Correlation matrix for employers' use of online search tools

2004 sample	1.	2.	3.	4.	5.	6.
1. Provision of *Apply* link	1					
2. Provision of *Send* link	0.541***	1				
3. Provision of email	0.284***	0.073***	1			
4. Provision of phone	0.197***	0.190***	0.170***	1		
5. Provision of fax	0.145***	0.142***	0.296***	0.353***	1	
6. Provision of postal address	0.125***	0.225***	0.160***	0.379***	0.375***	1
2005 sample	1.	2.	3.	4.	5.	6.
1. Provision of *Apply* link	1					
2. Provision of *Send* link	0.494***	1				
3. Provision of email	0.328***	0.092***	1			
4. Provision of phone	0.157***	0.168***	0.197***	1		
5. Provision of fax	0.134***	0.134***	0.290***	0.396***	1	
6. Provision of postal address	0.086***	0.188***	0.159***	0.416***	0.425***	1
2006 sample	1.	2.	3.	4.	5.	6.
1. Provision of *Apply* link	1					
2. Provision of *Send* link	0.453***	1				
3. Provision of email	0.265***	0.058***	1			
4. Provision of phone	0.124***	0.252***	0.266***	1		
5. Provision of fax	0.100***	0.185***	0.386***	0.494***	1	
6. Provision of postal address	0.051***	0.157***	0.223***	0.553***	0.519***	1

Notes: * Indicates significance at 10%; ** Indicates significance at 5%; *** Indicates significance at 1%.

TABLE 2

PANEL B: Correlation matrix for cross-equation errors from multivariate probit model for employers' use of online search tools

2004 sample	1.	2.	3.	4.	5.	6.
1. Provision of *Apply* link	1					
2. Provision of *Send* link	0.486***	1				
3. Provision of email	0.293***	-0.014	1			
4. Provision of phone	0.225***	0.378***	0.333***	1		
5. Provision of fax	0.136***	0.187***	0.454***	0.516***	1	
6. Provision of postal address	0.229***	0.354***	0.237***	0.539***	0.574***	1
2005 sample	1.	2.	3.	4.	5.	6.
1. Provision of *Apply* link	1					
2. Provision of *Send* link	0.230***	1				
3. Provision of email	0.374***	-0.048***	1			
4. Provision of phone	0.287***	0.361***	0.416***	1		
5. Provision of fax	0.141***	0.178***	0.481***	0.598***	1	
6. Provision of postal address	0.115***	0.322***	0.249***	0.620***	0.680***	1
2006 sample	1.	2.	3.	4.	5.	6.
1. Provision of *Apply* link	1					
2. Provision of *Send* link	0.265***	1				
3. Provision of email	0.286***	0.004	1			
4. Provision of phone	0.349***	0.356***	0.553***	1		
5. Provision of fax	0.251***	0.251***	0.653***	0.736***	1	
6. Provision of postal address	0.067***	0.169***	0.371***	0.683***	0.776***	1

Notes: * Indicates significance at 10%; ** Indicates significance at 5%; *** Indicates significance at 1%.

TABLE 3: Employers' use of search tools for different groups of vacancies

Data:	Job postings retrieved from Monster.com											
	Number of contact methods			Number of screening tools			Online job application link			Link for job posting online dissemination		
Sample:	2004	2005	2006	2004	2005	2006	2004	2005	2006	2004	2005	2006
All	1.257	1.109	1.182	0.312	0.507	0.369	0.487	0.459	0.318	0.764	0.775	0.693
Immediate jobs	1.413	1.419	1.641	0.271	0.416	0.297	0.552	0.512	0.284	0.810	0.813	0.712
Jobs that offer training	1.011	0.965	0.890	0.257	0.480	0.325	0.448	0.426	0.278	0.693	0.776	0.633
Jobs that require a graduate degree	1.137	0.918	0.962	0.371	0.555	0.396	0.468	0.406	0.264	0.733	0.730	0.495
Jobs that require a college degree	1.214	1.039	1.038	0.461	0.771	0.594	0.523	0.512	0.385	0.832	0.845	0.760
Jobs that require a high school degree	1.458	1.134	1.013	0.503	0.827	0.646	0.573	0.596	0.392	0.893	0.893	0.745
Jobs with active search	1.437	1.228	1.146	0.358	0.608	0.364	0.574	0.541	0.315	0.819	0.800	0.647
Jobs with a link to other job opportunities	1.329	1.253	1.440	0.408	0.673	0.597	0.639	0.609	0.514	0.823	0.861	0.863
Jobs with a link to a corporate website	1.269	1.069	1.032	0.289	0.436	0.359	0.519	0.484	0.385	0.725	0.742	0.782
Jobs posted by recruitment agencies	1.240	1.121	1.065	0.199	0.296	0.198	0.391	0.371	0.171	0.560	0.644	0.480

TABLE 4
PANEL A: Determinants of employer's use of online recruitment tools

Dataset:		Job postings retrieved from Monster.com online job board in 2006					
Dependent variable		1 if online job application preferred	1 if *Send this job to a friend* link provided in a job posting	1 if email provided	1 if phone provided	1 if fax provided	1 if postal address provided
		Marginal effect (S.E.)	Marginal effect (S.E.)	Marginal effect (S.E.)	Marginal effect (S.E.)	Marginal effect (S.E.)	Marginal effect (S.E.)
Variable name:	Sample mean	(1)	(2)	(3)	(4)	(5)	(6)
1 if job immediately available	0.164	0.078	0.061	0.200	0.039	0.122	0.039
		(0.004)***	(0.003)***	(0.003)***	(0.002)***	(0.004)***	(0.003)***
1 if on the job training offered	0.354	0.087	-0.031	-0.061	-0.004	-0.088	-0.076
		(0.003)***	(0.003)***	(0.003)***	(0.001)***	(0.003)***	(0.002)***
1 if College degree required	0.383	-0.020	0.071	0.072	0.015	-0.010	0.079
		(0.005)***	(0.004)***	(0.004)***	(0.002)***	(0.004)**	(0.004)***
1 if Post-BA degree required	0.022	0.060	-0.125	0.185	0.007	-0.084	0.010
		(0.009)***	(0.010)***	(0.007)***	(0.005)	(0.008)***	(0.010)
1 if education not identified	0.451	0.056	0.041	0.105	0.046	0.076	0.101
		(0.005)***	(0.004)***	(0.004)***	(0.002)***	(0.004)***	(0.004)***
Required work experience (years)	1.185	0.000	-0.013	-0.003	-0.006	-0.016	-0.008
		(0.001)	(0.001)***	(0.001)***	(0.000)***	(0.001)***	(0.001)***
1 if experience not identified	0.686	-0.239	-0.298	-0.182	0.003	-0.069	0.054
		(0.004)***	(0.004)***	(0.005)***	(0.002)	(0.005)***	(0.004)***
Number of "skill" in a job ad	1.522	-0.014	-0.005	0.003	-0.009	-0.020	-0.014
		(0.001)***	(0.001)***	(0.001)***	(0.000)***	(0.001)***	(0.001)***
1 if current search activity	0.116	0.021	0.013	0.137	-0.006	-0.016	-0.004
		(0.004)***	(0.004)***	(0.004)***	(0.002)***	(0.004)***	(0.004)
1 if recruitment agency	0.313	-0.038	-0.282	0.181	-0.037	-0.023	-0.087
		(0.003)***	(0.003)***	(0.003)***	(0.001)***	(0.003)***	(0.002)***
1 if link to other job openings	0.616	0.332	0.348	0.246	0.155	0.106	0.166
		(0.003)***	(0.003)***	(0.003)***	(0.002)***	(0.003)***	(0.002)***
1 if link to corporate website	0.368	-0.032	0.078	-0.115	-0.025	-0.059	-0.045
		(0.003)***	(0.003)***	(0.003)***	(0.001)***	(0.003)***	(0.002)***
Incidence of outcome		0.640	0.693	0.636	0.126	0.256	0.213
Number of observations		137,678	137,678	137,678	137,678	137,678	137,678
Pseudo R-squared		0.168	0.337	0.171	0.334	0.122	0.132
Log likelihood		-74,838.5	-56,276.4	-74,846.4	-34,658.2	-68,733.9	-61,883.5

Notes: Table 4A reports binary probit model estimates. * Indicates significance at 10%; ** Indicates significance at 5%; *** Indicates significance at 1%. Control variables not reported in the table: task characteristics, job industry, job's location, log of number of weeks of forgone online posting at data collection, indicator variable for multiple openings in a single posting, and length of job description (in number of characters). The dependent variable in column 1 identifies provision of the *Apply* link or other reference indicating that online job application is the preferred method of job application (refer to the Appendix for the list of search words we used to construct the variable).

TABLE 4
PANEL B: Determinants of employer's use of online screening tools

Dataset:	Job postings retrieved from Monster.com online job board in 2006			
Dependent variable		1 if screening for education		1 if screening for work experience
	Sample	Marginal effect (S.E.)	Sample	Marginal effect (S.E.)
Variable name:	mean	(1)	mean	(2)
1 if job immediately available	0.157	0.004	0.126	0.017
		(0.003)		(0.009)*
1 if on the job training offered	0.373	0.004	0.313	0.009
		(0.002)**		(0.007)
1 if College degree required	0.697	0.004	0.576	0.025
		(0.002)*		(0.008)***
1 if Post-BA degree required	0.041	0.015	0.020	0.016
		(0.008)**		(0.021)
1 if education not identified	…	...	0.174	-0.009
		...		(0.010)
Required work experience (years)	1.810	0.000	3.771	-0.005
		(0.000)		(0.001)***
1 if experience not identified	0.527	-0.317	...	...
		(0.007)***		...
Number of "skill" in a job ad	1.817	-0.006	1.655	0.006
		(0.001)***		(0.002)***
1 if current search activity	0.120	0.013	0.116	0.040
		(0.003)***		(0.009)***
1 if recruitment agency	0.313	-0.041	0.205	-0.111
		(0.002)***		(0.007)***
1 if link to other job openings	0.666	0.338	0.806	0.762
		(0.003)***		(0.002)***
1 if link to corporate website	0.385	-0.034	0.373	-0.134
		(0.002)***		(0.006)***
Incidence of outcome		0.308		0.610
Number of observations		75,635		43,261
Pseudo R-squared		0.515		0.348
Log likelihood		-22,645.3		-18,854.7

Notes: Table 4B reports binary probit model estimates.* Indicates significance at 10%; ** Indicates significance at 5%; *** Indicates significance at 1%. Control variables not reported in the table: task characteristics, job industry, job's location, log of number of weeks of forgone online posting at data collection, indicator variable for multiple openings in a single posting, and length of job description (in number of characters). In columns 1 and 2 we restrict the sample to job postings for which we were able to identify a qualification requirement either from the requirement menu or from the employer-provided job description. If we were to use all observations we would compare employers who chose to screen for a qualification requirement to those who did not either because they did not specify the requirement, they specified the requirement but did not provide the *Apply* link, or provided the *Apply* link but specified the requirement in a job description rather than by selecting from the requirement menu. Such a comparison may not be informative on account of heterogeneity in employers' reporting (writing) style.

TABLE 5: Online vacancy duration by search tool

Data:	Job postings retrieved from Monster.com		
	Mean duration (in weeks)		
Sample:	2004	2005	2006
All	5.886	6.177	6.627
Jobs with *Apply* link	5.780	6.469	7.189
Jobs with *Send* link	5.765	6.292	6.614
Jobs with email information	5.872	6.434	6.757
Jobs with phone information	6.198	5.867	5.234
Jobs with fax information	5.945	6.292	5.635
Jobs with postal address information	5.894	5.894	5.372
Jobs with education screening	5.856	6.977	7.716
Jobs with work experience screening	5.788	6.964	7.631
Jobs in the bottom 5th percentile by number of search tools used	6.995	4.771	6.362
Jobs in the bottom 25th percentile by number of search tools used	5.927	5.783	6.605
Jobs in the top 25th percentile by number of search tools used	5.888	6.568	6.412
Jobs in the top 5th percentile by number of search tools used	5.627	6.558	6.861

Notes: The three samples are not comparable due to differences in sample design. The 2004 sample consists of a stock of vacancies while the 2005 and 2006 samples consist of a flow of vacancies.

TABLE 6: Determinants of online job posting renewal

Dataset:	Job postings retrieved from Monster.com online job board					
Dependent variable:	1 if a vacancy's online posting renewed for additional 60 days					
Sample:	2004		2005		2006	
Variable name:	Sample mean	Marginal effect (S.E.) (1)	Sample mean	Marginal effect (S.E.) (2)	Sample mean	Marginal effect (S.E.) (3)
1 if job immediately available	0.143	-0.016	0.145	-0.017	0.164	-0.028
		(0.002)***		(0.003)***		(0.002)***
1 if on the job training offered	0.283	0.016	0.258	0.027	0.354	0.132
		(0.002)***		(0.002)***		(0.002)***
1 if College degree required	0.451	0.002	0.442	0.017	0.383	0.036
		(0.003)		(0.003)***		(0.003)***
1 if Post-BA degree required	0.024	0.010	0.024	0.023	0.022	0.183
		(0.008)		(0.008)***		(0.009)***
1 if education not identified	0.408	0.008	0.407	0.016	0.451	0.042
		(0.003)**		(0.004)***		(0.003)***
Required work experience (years)	1.534	-0.001	1.549	-0.002	1.185	-0.009
		(0.001)		(0.001)***		(0.001)***
1 if experience not identified	0.621	0.015	0.624	-0.085	0.686	-0.068
		(0.004)***		(0.003)***		(0.004)***
Number of "skill" in a job ad	1.382	-0.011	1.486	-0.007	1.522	-0.016
		(0.001)***		(0.001)***		(0.001)***
1 if current search activity	0.097	0.012	0.098	0.017	0.116	0.110
		(0.003)***		(0.003)***		(0.003)***
1 if recruitment agency	0.270	0.019	0.287	0.018	0.313	0.068
		(0.002)***		(0.002)***		(0.002)***
1 if link to other job openings	0.759	0.007	0.752	0.002	0.616	-0.069
		(0.002)***		(0.003)		(0.002)***
1 if link to corporate website	0.489	0.025	0.492	-0.018	0.368	-0.016
		(0.002)***		(0.002)***		(0.002)***
Mean of dependent variable		0.081		0.224		0.148
Number of observations		69,413		172,219		137,678
Pseudo R-squared		0.089		0.014		0.179
Log likelihood		-17,773.6		-90,383.6		-47,521.3

Notes: Table 6 reports binary probit model estimates. * Indicates significance at 10%; ** Indicates significance at 5%; *** Indicates significance at 1%. Control variables not reported in the table: task characteristics, job industry, job's location, log of number of weeks of forgone online posting at data collection, indicator variable for multiple openings in a single posting, and length of job description (in number of characters).

TABLE 7: Employer's use of online search tools and online job posting renewal

Data:	Job postings retrieved from Monster.com					
Dependent variable:	1 if a vacancy's online posting renewed for additional 60 days					
Sample	2004		2005		2006	
Variable name:	Sample mean	Marginal effect (S.E.) (1)	Sample mean	Marginal effect (S.E.) (2)	Sample mean	Marginal effect (S.E.) (3)
Provision of *Apply* link	0.487	0.009	0.459	0.016	0.318	0.041
		(0.002)***		(0.003)***		(0.003)***
Provision of *Send* link	0.764	-0.028	0.775	-0.005	0.693	-0.021
		(0.003)***		(0.002)		(0.002)***
Provision of email	0.715	0.011	0.667	0.036	0.637	0.012
		(0.002)***		(0.002)***		(0.002)***
Provision of phone	0.105	0.038	0.092	-0.011	0.126	-0.031
		(0.004)***		(0.004)***		(0.003)***
Provision of fax	0.268	0.013	0.216	0.002	0.256	-0.052
		(0.002)***		(0.002)		(0.002)***
Provision of postal address	0.226	0.012	0.188	-0.026	0.213	-0.046
		(0.002)***		(0.002)***		(0.002)***
Screening for education	0.243	0.018	0.394	0.049	0.308	0.059
		(0.004)***		(0.004)***		(0.004)***
Screening for work experience	0.427	-0.005	0.707	0.039	0.610	0.023
		(0.003)*		(0.005)***		(0.004)***
Mean of dependent variable		0.081		0.224		0.148

Notes: Table 7 reports results from 24 different binary probit models. Each estimate pertains to a probit model for a job posting online renewal as a function of vacancy attributes, worker requirements, employer attributes, and a variable that identifies an employer's use of an online search tool. The results that pertain to the use of screening tools draw on a sample of job postings for which we were able to identify a qualification requirement either from the requirement menu or from the employer-provided job description. * Indicates significance at 10%; ** Indicates significance at 5%; *** Indicates significance at 1%. Control variables not reported in the table: see Table 6.

APPENDIX

Variable name:	Search words:
Worker requirements	
1 if High-school degree required	high school; HS diploma; HS degree; GED*
1 if Associate degree required	associate degree; associate's degree; associates degree; AS degree
1 if Bachelor's degree required	bachelors; bachelor's degree; bachelor degree; BS*; BA*; BA degree; BS degree; four year degree; four-year degree; 4 year degree; 4-year degree; four year college; four-year college; 4 year college; 4-year college; university degree; college degree; baccalaureate degree; undergraduate degree; college graduate
1 if Post-BA degree required	MBA* master's degree; masters degree; master degree; MA degree; MS degree, doctorate; PH.D.; PHD
Required work experience in years	constructed from indicator variables that take the following values (mid point was taken; value 17.5 was assigned if more than 15 years of work experience is required): less than 1 year, 1 to 2 years, 2 to 5 years, 5 to 7 years, 7 to 10 years, 10 to 15 years, and more than 15 years
1 if independence required	autonomy, produces independently, produce independent, think independently, work both independent, acts independently, acting independent, work well independently, functions independent, function independently, operates independent, operating independently, works independent, working independently, work independent
1 if drive required	possess drive, driven, self-motivation, motivated, self-starter, selfstarter
Count of "skill"	a code was written that identified a number of times the word "skill" appears in a job posting's description
Job characteristics	
1 if team work required	teamwork, team work, team-work, part of team, part of a team, member of a team, team member, team-member, team player, team-player, teamplayer, team contribution, contribute to a team, contribute as a team, team build, team-build
1 if quality provision required	detailed oriented, detail oriented, attention to detail, detail-oriented, quality oriented, quality-oriented, committed to the quality, committed to quality, commitment to quality, quality service, quality control, maintains quality, quality standards, insure quality, ensure quality, provide quality, providing quality, attention to quality, assure quality, assures quality, quality results, supports quality, support quality, quality support, acquire quality, retain quality, retains quality, preserve quality, preserve high quality, deliver quality, delivering quality, delivery of quality, review quality, reviews quality, perform quality, performs quality
1 if multiple tasks required	multi-task, multi task, multiple task, multitask, diverse task, numerous task, variety of task, various task, many task
1 if on the job training offered	training
Dummy variables for industry	1 if banking, insurance, financial services positions; 1 if manufacturing, production positions; 1 if health positions; 1 if Internet, E-Commerce, IT positions; 1 if biotechnology, pharmaceutical positions; 1 if administrative, support services positions
1 if vacancy has to be filled immediately	immediately, immediate consideration, immediate opening, immediate need, immediate position, immediate opportunit, has immediate, have immediate, immediate office opportunit, asap, as soon as possible, hurry
1 if vacancy is a current position – active search indicated	current- opening/need/opportunit, currently-hiring/opening/position/seek/hiring/recruiting/interviewing/searching/need/look/staffing/have opening/have an opening/has opening/has an opening/accepting application/have many temporary/have position/have opportunity/has many temporary/has position/has opportunity/have an opening/have opening/have an excellent opportunit/has an opening/has opening/has an excellent opportunit/offering an opportunity/offering opportunit/offer an opportunity/offer opportunit/, we are hiring/, we are looking/, we are seeking/, we're seeking/, we're hiring/, we're looking/ we are hiring/ we are looking/we are seeking/we're seeking/we're hiring/we're looking, opportunity currently exists, opportunities currently exist, currently have (has) - part-time/part time/entry-level/entry level/a part-time/a part time/a entry-level/a entry level, currently have (has)- the opportunit/an opportunit/multiple needs/several opening, position is currently available, job is currently available, now we are looking, now we're looking, now has opening, now has an opening, now offering opening, now looking for, now hiring, opportunity now exist, opportunities now exist, now accept, now interviewing, openings

	now available, opening now available, openings are now available, opening is now available, opportunity now available, opportunities now available, opportunity is now available, opportunities are now available, job now available, jobs now available, job is now available, jobs are now available, resumes are now being accepted, now seek, now accept, need now to work, needed now to work
1 if preference for a local candidate	local applicant, local candidate, not relocate people, relocation cost not covered
Employer characteristics	
1 if multiple jobs posted in a posting	openings; positions
1 if opening posted by a recruitment agency	staffing agency, staffing firm, recruiter, if either one of the well known recruiting agencies was identified to have posted the job: "Adecco", "Manpower", "Kelly Services", "Ranstad", "Veritude", "Ardelle", "cdi corp", "kforce", "lucasgroup", "Management Recruiters International", "mri", "Robert Walters", "□anford rose", "snelling", "spherion", "winter, wyman", "Accountemps", "Robert Half", "OfficeTeam", "Allen and Associates", "TAC Worldwide"
1 if link to other job opportunities posted on Monster.com	other opportunit, click here to see all, view all of our, view all our, search for other
1 if link to firm's website	learn more about, visit our website, visit our web site, visit us, to learn more, visit, to learn more visit
Length of a job posting	a code was written to count the number of characters in each job posting
Forgone weeks of posting at the start of data collection	Dummy variables for the number of weeks prior to the date of the data extraction the vacancy was posted on the job board
Online search tools	
Online job application preferred	apply online; apply on-line; apply now; e-mail your resume; email your resume; e-mail your CV; email your CV
Apply Now link provided	apply now
Send this job to a friend link	send this job to a friend
Education requirement menu	Education Level:
Work experience requirement menu	Relevant Work Experience:

Notes: Each job posting was pulled from the Monster.com website and saved as a text file. For each of these text files the program identified whether a phrase (treated as a string) could be found in the text and if so a corresponding dummy variable was set to 1. For words marked with "*" a program searched for the words as a "stand-alone" string. In these latter instances an indicator variable records the presence of the word in the job posting if it is preceded or succeeded by a symbol other than a letter. Additional control variables were constructed to identify the location of a job.