Is Internet Job Search Still Ineffective?

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Using NLSY97 data for 2005-2008, we find that unemployed persons who look for work online are re-employed about 25 percent faster than comparable workers who do not search online. This finding contrasts with previous results for 1998-2001 and is robust to controls for cognitive test scores and detailed indicators of Internet access. Internet job search appears to be most effective in reducing unemployment durations when used to contact friends and relatives, to send out resumes or fill out applications, and also to look at ads. We detect a weak positive relationship between IJS and wage growth between jobs. JEL code J64

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1. Introduction

Over the past decade, the Internet has been credited for substantial reductions in search frictions in markets ranging from life insurance to apartment rentals (Brown and Goolsbee 2002; Kroft and Pope 2010). In contrast, studies of the Internet's effects on labor market matching have been few in number, and on balance find little or no evidence of a friction-reducing effect. For example, Kuhn and Skuterud (2004) find that unemployed workers who look for work on line have *longer* unemployment durations than comparable non-Internet searchers, while Kroft and Pope (2010) find no evidence that the rapid expansion of Craigslist as a job search tool has affected city-level unemployment rates.[1] At least on the surface, these results seem puzzling, in view of the dramatic expansion of on-line job search sites as well as the general decline in communication costs associated with the Internet. Both of these changes should increase the arrival rate of matches between job searchers and vacancies, thereby reducing search frictions in labor markets.

In this paper, we provide new evidence relevant to this 'puzzle' of ineffective Internet job search (IJS) using data on young U.S. jobseekers during the period 2005-2008, taken from the National Longitudinal Survey of Youth (NLSY97). Our main result is that Internet searchers' unemployment durations are about 25 percent shorter than comparable workers who search offline only. Specifically, after replicating Kuhn and Skuterud's (henceforth KS 2004) estimate of a counterproductive effect of IJS using their CPS data from 1998-2001 for this age group, we show that this counterproductive effect is reversed in the more recent period in the same regression specification. This reversal holds whether or not we control for a possible source of endogenous selection --searchers' scores

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[1] Stevenson (2007, 2009) finds some evidence suggesting that the Internet may have increased the rate at which employed workers change jobs.

on a widely-used cognitive skills test—that was not available in the earlier data. We speculate that improvements in technology over this period, ranging from better online job sites to network externalities associated with greater overall Internet penetration, might explain this change over time.

Our data also allow us to document a number of new results about how the Internet is used in the job search process, and about which types of job search activity are most facilitated by the Internet. For instance, we document a huge increase in Internet job search over the last decade: between 1998/2000 and 2008/2009, the share of young, unemployed workers who used the Internet to look for work tripled, from 24 to 74 percent.[2] In contrast to a hypothesis advanced in KS 2004, we find that online search is *not* disproportionately passive (relative to off-line search), which might help explain its apparent effectiveness in the more recent data. Consistent with a different hypothesis advanced by KS 2004, however, we do find that IJS is disproportionately formal, i.e. *not* involving friends and relatives. That said, in the rare instances where the Internet is used to contact friends and relatives about work, it appears to be very effective in securing re-employment.

2. Previous Literature

The impact of Internet use on the functioning of labor markets has been explored in several previous studies. Focusing first on the potential effects on unemployment durations, Kuhn and Skuterud (2004) use data from the December 1998 and August 2000 CPS Computer and Internet Use Supplements to study the impact of online search on the outcomes of unemployed workers. They find that Internet job seekers are positively selected on observables compared to offline job seekers and, as expected, have shorter unemployment durations. Once observable

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[2] All the NLSY Internet job search questions include email as a form of Internet use, and should be interpreted accordingly throughout this paper.

characteristics are held constant, however, the positive impact of Internet use disappears; indeed their estimates indicate a counterproductive effect. KS 2004 conclude that either Internet job search does not reduce unemployment durations or that workers who look for jobs online are negatively selected on unobservables.[3] In line with these results, Kroft and Pope (2010) find that the rapid expansion of the website "Craigslist" in different cities during 2005-2007 crowded out print ads, but had no impact on local unemployment rates. Thus, detecting a "general equilibrium" effect of online job search on labor market outcomes remains elusive as well.[4]

Our paper also relates to an older literature that attempts to estimate the relative effectiveness of different job search methods, despite the difficulties presented by endogenous job search choice (e.g. Holzer 1988; Bortnick and Ports 1992). Osberg (1993), for instance, argues that job search methods vary with the business cycle, and that public employment agencies are more effective during recessions. In contrast, using Portuguese data, Addison and Portugal (2002) found that public employment agencies are less effective at securing long-lasting and higher paid jobs. Several empirical studies suggest that searching for jobs through friends and relatives is a more effective search method compared to others (Blau and Robins 1990; Holzer 1988). Thomsen and Wittich (2010) study the effects of different job search channels (including Internet search as its own category) on

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[3] It is possible that Internet job search is more effective for employed (on-the-job) searchers, especially in light of the increasing number of adults who use the Internet regularly at work (Autor 2001). Stevenson (2007) provides evidence that workers who have Internet access at work are significantly more likely to transition from one job to another, within the same firm and across employers, compared to workers who do not have access to the Internet at their current job. Unfortunately, her data do not allow her to condition on (a) whether the worker is looking for another job, or (b) whether he/she is using the Internet to look for work.

[4] Bagues and Labini (2009) study the effects of a different type of Internet labor market intermediation: the availability to employers of official transcript information on recent graduates of an entire university in Italy. They estimate that students at universities where this service was available had shorter unemployment durations. Choi (2011) uses four CPS surveys including the two used by KS 2004 to estimate the effects of Internet search on unemployment durations.

unemployed workers' employment rates one year later using the German Socio-Economic Panel from 1998 through 2008. They find no significant effect of IJS (relative to not using it and keeping other search methods fixed).[5]

To our knowledge, no study has been able to directly assess whether the Internet has had an impact on the mix of job search methods used by workers. Stevenson (2009) provides suggestive evidence that the rate of Internet penetration into US cities is positively correlated with search *intensity*, measured either by the overall number of search methods used or by examining specific search methods, but she is unable to distinguish the rates of Internet use in each of the job search methods. Consistent with our findings, her results suggest that higher Internet penetration increases the likelihood of directly contacting an employer.

3. Data and IJS Time Trends

As noted, we use data from two sources, roughly a decade apart, to examine time trends in Internet job search and its correlates. For the earlier period, our sample consists of unemployed workers who responded to the December 1998 and August 2000 CPS Computer and Internet Use Supplements to the Current Population Survey (CPS). Data on these workers' subsequent search outcomes were collected by matching individuals to all the subsequent monthly CPS surveys in which they appeared; thus the data refer to unemployment spells that occurred between December 1998 and August 2001. This is the exact sample used in KS 2004. For comparability with our NLSY97 data, Internet access and job search rates for persons aged 23-29 in this sample are presented in Panel A of Table 1. About 24 percent of unemployed 23-29-year-

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[5] Their results are somewhat difficult to interpret, however, since they do not control for Internet access. Also, the only regression results reported are Heckit estimates without exclusion restrictions.

olds looked for work on line at that time; this number rises to 65 percent among the minority of that group who had home Internet access.

For the later period, we use information provided by respondents to wave 12 of the NLSY97, conducted in the Fall of 2008 when the respondents were 24-28 years old.[6] A novel feature of this wave is that, at three points in the interview decision tree, respondents are asked to list which of the twelve CPS job search activities they engaged in. After indicating whether they used each of these methods, respondents are then asked which of those activities involved any Internet use. We use these questions to generate new descriptive information on how young workers use the Internet to look for work (in Section 4) and to study the determinants and outcomes of Internet job search (in Sections 5 and 6 respectively). The exact wording of the NLSY97 job search questions is provided in Appendix A.

The three sets of job search questions in our NLYS97 data allow us to construct measures of Internet job search for four distinct samples of respondents in Panel B of Table 1. First, respondents who were not working at the interview date were asked to list all their current job search methods, including Internet use, as above. We refer to the subset of this group who engaged in at least one active search activity as our *unemployed* sample; means for the unemployed sample are shown in the first row of Panel B, and should by construction be directly comparable to the CPS numbers in Panel A. Comparing these figures reveals that home Internet access increased from 28.6 to 61.2 percent of unemployed persons over the past decade. Conditional on having home Internet access, the share of unemployed persons who used the Internet in at least one aspect of their job

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[6] Although the survey went into the field in Fall 2008, a small number of interviews took place in early 2009. Note that we choose our CPS sample to have one extra year on either side of the NLSY age interval. The motivation is purely to increase our statistical power; essentially nothing changes if we restrict the CPS sample to ages 24-28.

search rose from 64.9 to 86.1 percent. As a consequence of these two developments, the share of young unemployed workers who looked for work on line tripled over this period, from 24.2 to 74.4 percent.[7]

Next, NLSY respondents who were employed at the interview date were asked whether they had engaged in any job search activity in the last three months; if so they were asked the same list of search method questions as above.[8] We refer to persons who answered these questions and used at least one active search method as *employed jobseekers*; their means are shown in row 2 of Panel B. Given home Internet access, employed jobseekers are about three percentage points more likely to look for work on line than unemployed jobseekers; however their greater rate of access gives them about a 10 percentage point advantage in Internet job search over the unemployed group.

Third, the NLSY also asks currently employed workers to "think back when you found your current job with [employer name]", and to list all the job search methods they used to look for work at that time.[9] This is by far the largest sample of respondents for whom we observe job search methods in our data; we refer to this as our sample of *searches for the current job*. Search indicators derived from this question are presented in row 3 of Panel B.[10] In this group, only 43.6 percent reported looking for work on line.

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[7] All our results from the NLSY97 use sampling weights to adjust for the systematic oversampling of Blacks and Hispanics in the NLSY.

[8] Strictly speaking, respondents had to be in a 'long-term' job at the survey date (defined by the NLSY as a current job lasting longer than 3 months) to be asked this set of questions.

[9] It would of course also be interesting to know which of the methods used was ultimately responsible for locating the current job. For example, Weber and Mahringer (2008) use information of this nature in estimating the relative effectiveness of various search methods. But our survey question clearly asks respondents to list all the methods they used when they were searching.

[10] For comparability with the previous measures we also restrict this sample to active searchers, i.e. to persons who reported using at least one active search method.

Finally, row 4 of Table 1's panel B presents statistics for the subset of the above sample who experienced an unemployment spell immediately preceding the start of their current job. Like row 1, the statistics in this row represent Internet job search rates for a sample of unemployment spells; we refer to this as our sample of *unemployed searches for the current job*, or simply *NLSY sample 4*. This is the sample of unemployment spells we use to estimate the effects of IJS on durations in Section 6 below.[11]   Overall, 55.3 percent of this group looked for work on line. While a possible concern with this sample (relative to rows 1 and 2) is that it asks some respondents to recall search methods they used for a search spell that occurred up to three years earlier, we note that the most likely effect of inaccurate recall of whether the Internet was used for job search is attenuation bias and we will interpret our results accordingly.

4. How is the Internet Used to Look for Work?

Table 2 presents a detailed breakdown of the search methods used by currently unemployed workers (the row 2 sample in Table 2), including the use of the Internet for each of those methods. According to Table 2, a typical unemployed worker in the NLSY data used 1.58 out of 9 possible active search methods *off* line (i.e. without indicating any Internet use); the most common of these was "contacted friends or relatives". The same worker used 1.44 of the 9 possible active methods *on* line, the most frequent of which was "sent out resumes or filled out applications". Combining on and off-line search, a typical unemployed worker used 3.02 of the 9 possible active methods. Of these, the most Internet-intensive method was sending out resumes or applications: of workers who used this method, 72 percent used the Internet in doing so. Turning

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[11] See Section 6 for additional details on how this sample was constructed. Using wave 13 of the NLSY97 it is also possible to study the subsequent unemployment durations of the small number of workers who were unemployed in Wave 12, i.e. our *unemployed* sample. Because of the small sample size, however, we cannot reject a wide range of levels of IJS effectiveness, including a 24 percent effect in either direction, in this sample. Results are available from the authors.

to passive search methods, a typical unemployed worker used .74 out of 3 possible passive methods in our data; the vast majority of this passive activity was "looking at ads".

Kuhn and Skuterud (2000) compare the mix of 'traditional' search methods used by Internet versus non-Internet searchers but their data does not identify whether the Internet was used for any particular type of job search activity. To our knowledge, Table 2 presents the first available evidence on *how* unemployed workers actually use the Internet in their job search activities. As such, it contains at least three noteworthy results. First is the relatively wide range of 'traditional' job search activities, ranging from direct employer contact to contacting a public employment agency, in which the Internet is used. Indeed, aside from contacting friends or relatives, the frequency of Internet use was at least one third in every one of the twelve CPS job search activities. Overall, if we measure search activity both on and off line simply by counting the number of methods used,[12] the mean share of total job search activity that is conducted via the Internet is about 48 percent (the bottom right number in the Table). To the extent that this number was lower in 1998-2001, it might help explain IJS's apparent lack of efficacy at that time.

Second, as already noted, is the widespread use of the Internet in both active *and* passive search methods. In attempting to understand their unexpected findings for the effects of IJS on unemployment durations, KS 2004 speculated that Internet job searchers might consist disproportionately of casual and unmotivated jobseekers who mostly engage in low-cost, low-return activities such as looking at Internet job boards. According to our data, this is not the case: Simply "looking at ads" constituted .32/1.81 = 17.7 percent of unemployed

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[12] Counting the number of methods used is a widely-used measure of search effort or intensity. See for example Blau and Robins (1990).

workers' on-line search activity, compared to $0.30/1.96 = 15.3$ percent of their off-line activity. Also, as the last row of Table 2 indicates, 20 percent of Internet search is classified as passive, compared to 19 percent of off-line search.

Third, and consistent with a different hypothesis advanced in KS 2004, Internet job search is disproportionately *formal*, as opposed to informal (where we define latter as contacting friends and relatives). While $0.44/1.96 = 22$ percent of offline search involves contacting friends and relatives, this is true for only 6 percent of online search. In fact, according to column 4 of Table 2, contacting friends and relatives is the *least* Internet-intensive of all the 12 CPS search methods: only 20 percent of people who use this method say they used the Internet to do so. We find this low use of the Internet for informal job search surprising in view of the rapid growth of on-line social networking (especially among the young), but in 2008 social media may have linked young people mostly with other young people. As social media continue to expand into other demographic groups, they may become a more effective tool in job search.

Versions of Table 2 for two other populations –employed searchers, and workers who experienced an unemployment spell immediately preceding their current job—are available in Appendix Tables B1 and B2. These Tables confirm the main conclusions we drew from Table 2: Internet job search is widely used to undertake almost all the traditional job search methods, with the exception of informal channels. Moreover, the Internet is used in similar proportions among active and passive search methods.

5. Who looks for work on line?

Table 3 presents coefficient estimates from linear probability models in which the dependent variable equals one if the respondent is currently looking for

work on line, and zero otherwise.[13] Results are presented for three samples of
respondents, all of whom are unemployed at the relevant survey date. In columns
(1) and (2), the sample is exactly the one used in KS 2004, from CPS interviews
in December 1998 and August 2000.   Columns (3) and (4) retain only
respondents aged 23-29 from that sample, for comparability with the NLSY97
data. Finally, columns (5)-(7) present results for NLSY respondents who were
unemployed when interviewed in 2008, when the respondents were 24-28 years
old. Covariate lists and definitions were selected to be as comparable as possible
between the CPS and NLSY datasets; in addition to the covariates shown, all
regressions included controls for age, plus a full set of fixed effects for whether
each of the 12 possible BLS search methods was used. The rationale for these
detailed search method controls is to hold total search effort (and its mix across
methods) constant, in order to focus purely on the decision to look on line or
not.[14]   In all our reported NLSY results, we show a separate specification that
includes a control for the respondent's score on the Armed Forces Qualifying Test
(AFQT), which was administered when the NLSY respondents were between the
ages of 15 and 23. Cognitive test scores are not available in the CPS data.

Not surprisingly, home Internet access is a strong predictor of IJS in all
three samples. Also as we would expect, the size of the coefficient is
considerably smaller in 2008, when the mean level of Internet penetration is
considerably closer to saturation. All three data sets also show a strong, and
highly statistically significant association of IJS with education levels: without
Internet access or AFQT controls, unemployed respondents with a university
degree are over 40 percentage points more likely to look for work on line than

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[13] The results from estimating a probit regression are essentially similar to the results reported in
Table 3.
[14] That said, the results do not change appreciably if we exclude these controls for search intensity
and method mix.

unemployed high school dropouts. This gap falls to 20 percentage points when controlling for Internet access in 1998-2001 or for AFQT in 2008.

Table 3's results for race are of particular interest in view of the past decade's literature on the "digital divide" (e.g. Sevron 2002, Fairlie 2004) and also given an earlier literature on racial gaps in job search methods and outcomes (e.g. Holzer 1987, 1988). In the CPS data from around the turn of the century, unemployed Blacks and Hispanics were less likely than Whites to look for work on line, but this gap could be completely explained by racial gaps in Internet access. A decade later, there is no racial gap in IJS among unemployed workers, reflecting in part the greater ubiquity of Internet access and use. However, when we compare Blacks and Whites with identical AFQT scores (which is only possible in 2008/9), unemployed Blacks are significantly *more* likely to look for work on line than Whites. This is consistent with Holzer's argument that similarly-qualified Blacks rely more on formal networks than Whites, perhaps due to a relative paucity of informal contacts in the world of work.

Finally, while the standard errors are high in the smaller samples, the overall similarity of comparably-specified regressions for Internet job search between the CPS overall sample, the CPS ages 23-29 sample, and the NLSY97 sample adds to our confidence that any differences we see in the estimated effects of IJS in the next section are in fact due to changes in IJS effectiveness, rather than changes in the population under study. Specifically, comparing identical specifications in the CPS and NLSY (i.e. columns 3 versus 5 or 4 versus 6), the only significant difference appears to be a weaker effect of education on IJS in the latter period, especially for the middle education categories relative to the omitted category (less than high school), and in the presence of home access controls. We suspect this is a consequence of rising Internet use over time, which reduces the correlation between Internet access and education in the more recent period.

Identically-specified IJS regressions for two other NLSY samples –employed jobseekers, and the sample of workers used in the following section's duration analysis-- are presented in Appendix Table B3. They also show similar patterns, including a positive effect of being Black in the presence of AFQT controls, which is statistically significant in the larger of the two samples.

6. IJS and Unemployment Durations

Parallel to Table 3, Table 4 presents estimates of regression models for two CPS samples and one NLSY sample, but now the dependent variable in all cases is the log of the respondent's unemployment duration. For the CPS regressions in columns 1-4, the sample is identical to the one in KS 2004: all persons who were unemployed at the December 1998 and August 2000 survey dates. Their unemployment duration is the time between those dates and the respondent's date of reemployment; since the CPS follows individuals for a maximum of 16 months, the latest we see these spells is November 2001.

Another consequence of the CPS interview structure is that unemployment durations are only known in observation-specific intervals that in some cases are quite wide (in some cases as much as eight months). We incorporate this feature of the data using interval-normal regression. In other words, we assume that the mean of log duration is linear in the covariates, that the conditional-on-observables distribution of log durations is normal, and use maximum likelihood methods to infer the effects of the covariates given the interval in which the realized duration lies.[15]

In addition to the Internet search indicator itself, all the regressions in Table 4 contain the same covariates as in Table 3, which as noted are defined the

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[15] This accelerated failure time (AFT) procedure (see for example Kiefer 1988) is a simplified version of the estimation procedure used in KS 2004. KS 2004 provides a more detailed discussion and demonstrates that this class of AFT models is consistent with a wide and familiar class of proportional hazard models.

same way in both the CPS and NLSY97 data sets.[16] Recall that these controls

include a full set of fixed effects for whether each of the 12 possible BLS search

methods was used. The purpose of these controls is to hold total search effort

(and its mix across methods) constant, allowing our estimated effects to isolate

the pure effects of searching on versus off line. Consistent with KS 2004,

columns 1 and 2 of Table 4 show that IJS is associated with longer unemployment

durations. Also consistent with KS 2004, the estimated effect is almost twice as

strong (amounting to a 22-29 percent increase in unemployment durations) when

we add controls for home Internet access.[17] This is consistent with the notion that

unadjusted comparisons of Internet and non-Internet searchers are contaminated

by positive selection of persons with Internet access; once we control for this bias,

the true 'counterproductive' effects of IJS become apparent. Columns 3 and 4 of

Table 4 are identical to columns 1 and 2, except that they restrict the sample in the

CPS data to respondents between the ages of 23 and 29. While this raises the

standard errors, the point estimates are similar, and if anything suggest an even

more counterproductive effect of IJS.

Columns 5 and 6 of Table 4 estimate a model of log unemployment

durations in the NLSY97 data that is as similar as possible to columns 3 and 4.

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[16] There are only three differences between the CPS and NLSY specifications in Table 4. The first stems from the fact that our CPS durations are measured as time from the interview until reemployment. To control for the sorting and causal effects of time already spent unemployed, the CPS regressions include a control for elapsed unemployment duration at the survey date. Second, since our NLSY data samples spells as they end rather than as they start, we replace the survey year dummy in the CPS data with fixed effects for the year the unemployment spell ended in the NLSY data.   Third, we include state of residence unemployment rate at the survey date in the CPS data while we include state of residence unemployment rate at the time the unemployment spell ended in the NLSY data. We include these dataset-specific covariates because they seem to be theoretically appropriate for the samples used. That said, all of our main results for unemployment durations are unchanged if we drop either one of these covariates.

[17] The only differences between columns 1 and 2 of Table 4 and Table 4 in KS 2004 are thus (a) a shorter list of covariates, chosen to be identical with the covariate list in the NLSY data, and (b) the less flexible parameterization of the baseline hazard function inherent in a log duration specification. The latter choice is purely for simplicity; later in this section we show that our main NLSY results remain unchanged when we allow for a more flexible baseline hazard.

To estimate these durations we use the *NLSY sample 4* described in Table 1. This sample of unemployment durations that preceded the current job can be thought of as representative of the *outflow* from unemployment. Specifically, it is a sample of unemployment spells that ended in employment during a given period (specifically January 2007 through the survey date). We measure these spells' durations as the time between the end of the respondent's previous job and the start of the current one. While this approach is less typical than inflow-based samples in empirical studies of unemployment durations, in steady state a sample of outflows is just as representative as a sample of inflows.[18] In both cases, it is of course important to treat censored spells appropriately in the estimation.

In more detail, to construct our sample of unemployment durations, we start with all individuals who currently (at the Fall 2008 interview) hold a single job, and who started that job between January 1, 2007 and the survey date. We then keep only those individuals who experienced a jobless spell immediately before starting the current job, and who reported that they used at least one active method to search for work during that spell. The latter restriction ensures that we are looking at *unemployment* spells (as opposed to jobless spells more generally) and is identical to the definition of unemployment in our CPS sample. Finally, we construct the durations of these unemployment spells by looking backwards in time (as far as January 1, 2005) until we encounter the end of any previous job.[19] If we cannot find a previous job in this interval, the unemployment spell is coded as censored at that date, i.e. we know the spell started before January 1, 2005, but

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[18] We address pure time effects due to business cycles and other factors by including fixed effects for the year in which the unemployment spell ended, in addition to controlling for state of residence unemployment rates.

[19] We have experimented with alternative window periods for sampling new jobs (e.g. starting at dates other than January 2007), and with alternative limits for how far back we search for previous jobs (i.e. other than January 2005). Our main results on IJS and unemployment durations are not sensitive to these choices.

not exactly when. Since the number of spells that are censored in this way is very small, our sample of NLSY durations effectively spans the years 2005-2008.[20]

Turning to the results, we note first that, while the standard errors are sometimes high, the effects of the control variables in columns 5 and 6 are similar to those in columns 3 and 4. In particular, Hispanic workers have longer unemployment spells than Whites, and marriage dramatically lowers young men's unemployment durations, but not women's. Leaving the previous job involuntarily is associated with a huge increase in durations. The only coefficients that differ markedly between the two samples are for gender and being Black, though in both cases the standard errors are high.

Moving to the effects of IJS, its coefficient has opposite signs in the CPS and NLSY97 data: IJS now appears to *reduce* unemployment durations by about 25 percent. Even though having home Internet access is still associated with shorter unemployment spells, adding this control no longer affects the estimated IJS effect. Nor, as column 7 shows, does adding a control for unobserved individual ability that was unavailable in the CPS: AFQT. Indeed, the estimated benefits of IJS are slightly stronger in the presence of AFQT controls than in their absence.[21] As already noted, this large change in the IJS coefficient between our 1998/2000 and 2005-2008 data has at least two possible interpretations. One of these is a large change in selection into Internet search on unobservable characteristics, from negative to positive selection. In that regard it is certainly

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[20] Since these dates (just barely) predate the Great Recession, macroeconomic conditions were surprisingly similar during the two periods in which we study unemployment durations. The CPS spells cover the years 1998-2001, with national unemployment rates of 4.5, 4.2, 4.0 and 4.7 respectively. The NLSY spells cover the years 2005-2008, with unemployment rates of 5.1, 4.6, 4.6 and 5.8 respectively.

[21] We also controlled in the NLSY sample for different geographical indicators such as living in a rural area, living in a central city, indicators for region in the country, and state of residence fixed effects at the time the unemployment spell ended. The estimated impact of IJS remains stable and statistically significant, except when we add state fixed effects. Results are available from the authors.

possible that some of the factors identified by Kuhn and Skuterud (2004) as possible contributors to negative selection –such as a disproportionate share of casual searchers and searchers without informal contacts in online search—have weakened. And certainly our own NLSY97 data suggests that Internet search is no less active in the latter period than offline search. The rapid rise in IJS may also be associated with a change in selection patterns, though it is unclear whether this would accentuate positive or negative selection.[22]

That said, the large change in our estimated coefficients, plus the fact that patterns of selection on observables remain roughly similar over time, and the presence in our regressions of highly detailed controls for job search intensity, search method mix, and AFQT, suggest to us that improvements in Internet job search technology may also have played a significant role. We comment on developments in the Internet job search and recruiting industry that may have contributed to a changed causal effect of IJS in Section 8 of the paper.

In order to assess the robustness of our main result, Table 5 presents estimates from three additional regression specifications in the NLSY97. Aside from the changes discussed below, all specifications are identical to column 7 in Table 4; thus controls for home Internet access and AFQT are always present. In column 1, we replace the indicator for whether the respondent used the Internet in any of his/her job search activities by a more continuous measure. Specifically, the Internet *intensity* measure used in the top row of Table 5 gives the share of the number of job search methods used by the respondent (from one to 12) that

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[22] If selection into IJS is negative on unobservables (as KS 2004 argued), then the effects of an expansion in IJS (due either to an across-the-board fall in costs or rise in effectiveness) depends on whether the gap between the top tail and the rest of the search ability distribution is larger than the gap between the bottom tail and the rest of the distribution. If the gap at the top is larger, then Internet searchers will be more negatively selected in 2005/08 (when only the most able refrain from Internet search) than in 1998/00 (when only the least able participate). The converse applies if the gap at the bottom is larger.

involved some Internet use.[23] Consistent with the notion that this reduces the measurement error inherent in a crude dichotomous IJS indicator, the coefficient on Internet search increases in both size and significance. Now, moving from no Internet use to 100 percent Internet use in job search reduces unemployment durations by about 37 percent, an effect which is significant at the 1 percent level.

Column 2 of Table 5 uses the same Internet intensity measure as in column 1 but addresses the possibility that our indicator for home Internet access might not fully control for unobserved personal characteristics that raise both Internet use and the job-finding rate. Here, in addition to the home Internet access dummy, we also include separate indicator variables for whether the respondent has Internet access at six additional types of locations: school, work, a public library, an Internet café, a friend, or another location.[24] This has very little effect on the estimates. Finally, column 3 addresses the notion that all the log duration models estimated so far impose strong functional form assumptions on the time structure of the underlying hazard rate. Therefore we estimate a Cox partial likelihood model for the re-employment hazard on the same covariates as in column 2. While the coefficient magnitudes are not directly comparable to column 2, the sign and statistical significance of the coefficients strongly confirm our other results. Now, Internet job search is estimated to raise unemployed workers' re-employment hazard by about 28 percent; this effect is significant at the one percent level. Plots of the estimated survivor curve for IJS intensity levels of zero and the sample mean (.42) are provided in Figure 1; they show an effect of

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[23] Thus, for example, if the respondent used five of the twelve possible search methods and two of these involved some Internet use, her Internet intensity measure equals .4.

[24] Recall that all of our Internet access variables refer to the survey date. Thus, they may be, in part endogenous: persons who find a new job quickly might use their re-employment earnings to buy more Internet access, or might be more likely to find a job that provides Internet access. (Recall that all respondents are employed at the survey date because we are sampling from the inflow to employment). If anything, however, endogeneity of this form will lead us to underestimate the benefits of Internet search when we add these controls.

IJS throughout the job search process. After about 30 weeks of unemployment, Figure 1 shows that about 20 percent of workers with average IJS intensity are still unemployed, compared to about 24 percent of workers who look for work off line only.

Finally, to try to identify which particular types of job search activity are most facilitated by Internet use, we re-estimated column 3 of Table 5, replacing the Internet intensity variable with twelve dummy variables, indicating whether the Internet was used for each specific job search method, ranging from direct employer contact to "other passive" methods. Not surprisingly, most of the resulting coefficients were statistically insignificant; it is a challenge to disentangle this many effects in our small sample, especially where a number of the search methods are only rarely used. We also remind the reader that the search method questions for our sample of searches for the current job are retrospective; the resulting measurement error may also make it hard to identify separate Internet effects for each of the twelve search methods.

Still, the following results seem noteworthy. First, using the most common form of IJS, --sending out resumes or filling applications-- increases a worker's job-finding hazard by about 20 percent (coefficient = .203, p = .048).[25] Second, using the Internet to contact friends and relatives raises the job-finding rate by 36 percent, an effect which is statistically significant at the 1 percent level. Thus, even though contacting friends and relatives on line is a relatively rare form of IJS, it appears to be highly effective. Finally, the only other form of IJS with a statistically significant effect was "looked at ads" (coefficient = .336, p = .012). This is intriguing in view of the fact that the Bureau of Labor Statistics classifies looking at ads as a passive job search method. Perhaps looking at *Internet* job ads

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[25] Recall that our regression includes a full set of controls for the use of the twelve methods themselves (whether on- or offline). Thus this effect should be interpreted as relative to workers who use the same method offline; the same applies to all comparisons in this paragraph.

is different, due to the ease with which a passive 'looker' can become active with as little as the click of a mouse.

7. IJS and Wage Changes

Does looking for work on line help unemployed workers to find a better job than they would otherwise have found? Table 6 addresses this question in the NLSY data by regressing the log wage of the respondent's current job on the same sample that were used in Table 4. (Recall that this sample includes only persons who held at least one job after January 1, 2005. This is because we cannot reliably assign a unemployment spell start date to individuals who enter unemployment from a labor market state other than employment.) The covariates in Table 6 are also identical to Table 4, except that we have added a control for the level of the respondent's log wage in his/her previous job.[26]

Unsurprisingly, according to Table 6, workers who left their previous job involuntarily experience a wage reduction that is about 7 log points larger in magnitude than workers who quit their previous job, while a higher wage in the previous job is positively correlated with the wage at the current job. Workers with a university degree experience much more wage growth across jobs than other workers in this data; this likely reflects these young workers' first transitions into 'career' jobs related to their education.   The estimated effects of IJS on the current wage suggests a wage increase of about 5-7 log points, but the coefficients are statistically insignificant. Thus, in our data, we find weak evidence of a positive effect of IJS on wages in the new job suggesting that looking for work on line for young unemployed workers facilitates finding a better job faster.

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[26] Since wage information is collected in only one out of every four CPS surveys, analysis of wage changes is not feasible in the CPS data because we cannot control for the wage at the previous job.

8. Conclusion

Has the Internet reduced frictions in labor markets? And is the unemployment rate lower today that it would have been, if workers and firms were unable to search for each other using the Internet? In this paper, we argue that a necessary condition for this to be true is that in any *given* labor market, identical unemployed individuals differentiated only by whether they use the Internet in their job search should experience different search outcomes, with the Internet-searcher achieving better results. Of course, as is well known, this is not a sufficient condition for an aggregate unemployment-reducing effect of the Internet because of search externalities: more effective search by some workers may raise or lower the job-finding rate of other workers, so the aggregate effect of a technology that increases the offer arrival rate can be different from its partial-equilibrium effect, and can be either welfare-enhancing or reducing.[27]

In this paper, we study whether the above necessary condition is satisfied in data on young U.S. workers taken from two points in time: 1998/2000 and 2008/2009. While we cannot compare literally identical workers looking for work in different ways, we can compare observationally identical workers in the presence of a detailed set of covariates, including one –the worker's AFQT score— that has not been used in any previous studies of Internet job search. We can also distinguish the effects of IJS from the effects of differences across individuals in Internet access which otherwise would contaminate our estimates, and we have detailed controls for job search intensity and search method mix. We find that, while IJS appeared to be either ineffective or counterproductive a decade ago, it is now associated with about a 25 percent reduction in

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[27] In order to detect such an aggregate effect, a research design would need to take a market-level approach rather than comparing observationally identical individuals within a given market. To our knowledge, Kroft and Pope (2010) is the only study that has taken such an approach.

unemployment durations. In addition, a weak positive relationship between IJS and between-job wage growth was found.

What might account for this change in the apparent effectiveness of Internet job search? One possibility is that selection into Internet search on unobservables changed from being negative to strongly positive. While changes in selection may play some role, we think it is unlikely that they account for the entire change, in part because the pattern of selection on observables has remained very similar between the two time periods. Another possibility is design improvements in the main Internet job search sites, including not only commercial sites like Monster and Careerbuilder, but also government-operated sites plus a long list of local and occupation/industry-specific job boards. As the technology has matured, many of these sites have become much easier to navigate, and now provide a variety of services to both firms and workers (such as screening tools to sort through applications, and job filtering tools for workers) that were previously unavailable.

Another key change in job boards over the past decade that may have improved search effectiveness is the proliferation and growing popularity of niche job boards alongside the traditional 'omnibus' sites like CareerBuilder and Monster.[28] Industry- and occupation-based niche sites, such as allretailJobs.com, healthjobusa.com or actuary.com among many others may provide more targeted matches, and in many cases provide specialized services.[29] For example, AllRetailJobs.com provides a service to help job seekers to write a resume that is tailored to the retail industry. Both these new tools and the increasing specialization of sites are consistent with our finding that the Internet is highly

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[28] Weddle's – an employment consultancy firm - estimates that the number of niche job boards in the U.S. doubled since 2000, reaching an overall total of 100,000 websites (Silver, 2011).
[29] Notably, the main sites have started to imitate this trend towards specialization. For example, CareerBuilder now hosts a board targeted at health care workers (industrymiracleworkers.com) and another that focuses on restaurant employees (jobsonthemenu.com).

effective in generating re-employment when used to look at ads, to send out resumes, and to fill applications.

Another possible source of increased IJS effectiveness may have nothing to do with the way job boards are organized or the services each site provides. This candidate is simply the network externalities that are associated with the dramatic rise in overall Internet penetration and connectivity, and which are reflected in the huge increase in IJS documented in this paper. Simply because the Internet now connects each worker to many more firms (and vice versa) in several new and low-cost ways, it may have become a more powerful tool in the job search process than it was a decade ago. This explanation is consistent with our finding that jobseekers use the Internet to look for work in many ways besides visiting job boards.

Finally, one recent development that probably did not contribute to the apparent increase in IJS effectiveness between 1998/2000 and 2008/09, but that may have played an important role since then is the rapid expansion of social networking websites such as Facebook and LinkedIn. Indeed, while young unemployed workers made very little use of the Internet to contact friends and relatives about jobs in 2008/09, our estimates indicate that these rare contacts were, in fact, highly effective in securing jobs. And we suspect that social networking tools are already used much more frequently for job search. For example, while LinkedIn is primarily used for networking, it also allows companies to list jobs and users to research companies where they might want to work.[30] In 2011, LinkedIn introduced an "Apply within LinkedIn" button that allows users to apply for jobs using their LinkedIn profiles as resumes. Facebook also offers significant potential as a job search tool, both as an informal way to contact friends and relatives about jobs, and via the company's new job listing

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[30] LinkedIn is a social networking site for people in professional occupations founded in 2003.

app, introduced in 2012.[31] In sum, our finding that contacting friends and relatives on line is highly correlated with job finding rates, in combination with the expansion of social networking sites and the incorporation of job search features into them, suggests that the Internet has the potential to become an effective method of *informal* job search in the near future.

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[31] More than 1.7 million recruiters had posted jobs on Facebook's job listing app by the end of 2012 (Colao, 2012). And in 2010 (before Facebook's job listing app appeared), a survey conducted by the Wharton Small Business Development Center and Beyond.com indicated that – not conditioning on employment status—over 30 percent of Facebook users used Facebook to look for work (Beyond.com, 2010).

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Table 1: Fraction of Persons with Internet Access and Engaging in Internet Job Search, by Period and Labor Force Status

Period and Sample:	Fraction with Home Internet Access[a]	Fraction looking for work on line, given home Access	Fraction looking for work on line[b]	Sample Size[c]
	(1)	(2)	(3)	(4)
A. 1998/2000 (CPS Data)				
1. Unemployed	28.6	64.9	24.2	669
B. 2008 (NLSY97 Data)				
1. Unemployed	61.2	86.1	74.4	474
2. Employed Jobseekers	81.3	89.3	85.3	441
3. Searches for current job (all)	77.8	48.0	43.6	4,412
4. Searches for current job (unemployed)	74.4	63.6	55.3	1,166

Notes on Table 1: CPS samples restricted to ages 23-29 at the survey date; NLSY sample is 24-28 years old at the survey date.

[a] Refers to the survey date in all cases

[b] Does not equal (1) times (2) because it is possible to job search on line without home Internet access.

[c] Refers to column 3.

Data from 1998/2000 are from the December 1998 and August 2000 CPS Computer and Internet Supplements; Data from 2008 are from Wave 12 of the NLSY97. All NLSY97 data use sampling weights.

"Unemployed" in both surveys refers to a person currently not working, using at least one *active* search method according to the CPS definition (see Table 3 for the list of active methods).

 "Employed Job Searchers" are currently working, and using at least one active search method according to the CPS definition (see Table 3 for the list of active methods).

"Searches for current job (all)" refer to how respondents who were employed at the Fall 2008 survey date looked for their current job.

"Searches for current job (unemployed)" is the subset of the above searches that involved a spell of unemployment.

Table 2: Search Methods of Unemployed Workers, NLSY97

Method	(1) Share of workers using method off line	(2) Share of workers using method on line	(3) Share of workers using method, total (1+2)	(4) Share of method users doing so on line (2/3)
Active Search Methods:				
1. Contacted employer directly	0.36	0.29	0.65	0.45
2. Contacted public employment agency	0.19	0.19	0.38	0.50
3. Contacted private employment agency	0.07	0.08	0.15	0.53
4. Contacted friends or relatives	0.44	0.11	0.55	0.20
5. Contacted school/university employment center	0.05	0.06	0.11	0.55
6. Sent out resumes or filled out applications	0.24	0.48	0.72	0.67
7. Checked unions or professional registers	0.03	0.03	0.06	0.50
8. Placed or answered ads	0.16	0.17	0.33	0.52
9. Other active methods	0.04	0.03	0.07	0.43
A: Total active search methods (sum of (1)-(9))	**1.58**	**1.44**	**3.02**	**0.48**
Passive Search Methods:				
10. Looked at ads	0.30	0.32	0.61	0.52
11. Attended job training programs or courses	0.06	0.03	0.09	0.33
12. Other passive methods	0.02	0.02	0.04	0.50
B: Total passive search methods (sum of (10)-(12))	**0.38**	**0.37**	**0.74**	**0.49**
Total number of search methods (A+B)	**1.96**	**1.81**	**3.76**	**0.48**
Share of active methods in total search (A/(A+B))	0.81	0.80	0.80	-

Notes on Table 2: Sample size of unemployed workers is 474. Sample weights are applied.

Table 3: Determinants of Internet Job Search among Unemployed Workers

	CPS, All Ages		CPS, Ages 23-29		NLSY97		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Home Internet Access		.38217***		.45544***		0.22539***	0.20184***
		(.01237)		(.03406)		(0.053)	(0.060)
AFQT							0.08756***
							(0.031)
Black	-.06750***	.01197	-.07636**	-.01778	0.03174	0.08454	0.17182***
	(.01513)	(.01387)	(.03795)	(.03384)	(0.052)	(0.053)	(0.058)
Hispanic	-.05008***	.01832	-.03466	.01806	0.00785	0.03242	0.06363
	(.01732)	(.01576)	(.04271)	(.03798)	(0.061)	(0.059)	(0.072)
Female	.00848	.02390*	.04265	.05547*	0.05842	0.05052	0.08326
	(.01407)	(.01268)	(.03501)	(.03098)	(0.047)	(0.046)	(0.053)
Involuntary Job Loss	.01635	.02160*	-.02448	-.01129	0.02210	0.00173	0.02696
	(.01255)	(.01131)	(.03177)	(.02811)	(0.044)	(0.043)	(0.047)
Some high school	.02764	-.00916	-.00472	-.00882	0.23081**	0.20319**	0.07510
	(.02728)	(.02461)	(.07854)	(.06946)	(0.104)	(0.101)	(0.120)
High School Degree	.08053***	.03537	.02708	.00650	0.20172*	0.13969	0.05167
	(.02649)	(.02391)	(.07459)	(.06598)	(0.105)	(0.102)	(0.119)
Some College	.24308***	.13374***	.22508***	.09359	0.35606***	0.27616***	0.13395
	(.02779)	(.02529)	(.07603)	(.06795)	(0.106)	(0.106)	(0.121)
University Degree	.40066***	.21247***	.46716***	.22060***	0.46623***	0.37548***	0.21018*
	(.02965)	(.02740)	(.08017)	(.07326)	(0.108)	(0.108)	(0.126)
Married	.07101***	.03817**	.01259	.05643	0.15426**	0.13573*	0.10643
	(.01931)	(.01743)	(.05245)	(.04650)	(0.076)	(0.077)	(0.079)
Married*Female	-.04835*	-.05824***	-.02012	-.06830	-0.18220	-0.17284	-0.19106
	(.02492)	(.02245)	(.06822)	(.06044)	(0.112)	(0.109)	(0.119)
State Unemployment Rate	.00620	.00385	-.02146	-.01504	-0.00330	-0.00668	-0.02230
	(.00605)	(.00545)	(.01488)	(.01317)	(0.020)	(0.020)	(0.021)
Observations	4,139	4,139	669	669	452	447	346

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes to Table 3: Dependent variable equals one if the respondent engaged in any Internet job search, and zero otherwise. The sample for all columns is workers who were unemployed at the interview date. All regressions control for age effects (ten-year bins in columns 1 and 2, and single years of age in columns 3-7), plus fixed effects for whether each of the twelve CPS search methods was used. CPS regressions include a fixed effect for the August 2000 survey date. AFQT scores are normalized to have a unit standard deviation.

Table 4: Determinants of Log Unemployment Durations

	CPS, All Ages		CPS, Ages 23-29		NLSY97		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Search online	.12228**	.21588***	.20684	.32262*	-0.23729**	-0.21489*	-0.26974**
	(.06107)	(.06895)	(.14657)	(.17110)	(0.119)	(0.120)	(0.133)
Home Internet Access		-.17987***		-.21335		-0.12239	-0.16944
		(.06182)		(.16351)		(0.122)	(0.136)
AFQT							-0.10150
							(0.067)
Black	.15344**	.12531*	.15860	.14745	0.09849	0.08482	-0.02478
	(.06521)	(.06587)	(.14935)	(.14970)	(0.114)	(0.115)	(0.134)
Hispanic	.08403	.05669	.18708	.17282	0.23335*	0.22445*	0.18792
	(.07266)	(.07322)	(.16971)	(.17004)	(0.122)	(0.122)	(0.143)
Female	-.02805	-.03901	-.00611	-.01953	0.25215**	0.25413**	0.23769*
	(.05864)	(.05871)	(.13319)	(.13350)	(0.114)	(0.115)	(0.126)
Involuntary Job Loss	.05031	.04671	.24085**	.23465*	0.33972***	0.34602***	0.36325***
	(.05083)	(.05080)	(.12203)	(.12210)	(0.109)	(0.109)	(0.118)
Some high school	.09930	.11607	.11701	.12196	0.00989	0.00410	-0.05225
	(.11695)	(.11693)	(.31022)	(.31049)	(0.270)	(0.272)	(0.336)
High School Degree	-.01466	.00183	-.16077	-.15102	-0.29495	-0.28219	-0.31462
	(.11278)	(.11272)	(.29696)	(.29729)	(0.258)	(0.260)	(0.323)
Some College	-.01535	.01602	-.12853	-.09200	-0.42352*	-0.39324	-0.31911
	(.11900)	(.11927)	(.30655)	(.30793)	(0.254)	(0.257)	(0.323)
University Degree	-.07339	-.01429	-.51332	-.44464	-0.54388**	-0.50174*	-0.34101
	(.12677)	(.12818)	(.31978)	(.32447)	(0.258)	(0.263)	(0.335)
Married	-.11139	-.10626	-.54118***	-.56333***	-0.51380***	-0.50407***	-0.60733***
	(.07627)	(.07623)	(.18570)	(.18632)	(0.151)	(0.150)	(0.166)
Married*Female	.13897	.15343	.65051***	.68511***	0.71352***	0.70471***	0.70540***
	(.09981)	(.09982)	(.24782)	(.24907)	(0.215)	(0.215)	(0.235)
State Unemployment Rate	.05816**	.06020**	.10727*	.11015**	0.14365***	0.14353***	0.14532***
	(.02494)	(.02492)	(.05606)	(.05601)	(0.045)	(0.045)	(0.049)
Observations	4,139	4,139	669	669	1,054	1,049	840

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes on Table 4:

All regressions include fixed effect for single years of age, fixed effects for whether each of the twelve CPS search methods was used, and a control for the unemployment rate in the respondent's state.

CPS regressions refer to unemployment spells in progress at the Computer and Internet Supplement dates; they include a control for elapsed duration prior to that date and a fixed effect for the August 2000 survey date. CPS estimates use interval normal regression to account for the interval nature of the data and incomplete spells. State unemployment rates refer to the survey month.

NLSY97 regressions refer to unemployment spells immediately preceding the start of the respondent's current job; they include fixed effects for the year the unemployment spell ended. NLSY97 estimates use interval normal regression to account for unemployment spells whose start date was before January 2005. Stae unemployment rates refer to the month the unemployment spell ended. AFQT scores are normalized to have a unit standard deviation.

Table 5: Determinants of Unemployment Durations, NLSY97: Robustness Checks

	Dependent Variable		
	(1)	(2)	(3)
	Log(Duration)	Log(Duration)	Log (Re-employment Hazard)
Search Online	-0.37386***	-0.36119***	0.28146***
	(0.140)	(0.140)	(0.089)
Home Internet Access	-0.15775	-0.10562	0.10709
	(0.136)	(0.144)	(0.093)
AFQT	-0.09825	-0.09084	0.04469
	(0.067)	(0.067)	(0.044)
Black	-0.02968	-0.01273	0.01487
	(0.133)	(0.134)	(0.090)
Hispanic	0.18857	0.18971	-0.10306
	(0.143)	(0.143)	(0.091)
Female	0.23655*	0.25652**	-0.29044***
	(0.126)	(0.125)	(0.079)
Involuntary Job Loss	0.35439***	0.34669***	-0.13388*
	(0.118)	(0.118)	(0.073)
Some High School	-0.06557	-0.04897	-0.00823
	(0.336)	(0.339)	(0.212)
High School Degree	-0.33541	-0.33528	0.18110
	(0.322)	(0.326)	(0.202)
Some College	-0.32538	-0.34159	0.32366
	(0.322)	(0.325)	(0.204)
University Degree	-0.31806	-0.30097	0.27496
	(0.335)	(0.340)	(0.213)
Married	-0.61500***	-0.59339***	0.30411***
	(0.164)	(0.164)	(0.118)
Married*Female	0.71886***	0.70571***	-0.33623**
	(0.234)	(0.234)	(0.157)
Unemployment Rate	0.14672***	0.14427***	-0.11581***
	(0.049)	(0.049)	(0.033)
Observations	840	840	840

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes on Table 5: Columns 1 and 2 are estimated by censored normal regression; coefficients show the change in log duration associated with a unit change in the regressor. Column 3 is estimated by Cox partial likelihood;   coefficients show the change in the log of the re-employment hazard associated with a unit change in the regressor. In this table, "search online" is a continuous variable indicating the share of the respondent's search methods in which he/she used the Internet.   The controls in Column 1 are identical to the most saturated specification in Table 4 (column 7). In addition to the home Internet access dummy, columns 2 and 3 include separate indicator variables for six additional types of locations: school, work, a public library, an Internet café, a friend, or another location.

Table 6: Determinants of Log Wage Changes between old and new job, NLSY97

	(1)	(2)	(3)
Search Online	0.05800	0.04691	0.07480
	(0.043)	(0.044)	(0.050)
Previous Log Wage	0.40074***	0.39953***	0.34949***
	(0.053)	(0.053)	(0.057)
Home Internet Access		0.06442	0.07659
		(0.042)	(0.048)
AFQT			0.02127
			(0.027)
Black	-0.02403	-0.01724	0.01411
	(0.037)	(0.037)	(0.046)
Hispanic	0.07336**	0.07111**	0.09196**
	(0.035)	(0.035)	(0.040)
Female	-0.12581***	-0.12403***	-0.11192**
	(0.041)	(0.041)	(0.049)
Involuntary Job Loss	-0.07484**	-0.07412**	-0.07127*
	(0.035)	(0.036)	(0.039)
Some High School	0.09370	0.09016	0.03476
	(0.073)	(0.072)	(0.081)
High School Degree	0.02444	0.01731	-0.03582
	(0.077)	(0.077)	(0.092)
Some College	0.16630**	0.14830**	0.11004
	(0.075)	(0.074)	(0.089)
University Degree	0.45931***	0.43442***	0.40232***
	(0.077)	(0.077)	(0.097)
Married	0.02254	0.02310	0.06825
	(0.051)	(0.051)	(0.056)
Married*Female	0.03896	0.03933	-0.02519
	(0.069)	(0.069)	(0.077)
Unemployment Rate	-0.02701*	-0.02690*	-0.02686*
	(0.014)	(0.014)	(0.016)
Observations	1,001	996	799

Robust standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

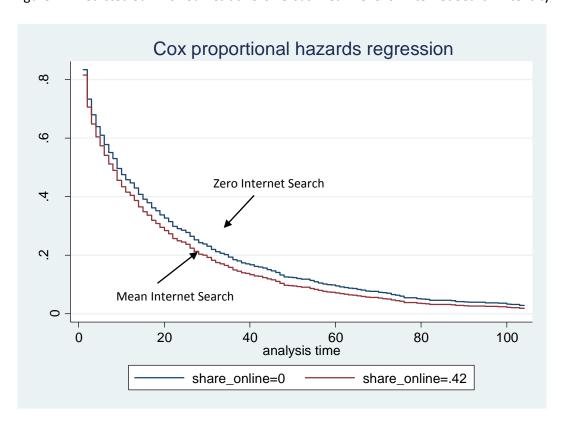Notes on Table 6: Sample and Covariates are identical to Table 4.

Figure 1: Predicted Survivor Curves at Zero versus Mean Level of Internet Search Intensity

Appendix A: NLSY survey questions on job search methods

1. *Unemployed* **Sample.** The following survey question was asked of all respondents with a current job gap; our "unemployed" sample consists of the subset of this group who used at least one active job search method:

 "Please look at this list of activities that people sometime use to find a job. Which of them did you use to look for work?"

2. *Employed* **Sample.** The following survey question was asked of all respondents with a current long-term job, where "long-term" is defined by the NLSY as longer than 3 months. Our "employed searchers" sample consists of all persons who were asked this question, and who listed at least one active job search activity:

"In the past three months, have you done anything to look for work? Please don't include any job search activities you've already told me about." If the answer is yes, the respondent is asked "Please look at this list of activities that people sometimes use to try to find a job. Which of these have you done to look for work?

3. Samples of *searches for current job***.** The following survey question was also asked of all respondents who are currently employed in a long-term job. We use it to construct our sample of the unemployment spells that ended with the current job, and to measure the search methods used during those spells:

"Think back to when you found your current job with [employer name]. Please look at this list of activities that people sometimes use to try to find a job. Which of these did you do to look for work at that time?"

After each of these questions, respondents were presented with the list of the 12 CPS search activities (12 in total) shown in Table 3. After checking off all methods that they used, respondents were then asked, "Of the methods that you used, which of them used the Internet, for example, e-mail or a web-site?"

Appendix B (for online publication): Supplementary Tables

Table B1: Search Methods of Employed Jobseekers

Method	(1) Share of workers using method off line	(2) Share of workers using method on line	(3) Share of workers using method, total (1+2)	(4) Share of method users doing so on line (2/3)
Active Search Methods:				
1. Contacted employer directly	0.15	0.27	0.42	0.64
2. Contacted public employment agency	0.02	0.10	0.12	0.83
3. Contacted private employment agency	0.04	0.06	0.10	0.60
4. Contacted friends or relatives	0.30	0.17	0.47	0.36
5. Contacted school/university employment center	0.01	0.07	0.08	0.88
6. Sent out resumes or filled out applications	0.10	0.56	0.66	0.85
7. Checked unions or professional registers	0.01	0.02	0.03	0.67
8. Placed or answered ads	0.05	0.19	0.24	0.79
9. Other active methods	0.02	0.04	0.06	0.67
A: Total active search methods (sum of (1)-(9))	**0.70**	**1.48**	**2.18**	**0.68**
Passive Search Methods:				
10. Looked at ads	0.10	0.39	0.49	0.80
11. Attended job training programs or courses	0.01	0.01	0.02	0.50
12. Other passive methods	0.03	0.00	0.03	0.00
B: Total passive search methods (sum of (10)-(12))	**0.14**	**0.40**	**0.54**	**0.69**
Total number of search methods (A+B)	**0.84**	**1.88**	**2.72**	**0.69**
Share of active methods in total search (A/(A+B))	0.83	0.79	0.80	-

Notes on Table B1: Sample size of employed jobseekers is 441. Sample weights are applied.

Table B2: Search Methods during Previous Unemployment Spell

Method	(1) Share of workers using method off line	(2) Share of workers using method on line	(3) Share of workers using method, total (1+2)	(4) Share of method users doing so on line (2/3)
Active Search Methods:				
1. Contacted employer directly	0.34	0.25	0.59	0.42
2. Contacted public employment agency	0.04	0.05	0.09	0.56
3. Contacted private employment agency	0.03	0.03	0.06	0.50
4. Contacted friends or relatives	0.31	0.10	0.41	0.24
5. Contacted school/university employment center	0.03	0.06	0.09	0.67
6. Sent out resumes or filled out applications	0.15	0.31	0.46	0.67
7. Checked unions or professional registers	0.01	0.01	0.02	0.50
8. Placed or answered ads	0.05	0.10	0.15	0.67
9. Other active methods	0.02	0.02	0.04	0.50
A: Total active search methods (sum of (1)-(9))	**0.98**	**0.93**	**1.91**	**0.49**
Passive Search Methods:				
10. Looked at ads	0.08	0.18	0.26	0.69
11. Attended job training programs or courses	0.02	0.02	0.04	0.50
12. Other passive methods	0.02	0.00	0.02	0.00
B: Total passive search methods (sum of (10)-(12))	**0.12**	**0.20**	**0.32**	**0.63**
Total number of search methods (A+B)	**1.10**	**1.13**	**2.23**	**0.51**
Share of active methods in total search (A/(A+B))	0.89	0.82	0.86	-

Notes on Table B2: Sample size of employed workers is 1,166. Sample weights are applied.

Table B3: Determinants of Internet Job Search in Alternative Samples, NLSY97

	Sample of Employed Jobseekers			Sample of Previous Unemployment Spells		
	(1)	(2)	(3)	(4)	(5)	(6)
Home Internet Access		0.16782***	0.17595**		0.16536***	0.16558***
		(0.059)	(0.071)		(0.033)	(0.036)
AFQT			0.03275			0.03252*
			(0.027)			(0.020)
Black	-0.02436	-0.00664	0.03431	0.02140	0.03966	0.08011**
	(0.052)	(0.054)	(0.062)	(0.034)	(0.034)	(0.040)
Hispanic	-0.03064	-0.03052	-0.00081	0.03075	0.02861	0.02855
	(0.058)	(0.054)	(0.065)	(0.036)	(0.035)	(0.043)
Female	-0.05059	-0.04698	-0.07321	0.08610***	0.08850***	0.07123**
	(0.051)	(0.051)	(0.056)	(0.032)	(0.032)	(0.035)
Involuntary Job Loss	-0.03270	-0.03723	-0.05624	0.08493***	0.08119***	0.08198**
	(0.045)	(0.045)	(0.052)	(0.030)	(0.030)	(0.034)
Some High School	0.21779	0.21251	0.07613	0.04529	0.03856	0.10795*
	(0.168)	(0.155)	(0.127)	(0.069)	(0.065)	(0.063)
High School Degree	0.22422	0.22777	0.02115	0.13804**	0.11717*	0.16554***
	(0.164)	(0.150)	(0.125)	(0.068)	(0.065)	(0.063)
Some College	0.31310*	0.29143*	0.07278	0.21457***	0.16342**	0.19050***
	(0.162)	(0.149)	(0.117)	(0.069)	(0.067)	(0.065)
University Degree	0.39804**	0.34987**	0.15396	0.47048***	0.39201***	0.38030***
	(0.157)	(0.145)	(0.112)	(0.068)	(0.067)	(0.068)
Married	0.06436	0.05581	0.09322	-0.00143	-0.00422	-0.00943
	(0.057)	(0.055)	(0.059)	(0.043)	(0.043)	(0.044)
Married*Female	-0.09096	-0.07032	-0.09321	0.00405	0.00828	0.04781
	(0.091)	(0.087)	(0.097)	(0.060)	(0.059)	(0.063)
Mean Unemployment	0.00159	0.00985	0.00543			
	(0.017)	(0.018)	(0.018)			
Unemployment Rate				0.00139	0.00046	-0.00136
				(0.012)	(0.012)	(0.013)
Observations	350	347	282	1,054	1,049	840

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes on Table B3: Dependent variable equals one if the respondent engaged in *any* Internet job search, and zero otherwise. All regressions control for age effects (ten-year bins in columns 1 and 2, and single years of age in columns 3-7), and fixed effects for whether the respondent used each of the twelve CPS job search methods.

Table B4: Sample Means, Unemployment Duration Regression Regressions

	CPS	NLSY97
Search online	.242	.553
Home Internet Access	.286	.738
Black	.212	.158
Hispanic	.164	.144
Female	.521	.498
Involuntary Job Loss	.366	.251
Some high school	.173	.140
High School Degree	.353	.227
Some College	.265	.210
University Degree	.161	.383
Married	.281	.288
Observations	669	1,049

Notes on Table B4: Mean unemployment duration in the NLSY97 is 19.8 weeks. Unemployment durations in the CPS are only available in broad categories, so a mean cannot be calculated directly. Predicted mean duration following the interview date for the model in column 4 of Table 4 is 7.9 weeks.