

The Internet and Matching in Labor Markets

Peter J. Kuhn,
University of California, Santa Barbara

1. What is Internet Job Search (IJS)?
2. What is Internet Recruiting (IR)?
3. The Growth in IJS/IR.
4. Who Looks for Work on Line?
5. Possible Effects of IJS/IR on Labor Markets
6. Evidence on the effects of IJS/IR on Labor Markets
7. Summary and Policy Implications

Glossary

aggregator sites internet sites that screen incoming resumes and job postings then redirect them to appropriate job boards, or employers

electronic job search agents job board feature that emails a worker when a new vacancy satisfying worker-supplied criteria is posted.

job board an internet site where job advertisements are posted, similar to the classified section of newspapers

“lurking” joining a usenet or tech support group to determine which members of the group are consulted most often for their expertise, for the purpose of recruiting those individuals

negative selection on unobservables the notion that a certain group, say internet job searchers, has hard-to-measure characteristics such as low motivation, poor informal networks, or poor interview skills, which tend to reduce a certain measure of labor market success, such as rapid re-employment

positive selection on observables the notion that a certain group, say internet job searchers, has easily-measured characteristics such as age, education, and occupation that are conducive to a certain indicator of labor market success, such as rapid re-employment

resume spider, or **resume robot** software tool that trolls the internet in search of “passive” job seekers

reverse spamming the practice of collecting resumes posted in various locations and re-posting them elsewhere without the owner’s knowledge

salvagers company employees, or software, that troll the internet looking for resume postings by that company’s own employees

URL peelback the practice of searching through higher levels of the directory structure of a firm’s website in order to locate other “poachable” employees once one such employee has been found.

The last five years have seen an explosion in the number of firms who use the internet to recruit workers, and in the number of workers who use the internet to look for jobs. In what ways has the internet been used by workers and firms looking for new matches? Among which kinds of workers and firms are these new methods most predominant? Do internet methods help individual workers find better jobs faster? And

is the internet likely to have aggregate implications for matching efficiency in labor markets? These are the main questions addressed in this article.

1. What is Internet Job Search (IJS)?

For most people, the activity most immediately associated with the notion of “internet job search” is perusing job postings on an internet job board such as monster.com, or hotjobs.com. Clearly, however, many workers’ use of the internet in the job search process now goes well beyond these activities. For one thing, in addition to these “omnibus” job boards, there are now literally thousands of more specialized internet job boards, including government sites (such as the Employment Service-sponsored jobsearch.org), regional sites (nevada.jobs, salley.com, Yahoo, CitySearch); sites associated with traditional newspaper advertisements (careerpath.com); and specialized or “niche” sites defined by occupation (dice.com, teacherjobs.com, toxpath.org, collegehire.com).

Further, internet-based job search activity also goes well beyond viewing ads on job boards. Other important uses of the internet in job search include *posting resumes* on job boards; using email to contact friends and professional colleagues about possible job opportunities; “cold” emailing of resumes to firms; visiting the employment section of a firm’s website to learn about job openings; preparing for a job interview using the company’s web site; and filling out on-line job applications. Finally, the number of ways to use the internet in job search keeps expanding. Some recent innovations include electronic “job search agents”, which automatically email workers when new job openings fitting their interests arrive at a job board, and auction sites such as bid4geeks.com, where a worker or an entire team can offer themselves for auction. Given access to the internet, virtually all of the above services are typically free of charge to workers.

In sum, the possible uses of the internet in job search are multifaceted and – conditional on having internet access— low cost. Because of this, it will soon be hard to imagine any job search strategy without at least *some* internet component. Internet job search is quickly becoming not just a new way to look for work; it will likely be an *aspect* of almost every worker’s job search strategy, which enters that strategy in different ways for different workers.

2. What is Internet Recruiting (IR)?

Like workers, firms with a vacancy to fill now can take advantage of internet technology in a number of different ways. These range from posting an ad on an internet job board; posting an ad on a company web site or professional-organization web site; setting up an on-line application procedure; and searching through posted resumes on job boards as well as in other internet locations. Recent developments in internet options for firms include the development of “aggregator” sites such as webhire.com, which analyse firms’ vacancies, then direct them to appropriate posting sites; or like hire.com, which

pre-screen workers' resumes and direct them to client firms. Another rapidly growing service provided on line is credential-checking: webhire.com now offers to check social security numbers, current and previous addresses, references, educational credentials, criminal court records, civil and bankruptcy court records, driving records, credit reports, and previous workers' compensation claims. Online skills testing is also available, ranging from software programming to basic math and telephone etiquette. Some internet recruiting sites also provide local salary information to firms using their services, based both on government-collected data as well as their own records.

As for workers, the financial costs to firms of using the internet for recruiting are low compared to more traditional recruiting methods. For example, posting a typical career ad on an internet job board for several weeks currently costs a few hundred dollars. Some sites offer unlimited postings to client firms for about \$15,000 per year. In contrast, a typical career ad in a daily newspaper costs about \$2000 for a single day; a quarter-page ad can cost \$15,000 in many markets.

Internet recruiting procedures may however have advantages for firms that go even beyond lower financial costs, time savings, and more accurate and detailed information about job applicants. These advantages, often cited by human resource professionals as key to their decision to adopt internet recruiting methods, stem from the interaction between internet application procedures and firms' internal database management procedures. Consider, for example, the vice president of human resources for a Canadian technology company, who until recently received 150 paper resumes per day. "I used to joke that I was VP in charge of filing cabinets. Every time we placed career ads in the newspaper, we knew that 70 percent of our needs were already sitting there in those filing cabinets—yet there was no efficient way to screen them". Thus an important, though perhaps less obvious application of the internet to recruiting activities involves greater internal efficiency in matching a stock of job applications that have already been received to each firm's vacancy pool.

3. The Growth in IJS/IR.

The above cornucopia of internet options for job searchers and recruiters is, of course, very recent. Essentially none of these options were available in the 1980's. Even by the mid-1990's, internet job search options were likely limited to the use of email by computer specialists and academics to pursue job leads. In what follows I document this phenomenal rate of diffusion in two ways. First I draw on published figures from the internet recruiting industry itself. Then I turn to my own analysis of the only available nationally-representative data on internet search activity.

Turning first to published sources, a recent source estimated the number of on-line job sites at 500 in 1998, versus 6500 in 2000. Forrester Research, Inc. recently estimated internet recruiting expenditures at 260 million dollars in 1999, and projects a level of 1.7 billion in 2003. By late 2000, the number of resumes on line in the U.S. was estimated at 7.6 million. The number of jobs posted on line at that time, *on the top 11 sites only* was 1 million (up 60% from 1999). In 1998, 17 percent of Fortune 500

companies indicated that they conducted corporate recruiting on the internet; this rose to 45% by 1999 and is expected to be 100% by 2003. A 2001 survey of Coopers-Lybrand clients indicated that 27.5 percent of their newly-hired middle managers, and 17% of their newly-hired executives, had been found on web sites. 57% of Global 500 companies reported that most-visited section of their website was the employment section.

While above are highly suggestive, nationally-representative statistics on the use of the internet in job search that are genuinely comparable across years are very scarce. The only exception of which I am aware is data from the Internet and Computer Use Supplement to the Current Population Survey, conducted in December 1998 and August 2000. Data taken from these surveys are presented in Table 1. Because of the time period in question, these statistics refer simply to the fraction of persons who used the internet *in any way* to look for jobs; while this is probably the appropriate question to ask for the time period under study, given the above discussion a more recent analysis would probably do better to ask *in what way* the internet is used to look for jobs.

Table 1: Measures of Internet Job Search and Internet Access, by Labor Force Status, Current Population Survey Data

	December 1998	August 2000
Percent who “regularly” searched for work on line:		
Employed, at work	7	11
Unemployed jobseekers	15	26
Percent of population with (home) internet access:		
Employed, at work	35	52
Unemployed jobseekers	22	39
On-line job search, among those with (home) internet access:		
Employed, at work	16	18
Unemployed jobseekers	50	54

Source: tabulations from CPS survey data, generously provided by Mikal Skuterud.

Table 1 clearly indicates that the growth in internet job search among U.S. workers has been phenomenal. From being essentially nonexistent in, say, 1995, by August 2000 IJS was regularly used by over a quarter of unemployed workers. Focusing on workers with home internet access, that rate was over one half. Not surprisingly, internet job search was less common among employed persons, but also increased substantially over time. Interestingly, most of the growth in IJS between 1998 and 2000 was associated with increased penetration of the internet into peoples’ homes; usage rates among persons with access did not increase very much over this period.

To get a better idea of the current importance of internet job search, it is perhaps helpful to compare its incidence with that of other job search methods on which the CPS

collects data. At 26% of unemployed workers, internet job search was more common (in August 2000) than the following seven job search methods: public employment agencies (18%); private employment agencies (8%); contacting friends or relatives (13%); placing or answering ads (13%); school or university employment centers (4%); union or professional registers (2%); and “other active” methods (4%). Internet search was less frequent than only two methods: “direct employer contact” (66%), and “sent out resumes / filled out applications” (49%).¹ Turning to *employed* workers, the above CPS files contain no data on the use of “traditional” job searches among this group. However, it is noteworthy that the above estimates of employed internet search are higher than any previously published estimates of employed job search via all methods combined, so it is possible that the advent of internet job search (IJS) has caused an increase in on-the-job search (OJS).

Not surprisingly, an industry facing the phenomenal expansion documented above is likely to experience some growing pains. One of the most important of these has concerned worker privacy. Privacy violations have occurred when some recruiting firms engage in “reverse spamming”; this is a process of collecting resumes that have been posted on other sites (or not posted with the intent of job search at all). Workers then receive unwanted and unexpected contacts from employers, a process which can undermine the confidence of workers in the internet recruiting system. Compounding the privacy problem is the use by some companies of “salvagers”—individuals and software programs that troll the internet in search of resume postings by the firm’s own employees. When reverse spamming and salvaging both occur, employees can be accused of disloyalty even without having intentionally decided to look for another job. A second problem in the industry has been misrepresentation, both by workers and firms. Workers’ misrepresentation of credentials has, of course, been a problem since well before the spread of the internet, and the increased ease of checking credentials on line noted earlier may even reduce this kind of fraud. A newer kind of misrepresentation that appears to be more closely associated with the internet takes place when recruiting companies in search of a scarce kind of talent post internet ads for fictitious jobs; workers who respond to these are then redirected to other jobs in a classic “bait and switch” maneuver.

4. Who Looks for Work On Line?

Not all jobseekers are equally likely to use the internet in their search for work, and one of the largest gaps between identifiable groups is along racial and ethnic lines. This gap is illustrated in Table 2, which is taken from the same data set as Table 1. Some of the key features of that table are the following. First, among unemployed workers there is a large black-white gap in the share who use the internet to look for a new job,

¹ Some caution is required in interpreting these statistics because the phrasing of the internet job search question is not directly comparable to the other job search method questions. The latter ask specifically whether an activity occurred in the past month; the internet question specifies that the activity is (currently) engaged in *regularly* without specifying an explicit time period. It is unclear whether this biases internet search measures upwards, downwards, or at all, relative to the other measures.

which *increased* from $16.5 - 9.2 = 7.3$ percentage points in 1998 to $29.0 - 14.6 = 14.4$ percentage points in 2000. Similar gaps and trends are evident between whites and Hispanics. Second, essentially *all* of the racial gap in internet job search can be accounted for by differences in access to the internet: the “digital divide” in home internet access was very large in both 1998 and 2000. Third, once we restrict attention to unemployed persons who have home internet access, the racial/ethnic gap disappears and in some cases is even reversed. For example, in December 1998, 64% of unemployed blacks with home internet access searched for jobs on line, compared to 48% of whites in the same situation. This apparent relative attractiveness of the internet as a job search tool to minority workers is discussed in more detail in Section 6 below.

A final observation from Table 2 is that racial and ethnic gaps in IJS are smaller among employed workers than among unemployed workers; in fact by August 2000 more employed blacks looked for new jobs on line than employed whites *despite* the fact that employed blacks were much less likely to have home internet access. This could simply reflect the fact that more blacks are in short-term jobs and are therefore more likely to be looking for another job by any means, including the internet.

Table 2: Internet Job Search and Internet Access, by Race and Ethnicity

	December 1998			August 2000		
	White	Black	Hispanic	White	Black	Hispanic
Searched for work on line:						
Employed, at work	.071	.063	.040	.110	.114	.070
Unemployed jobseekers	.165	.092	.072	.290	.146	.149
With (home) internet access:						
Employed, at work	.369	.163	.165	.545	.324	.279
Unemployed jobseekers	.254	.104	.076	.463	.173	.198
On-line search, given access:						
Employed, at work	.155	.214	.167	.174	.255	.184
Unemployed jobseekers	.479	.640	-*	.546	.523	.483

Source: tabulations from CPS survey data, generously provided by Mikal Skuterud.

*Sample size too small to report.

What other observable differences are there between internet job searchers and other jobseekers? Data from the same sources indicates that most of these differences are what one would expect based on which types of workers are likely to have internet access. Among unemployed jobseekers, those who incorporate the internet into their job search strategy are much better educated than those who do not. In addition, they tend to be in occupations with low unemployment rates, are more likely to have worked immediately before the current unemployment spell, to have shorter retrospective unemployment durations when they are interviewed about job search methods, and are more likely to be in their “prime” working years (25-54) than either under 25 or over 54.

In none of our work have we ever detected a significant gender differential in the use of the internet for job search.

A convenient way to summarize the above findings is to say that, overall, internet searchers are “positively selected on observables”, i.e. they have easily-observable characteristics that would tend to lead to faster re-employment rates *even if* these individuals did not use this new technology to look for jobs. Since this kind of selection must, of course, be taken account of in any attempt to measure the true effect of IJS on job search outcomes, it is an issue to which we will return in Section 6 of this article.

5. Possible Economic Effects of IJS

Economic theory suggests a wide range of possible effects of internet-facilitated job search on labor markets. The simplest and most direct implications arise in the context of partial-equilibrium search models, such as the classic one described by Steven Lippman and John McCall in 1976. Probably the simplest way to incorporate internet search into this class of models is as an increase in the arrival rate of offers, or as a decrease in search costs. In this context, we would expect internet search to reduce unemployment durations, and to increase the quality of job matches that are eventually found.² Partial-equilibrium reasoning also suggests that the introduction of internet search might change the optimal usage rates of other, “traditional” job search methods, depending on whether they are complementary or substitutes with internet search.

But what if *all* workers use the internet to look for work? Can they all still benefit from this new technology? Clearly, the aggregate effects of internet job search technology depend on one’s general-equilibrium model; as is well known the nature of these models makes the ultimate effects of, say, a decrease in search costs or an increase in the offer arrival rate both manifold and hard to predict.³ For example, in a simple “musical chairs” model with a fixed number of jobs and no match-specific productivity shocks, aggregate effects might be small, though the total number of jobs occupied at any given time (and thus the employment-to-population ratio) would likely rise. In more realistic equilibrium search models --such those published by Kenneth Burdett in 1978 or by Dale Mortensen and Christopher Pissaridies in 1994-- possible effects of an improvement in search technology include changes in equilibrium unemployment durations, in mean job durations and turnover rates, the unemployment rate, the average wage level, the fraction of employed workers engaged in on-the-job search (OJS), and (depending on the source of the heterogeneity in wage offers) on average match productivity. Models with a macroeconomic component might also yield shifts in the Phillips curve, perhaps increasing the economy’s prospects for non-inflationary growth. In yet other models where asymmetric information plays a role, such as one recently described by Kevin Lang, a reduction in the costs of applying to jobs could be Pareto-

² It is of course possible for workers to adjust to an internet-induced increase in the offer arrival rate by raising their reservation wages so much that unemployment durations rise instead of falling. In a 1985 paper, Kenneth Burdett and Jan Ondrich show that a relatively weak condition (log-concavity of the wage-offer density) is sufficient to rule out this possibility.

³ As an illustration of this complexity, Dale Mortensen’s 1986 review of the possible effects of unemployment insurance is instructive.

worsening, in part by reducing the average match quality in every firm's applicant pool. Very little work has been done to formally derive the effects of improvements in search technology in the context of equilibrium search models, and an important task for future research in this area is clearly to do just this.

While a formal search model is helpful in pointing out the wide scope of possible internet effects on labor markets, it is fortunately possible to make a number of additional, and sensible, hypotheses about the effects of internet job search technology without fully solving out such a model. For example, if the internet reduces the costs of obtaining information about jobs and wages at other firms or in other regions, a simple arbitrage argument implies that internet job search should reduce the magnitude of “non-competitive” wage differentials between workers, i.e. wage differentials that are not associated with portable differences in worker productivity. Thus, David Autor has speculated that the internet's easy access to information about jobs in other parts of the country could reduce interregional wage differentials. Relatedly, the internet might also facilitate the recruiting of workers across international borders, a practice which could include sending more work abroad *via the internet* as well as bringing more workers into the U.S, tending ultimately to reduce international wage differentials. Finally, easier “poaching” of a firm's best workers—which is a widely-discussed aspect of internet recruiting activity—could actually *increase* the size of within-firm wage differentials, as firms are forced to match outside offers. In this case, the “non-competitive” wage differentials that are eliminated by increased labor market arbitrage are the oft-cited tendencies of firms to compress wages among their workers, for a wide variety of reasons including insurance and equity concerns. In sum, a fruitful line of inquiry concerning internet effects on the functioning of the labor market could focus on changes in wage structure that would be implied by simple arbitrage arguments. It is unclear, however, that these arguments will apply as forcefully to labor markets as they do to a fairly standardized product such as insurance, where Jeffrey Brown and Austan Goolsbee have already demonstrated an internet arbitrage effect.

A final class of possible internet effects stems neither from an increased “flow” rate of contacts between workers and firms nor from a reduction in costs per contact; it stems instead from the greater *quality* and *depth* of information about workers generated by the increased ability of firms to check workers' qualifications and claims about their background on line, described above in Section 2. In essence, more accurate information about workers' past performance could have an effect on labor markets that is parallel to the widely-discussed potential effects of practices like genetic testing on insurance markets: new employers will have a greater ability to “cherry-pick” the stock of experienced workers, and workers with a poor employment history may have a much harder time making a “fresh start” in their careers. As in insurance markets, this may have some undesirable effects, but it may also increase workers' incentives to maintain a clean work record early in their careers, with attendant social benefits. Clearly, an examination of the possible effects of improved information quality may also be a fruitful avenue of research on possible internet effects on the labor market.

Having completed our theory-based discussion of the *possible* effects of internet search technology on labor markets, it is important to recall that the entire discussion in this section has taken for granted the notion that the internet really does represent a significant technological improvement in job search technology at the level of the individual worker, either by raising offer arrival rates, reducing search costs, or increasing information quality. As we shall see in the following section, however, even this is not yet clear. Thus the most important empirical question concerning internet job search may be simply whether it has any detectable, “first order” partial equilibrium effects. This question is addressed in the next section.

6. Evidence on the Effects of Internet Job Search

At this point, very little empirical evidence is available about the *actual* effects of internet job search or recruiting on workers, firms, or labor markets as a whole. Some very crude evidence is available on two issues, one of which is the relationship between internet and “traditional” job search methods. In particular, if anything, cross-sectional CPS data actually suggest a kind of complementarity with these methods: on average, unemployed persons who look for work on line actually use more, rather than fewer of the traditional job search methods. Crude time-series statistics also show no reliable indication that the ongoing decline in unemployed workers’ use of the Employment Service to locate new jobs has been accelerated by the growth in private, online substitutes. A second issue concerns the effects of the internet on the total amount of on-the-job search (OJS). On this topic, recent research by Mikal Skuterud finds no evidence that the long-standing secular increase in total OJS over the past two decades has been accelerated by the spread of the internet.

The only existing in-depth econometric study of the effects of internet job search on *any* labor market outcome is contained in a recent working paper by Mikal Skuterud and myself. This study focuses on a fairly narrow question, in particular on the partial-equilibrium effects of an individual unemployed worker’s decision to incorporate the internet into his/her job search strategy on the length of time he/she remains unemployed. The data used are the December 1998 and August 2000 CPS Internet Supplements described above, matched with job search outcomes of the same workers in subsequent months. Despite that narrow focus—dictated by the constraints of the CPS data—the results are both unexpected and intriguing.

Briefly put, in a simple comparison of means, we find that unemployed persons who look for work on line are substantially more likely to be employed one year later than those who do not use the internet to look for work. Importantly, however, this difference disappears when we hold constant observable characteristics of the workers. In other words, the higher re-employment rate of internet job searchers is not an effect of better search technology but simply an artifact of the fact that this group is better-educated, working in high-demand occupations, and more likely to be in their “prime” working years. In other words, as already noted, internet searchers are *positively selected on observables*.

Carrying our analysis further, Skuterud and I next find that the unadjusted re-employment gap in favor of internet searchers is not just eliminated but in fact *reversed* when we make appropriate adjustments for censoring of unemployment spells and length-biased sampling in data of this kind. Since it is unlikely that internet job search actually *harms* workers who choose to adopt it (otherwise why would they choose to engage in this activity?), we conclude that internet job searchers must be *negatively selected on unobservables*. In other words, they must have unobserved characteristics that make them less likely to become re-employed than other job searchers with equivalent observed characteristics. This negative selection on unobservables is our strongest conclusion in the paper, because while our data could still be reconciled with a beneficial causal effect of internet search on re-employment rates, this could only be the case if selection on unobservables is particularly strong.

What processes or mechanisms might give rise to negative selection of internet job searchers on hard-to-observe dimensions? One of the most obvious is the very low cost of internet job search itself: unlike more costly methods, the costs of internet job search are unlikely to deter even individuals who have only a very minor interest in a new job from participating in this activity; thus the population of internet job searchers may consist disproportionately of very casual job searchers. Another possible mechanism is poor informal contacts: perhaps unemployed persons use formal, anonymous job search methods such as the internet when they have few informal contacts that might lead to rapid re-employment. Such a process could also explain our Section 4 result, that given internet access blacks are sometimes more likely to look for work on line than whites. It is also reminiscent of Harry Holzer's (1987) finding that unemployed blacks are more likely to use "formal" methods of job search (such as public employment agencies and help-wanted ads), which he attributes this to a relative lack of informal contacts in good jobs.

Is our finding of negative selection on unobservables consistent with the experience of the on-line job search and recruiting industry over the last few years? Interestingly, there has in fact been a growing perception in the industry that on-line resumes are "adversely selected", as illustrated by the recent comments of a recruiting executive. This executive observed that job boards are populated with four types of resumes: "the unhappy (and thus probably not a desirable employee); the curious (and therefore likely to be a 'job-hopper'; the unpromotable (probably for a reason); and the unemployed (probably for a worse reason)". Relatedly, a number of emerging practices in the on-line recruiting industry appear very much to be responses to this adverse selection problem. These practices try to locate "passive" jobseekers who have *not* chosen to post their resumes on job boards or made any deliberate effort to look for work on line. Examples include "candidate mining software" such as resume spiders, or resume robots, that troll the internet in search of persons with specific qualifications (see for example recruitersnetwork.com). Other efforts to find passive jobseekers include the practice of "lurking", where a recruiter joins a tech message group or newsboard. Observing activity there allows the recruiter to see which member receives the most requests for advice, and therefore to target him or her for job offers. Another technique, known as "URL peelback" --simply stripping away the last portions of a URL-- is a way

of navigating through a company's website to find other potentially recruitable employees when you have found one.

In sum, our finding that internet jobseekers are negatively selected on unobservables seems to accord well with current perceptions in the on-line recruiting industry. Because of this adverse selection problem, we are unable to determine conclusively from our data whether internet job search is truly effective in reducing the jobless durations of those who adopt this search method. Future work on this topic would benefit greatly from an experimental or quasi-experimental approach, and given the rapidly evolving nature of on-line job search, would do well to distinguish between the many different ways in which the internet is now being incorporated into the job search process.

7. Summary and Policy Implications

Clearly, the internet has already had major effects on the *way* workers look for jobs: there are so many ways to incorporate it into one's job search strategy that it will soon be hard to imagine a job search that does not do so in some way or other. Just as clearly, the internet has the potential to affect a long list of individual and economy-wide labor market outcomes in a big way. These include unemployment durations, frictional unemployment, wage distributions, aggregate productivity, and many more. That said, we currently know very little about whether the incorporation of the internet into the job search process has realized any of this potential. The one study that looks at these questions generates very disappointing results regarding the internet's potential to get unemployed workers back to work more quickly. Certainly, it is too early to know whether an internet-related technological improvement in the matching function has played a role in the "miraculous" combination of low unemployment and low inflation experienced by the U.S. in the last few years.

Given the lack of evidence on internet effects, it is perhaps surprising that the current discussion still yields some implications that deserve the immediate attention of policymakers. Two of these concern data collection. First, because of the rapid migration of job ads away from print media and towards the internet, the current method of calculating a well-known labor market statistic—the help-wanted index (HWI)—is clearly obsolete. Since the U.S. HWI is based on the number of column-inches of job advertisements in newspapers, statisticians and policymakers need to modify the way this index is defined, and to use care in interpreting recent trends in the traditional HWI as an indicator of labor market tightness.

Second, most countries now define unemployed persons as non-employed individuals who engage in one or more of a prespecified list of "active" job search methods. As the internet comes to pervade most workers' job search strategies, government statisticians will need to define which *kinds* of internet job search are considered active or not. For example, when a worker places an ad in a newspaper to indicate that he or she is seeking work, that activity is currently (unlike simply reading newspaper ads) considered active job search. If he or she engages in the (considerably

less costly) practice of posting a resume *somewhere* on the internet, is that also considered active? Or must the posting be on a recognized site or cost a certain minimum amount? Many such questions will need to be answered, and the answers have important implications because they affect the calculation of one of the nation's most important economic statistics—the unemployment rate.

Finally, the growth of internet job search sites such as monster.com and its many competitors may require policymakers to rethink the role of public employment agencies. Clearly, one historical function of the Employment Service and its equivalent in other countries has been to operate a pre-internet “job board” that attempts to match unemployed workers with vacancies. One rationale that has often been given for public provision of this service is that information of this kind is a public good that would not otherwise be provided by private markets. Now a large number of firms are providing this service, and doing so free of charge to workers. Perhaps it is time to rethink the function of the Employment Service in light of the expansion of the internet job search industry: what exactly does a government-operated job board add to the services currently being provided by the thousands of job boards now available, free of cost to workers, for jobs of all kinds?

Further Reading

Autor, David. “Wiring the Labor Market” *Journal of Economic Perspectives* 15 (1) (Winter 2001): 25-40.

Brown, Jeffrey and Austan Goolsbee. “Does the Internet Make Markets More Competitive? Evidence from the Life Insurance Industry” *Journal of Political Economy* 110(3) (June 2002): 481-507.

Burdett, Kenneth. “A Theory of Employee Job Search and Quit Rates” *American Economic Review* 68(1), (March 1978): 212-20.

Burdett, Kenneth and Jan Ondrich. “How Changes in Labor Demand Affect Unemployed Workers”. *Journal of Labor Economics* 3(1) (January 1985): 1-10.

Dixon, Pam. *Job Searching Online for Dummies* Foster City, CA: IDG Books Worldwide, Inc. 2000.

Holzer, Harry J. “Informal Job Search and Black Youth Unemployment”. *American Economic Review* 77 (June 1987): 446-52.

Kuhn, Peter and Mikal Skuterud, “Job Search Methods: Internet versus Traditional”. *Monthly Labor Review*, October 2000, pp. 3-11.

Kuhn, Peter and Mikal Skuterud. “Internet Job Search and Unemployment Durations”. IZA discussion paper no. 613 , October 2002. (available at www.iza.org)

Lippman, Steven and John McCall, "The Economics of Job Search: A Survey: Part I"
Economic Inquiry 14(2) (June 1976): 155-89

Mortensen, Dale. "Job search and labor market analysis" in O. Ashenfelter and R.
Layard, eds, *Handbook of Labor Economics*, vol. 2. Amsterdam: North-Holland,
1986.

Mortenson, Dale and Christopher Pissaridies. "Job Creation and Job Destruction in the
Theory of Unemployment" *Review of Economic Studies*; 61(3) (July 1994): 397-
415.

Skuterud, Mikal "Causes and Consequences of the Upward Trend in On-the-Job Search:
1976-1995", unpublished paper, McMaster University, 2001.