The Internet, Job Search, and Worker Mobility

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Abstract

The Internet represents a large shock to information flows and the nature of market transactions. This paper focuses on how this shock translates into changes in job search. It is likely that the Internet has both reduced search costs, and altered relativities, such as the returns to different types of search, and the ease with which one can search outside the local labor market. I find that in states that adopted the Internet rapidly, the unemployed have expanded their search activities and reallocated their effort across types of job search. The employed also appear to be searching more (or more successfully), with job-to-job flows increasing. Moreover, the Internet has changed the scope of job searches, as information now flows more freely across regional economies, stimulating greater migration across states. While it can be difficult to disentangle whether changes in state labor markets reflect Internet usage or drive Internet adoption, I find a useful instrument that isolates the causal mechanism: the Internet has diffused in much the same way as past innovations, and hence average state ownership rates of household appliances in 1960 describe Internet adoption patterns over the past decade. Disaggregating my main results, I find that the Internet has had the largest effects on the search behavior and mobility of the young and those with at least some college. Estimates on "placebos", such as low-skill workers, show little effect.

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1. Introduction

The past ten years have witnessed an explosion in consumer consumption of Internet content. Because the Internet provides a low-cost mechanism with which to transfer and receive vast amounts of information, the adoption of this technology potentially alters activities impacted by the cost of information transmission. One example is job search. Corporate Web sites providing detailed information about available jobs have proliferated along with private "virtual" employment agencies like Monster.com that serve as a nationwide clearing house promising job seekers "the best job search tools and career advice on the planet." Consumers have turned in droves to the Web to take advantage of this new wealth of employment information with more than one in four online adults visiting job or career information sites in late 2002.[1] This paper investigates how the opportunities provided by the Web have changed job search.

The first question this paper asks is whether job search activity has increased as a result of the Internet. By making it cheaper to apply for jobs and to find job ads, the Internet should cause people to read more ads and apply for more jobs.[2] As such, we should expect an increase in search intensity for job search activities that are made cheaper by the Internet. However, while "search intensity" has a clear meaning in matching models, we lack a good empirical counterpart for this concept. Theory has less clear implications for easily measured job search metrics. For instance, time spent searching for a job may either go up or down depending on the elasticity of substitution between job search and other activities. The most readily available data covering the period of rapid Internet adoption measures job search activity at the extensive margin—the number of search activities in which a person engages. Whether the Internet causes individuals to search more or less extensively depends on the relative price changes of the different job search methods. For example, if emailing friends and contacts is now much easier than before, individuals may decide to forgo another activity such as contacting a union or professional organization. This paper will examine changes in the job search of the unemployed at the extensive margin.

Ultimately, the goal of assessing how Internet job search has changed job search behavior is to ascertain whether it has affected the matching process and thereby changed important labor market outcomes such as reservation wages, match quality, and the duration of unemployment. While Kuhn and Skuterod (2003) have shown that unemployment duration is not lower for Internet job searches, the greatest impact of the Internet may be on the employed if Internet job search

[1] Data are from Forrester Research's 2003 Technographics Benchmark. Individuals who use the Internet were asked how often they use certain types of Web sites.

increases on-the-job search, leading current workers to make better matches.[3] If on-the-job search has risen, we should see an increase in employment-to-employment flows. If the Internet facilitates better matches then productivity may rise leading to higher wages. Alternatively, the increased access to information about outside offers may simply represent a shift in bargaining power toward workers, leading to an increase in wages.

It is important to note that even if the Internet has led job seekers to increase job search activity, the overall effect on the labor market need not be positive. For example, the lower cost of applying for jobs could have ambiguous effects on unemployment, as there may be an offsetting increase in the cost of employers' selection of candidates from the applicant pool.[4] Furthermore Internet technology has also made it easier for firms to identify potential candidates among those who are not actively searching. If firms become more likely to make offers to those who are currently employed, overall match quality may increase at the same time that unemployment duration rises.

The second question this paper asks is whether the Internet has increased the geographic boundaries within which job seekers hunt. It is reasonable to assume that prior to the Internet the cost of job search was a function of the distance of the relevant information. Most newspaper ads are local, and, while available, procuring out-of-town newspapers is more expensive and time-consuming. By contrast, the cost of search on the Internet is independent of the proximity of the job seeker to a potential job. In other words, while the Internet may lower the cost of searching for all jobs, it is unlikely that it does so uniformly. Rather it is likely that it has reduced the cost of searching for jobs in distant locations relative to that for jobs locally.

If this hypothesis is correct then the Internet, by making information about jobs less dependent on the distance of the information from job-seekers, should make workers more likely to migrate from local markets for work related reasons. It should be noted that the US has long been heralded for the extent to which workers are willing to move; they move farther and more readily than their counterparts in other industrialized countries. However, there still exist differences in state unemployment and wage rates that could be potentially arbitraged away by greater worker mobility.

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[2] Implicitly this assumes that job search is not a Giffen good.
[3] Kuhn and Skuterod (2003) find that, conditional on observables, unemployment duration may be higher for Internet job searchers, something that they attribute to sorting on unobservables.
[4] This point is made in Mortensen (2000), Krueger (2000), and Lang (2000).

The paper proceeds as follows: the first section starts by examining CPS data to understand who is online and who is searching for jobs online. Having established that variation in Internet access drives variation in online job search, I examine briefly the difference between the diffusion of the Internet for non-commercial purposes versus commercial Internet usage. In discussing the causes of state level variation in Internet penetration, I identify a novel instrument for consumer Internet usage: adoption rates of previous consumer technological advances. The rest of the paper pursues an empirical strategy that analyzes changes in state online penetration rates to investigate effects of the Internet on labor market outcomes. I examine the effect of rising Internet penetration on job search activity of the unemployed, employment-to-employment flows of the employed, and interstate mobility rates of all labor market participants.

I find that over the past ten years the variety of job search methods used by the unemployed has increased and that the Internet has led to reallocation of effort among various job search activities. Higher Internet penetration is associated with a significantly higher probability of contacting an employer directly and/or looking at job ads. Among employed workers, I find that employment-to-employment flows increase, particularly for those in the private sector with a college degree or higher. Finally, I find that states with a larger rise in Internet penetration rates experienced a higher rate of change in state out-migration between the 1990 and 2000 census, suggesting that the Internet may have led to greater awareness of job opportunities in other states. More puzzlingly, I also find lower inflows for these states, suggesting perhaps that there are other important factors at work.

2. Online Job Search

The Internet has made searching for a job easier, providing freer access to a profusion of job listings, as well as company and career information. Data from the 1998 and 2001 CPS computer usage supplements confirm that once people have access to the Web they do indeed turn to it for job information. Table 1 shows that in 1998 5.7% of adults searched online for jobs, rising to 9.4% by 2001. Of those online, over half of the unemployed and 17% of the employed engaged in online job search in both 1998 and 2001. Overall, 16.9% of those online used the Internet to search for jobs and this proportion was unchanged between 1998 and 2001. In other words, while online job search rose by nearly two-thirds between 1998 and 2001, all of that growth was due to an increase in access to the Internet rather than an increase in the propensity of those using the Internet to look

for jobs online. On the other side of the market, it is clear that the number of job postings has risen, although firm data remains elusive.

Among Internet users there is surprisingly little heterogeneity between demographic groups in the tendency to use the Internet to search for a job. Appendix Table 1 shows the proportions of different demographic groups searching for a job online and then shows the proportion searching for jobs online among those with Internet access. Among those online, income, age, race, and gender differences are only minor for those unemployed. The differences among the employed likely reflect differences in general search activity. For instance, among the employed the young are more likely to search for a job. While I do not have comparative data on offline job search tendencies by the employed, the magnitudes of online job search are worth noting. For instance, 28% percent of employed, online individuals aged 25 to 30 searched for a job online.

Overall, the main differences worth noting are that those with more education are more likely to search for a job online and that employed blacks, conditional on access, are more likely than employed whites to search for a job online.[5] While the former suggests that Internet job search may reflect sorting on observables, the latter suggests the possibility of sorting on unobservables.

Overall, there exist differences in Internet access rates across groups, and these differences drive large wedges in online job search behavior between sub-populations. Thus while, it appears that given access to the Internet, workers of various abilities turn to the Internet to access their opportunities in roughly equal proportions, there remain large differences in access.

3. Consumer Versus Commercial Internet Use

Because Internet access appears to drive greater online job search, variation stemming from aggregate differences in Internet access provides useful variation in Internet job search propensities. Proprietary data obtained from Forrester Research provides data from large annual surveys on whether an individual is actively online (defined as accessing the Web at least 3 times in the past 3 months). These surveys commenced in 1997 and contain roughly 100,000 respondents per year through 2001 and 60,000 per year thereafter. Additionally, Forrester captures retrospective information about when a person first went online allowing data to be constructed back to 1994. I combine current and retrospective data from these surveys to

[5] This point is also made in Kuhn and Skuterod (2003).

measure annual state online penetration rates.[6] Measurements for 1992 and 1993 are interpolated following Goolsbee and Brown (2002).[7] Prior to 1992, Internet penetration, while unmeasured, is effectively zero.

While the literature on Internet adoption has largely focused on its rapid adoption or differences across demographic groups, there exists tremendous variation in online penetration rates across state economies. Table 2 shows the mean, standard deviation, minimum, and maximum of state online penetration rates defined to include those who regularly used the Internet. By 2002 70% of the US used the Internet, but across states this varied from 53% to 80%. Much of the variation in Internet use at the state level reflects long-standing patterns in their speeds of technological adoption. As such, changes in Internet penetration rates are likely correlated with the fixed characteristics of the state, rather than contemporary social, economic, and political trends.

The empirical strategy I will employ throughout this paper is to analyze variation in state online penetration rates over time to investigate the impact of the Internet on labor market outcomes. However, this strategy raises several questions. The first is whether state consumer Internet use merely reflects state commercial Internet usage. If this were true then the mediating mechanism explaining any association between changes in state Internet penetration and changes in job market outcomes may simply reflect the adoption of Internet technology by industry. For example, states with bigger changes in Internet penetration might be states with faster productivity growth due to commercial use.

The second question this strategy raises is whether the mediating mechanism is simply variation in regional business cycles. For example, states with faster growing economies may have citizens with more rapidly increasing purchasing power, some of which may be used to acquire Internet access. In this case, a finding of more employment-to-employment flows, for example, may be caused by macroeconomic conditions rather than Internet job search.

To address the first concern I compare the adoption of the Internet by consumers with that by firms.[8] While adoption by both consumers and firms has occurred at a rapid pace, the

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[6] Forrester provides data for 48 states plus the District of Columbia, omitting Hawaii and Alaska from their surveys.

[7] Goolsbee and Brown calculated rates for 1992 and 1993 by scaling 1994 online usage by the overall rate of growth of domain names. I applied their scaling to my estimates of 1994 online usage; my estimate differs from theirs because I obtained access to a larger set of surveys.

[8] Data on commercial penetration refer to the measure of commercial participation developed in Forman, Goldfarb, and Greenstein (2002).

adoption patterns have not been at all similar.[9] Forman, Goldfarb, and Greenstein (2002) construct a measure of commercial adoption using the Harte Hanks Market Intelligence Survey. They construct two measures of commercial adoption: "participation" and "enhancement". The former represents investment in and adoption of Internet technology by firms while the latter captures the use of technology specifically for competitive advantage such as electronic commerce. Neither of the measures is particularly well-correlated with consumer use: Figure 1 illustrates the relationship between commercial and consumer Internet adoption in 2000 using the more broadly defined "participation" measure of commercial adoption.[10] Regressions of consumer online participation for each year from 1994 through 2003 on commercial penetration in 2000 show no statistically significant relationship, confirming that commercial adoption neither leads nor lags consumer adoption.[11]

The second concern is less easily resolved. While controls can help resolve whether Internet usage is a cause or consequence of changing conditions, the best solution is to develop an instrument that would be correlated with changes in Internet penetration, but not correlated with changes in the business cycle (or other potential mediating mechanisms). To identify a potential instrument, I consider the hypothesis that consumer Internet adoption would follow long-standing patterns in the adoption of household appliances. To test this hypothesis, I examine the relationship between Internet use and adoption of other basic consumer technological improvements. In 1960 only 23% of households had an automatic washer and 76% had a telephone. Figure 2 shows state Internet penetration rates in 2000 graphed against a linear combination of state ownership rates of automatic washing machines and telephones in 1960.[12] The predictive power of these historical patterns of adoption of household appliances for Internet penetration is remarkable. This figure strongly suggests that the Internet is diffusing to households in a pattern similar to other household innovations. As a communication technology,

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[9] Not surprisingly, Web domain registration and household Internet use are also correlated; the more people there are online the more firms there are trying to capture their attention. But Web domain registration does not represent commercial Internet use more generally.

[10] The finding that commercial participation is uncorrelated to household adoption using data from Forrester Research's Technographics Benchmark data matches that found by Forman, Goldfarb, and Greenstein using NTIA estimates of Internet household use.

[11] Earlier years actually show a negative, albeit insignificant, relationship between the two.

[12] Automatic washers differ from manual washing machines. The 1960 census captured information about washing machine ownership and categorized ownership into auto or semi-automatic and those with a wringer or separate spinner. Television and radio are both predictive of Internet use, but are sufficiently correlated with telephone penetration as to add no marginal predictive power. Other appliances, such as dryers and air conditioners were not considered because of the influence of climate on their adoption.

it is unsurprising that Internet penetration closely mirrors that of the telephone (moreover, most Interact access occurs over telephone lines). However, because telephones were further along in the adoption process, the diffusion of automatic washing machines, which were a newer technology in 1960 and therefore were much earlier in the adoption process, provides separate, useful variation. Together, usage of automatic washers and telephones in 1960 provide a reliable instrument for consumer variation in Internet penetration. Throughout the paper, I will find that IV regression yield qualitatively similar, albeit less precise estimates than those of standard OLS regressions on a state-year panel.

4. Job Search by the Unemployed

The data strongly suggest that Internet job search is both important and growing as Internet penetration deepens. Furthermore, stories abound about the flood of resumes received by employers through electronic submission. While unsubstantiated, these claims are consistent with the theoretical prior that lower cost job search should raise search intensity. However, as previously discussed the implications for more readily measured job search metrics are ambiguous. Over the relevant time period—1994 through 2003—the monthly CPS consistently captures the types of job search activities undertaken by the unemployed. Specifically, the unemployed are asked to list all the things that they have done in the previous four weeks to look for a job. The categories do not include Internet job search, but they don't exclude them either. For example, the category "submitted resume" could apply to electronic submission and those who "looked at job ads" could have done so via online or newsprint advertisements.

The Internet is likely to have changed job search at the extensive margin if either Internet search makes methods more complementary—for example if reading job ads online makes you more likely to submit resumes because it can be easily done electronically—or if Internet search changes the relative costs of different job search methods. Looking at the US as a whole, Figure 3 shows that there has been a steady and significant increase in job search by the unemployed—at least at the extensive margin—over the past decade. The national unemployment rate through this period is shown on Figure 3 and it is clear that these increases are not driven by macroeconomic conditions as the average number of search methods rises not only through the recent downturn but also through the long boom.[13] In contrast to what would be expected given the changes in the broader economy over the period, the percentage of the unemployed who sent

[13] Blau and Robbins (1990) show that individuals search more extensively with high unemployment.

out a resume in the previous four weeks rose from 36% in 1994 to 48% at the peak of the boom in 2000, and continued to rise to 55% in 2003 as unemployment rose. Similarly, the proportion looking at job ads rose from 17% to 23% and ultimately 30% over the same period. Moreover, the anonymity of the Web does not appear to be being replacing traditional networking, as the percentage of the unemployed contacting friends or relatives went from 16% to 19% over the period.

Table 3 further explores the relationship between the job search methods of the unemployed and state-level Internet penetration rates. Column B shows the result of the following regression run for each search method:[14]

$$\%\ of\ unemployment\ using\ job\ search\ \ method\ j_{s,t} = \beta\ Online\ Penetration_{s,t} + \sum_{i=0}^{2} \mu_i\ unemployment\ rate_{s,t-i}$$
$$+ \sum_{k} \varphi_k State\ demographic\ characteristics^{k}_{s,t}\ +\ \psi\ \%\ of\ workers\ \ in\ large\ firms_{s,t} + \sum_{s} \eta_s State_s + \varepsilon_{s,t} \qquad (1)$$

These regressions show that each type of job search method became more popular as Internet penetration deepened.[15] All methods had large, statistically significant increases: a change from no Internet to 50% Internet penetration is associated with a 15% increase in the probability of sending out a resume, a 37% increase in the probability of looking at job ads, a nearly 50% increase in the probability of contacting a private employment agency, a 37% increase in the probability of looking at job ads, and a two-thirds increase in "other active search." Summing all search methods shows that on average the unemployed have used two of the methods queried. As expected given the increase shown over the period for all search methods, running equation (1) for total search methods shows a statistically significant and large increase in the extensiveness of job search.

Column C adds year fixed effects to the previously run regressions. These results show that the effects in Column B are largely identified off of the aggregate time series variation: controlling for year fixed effects yields more imprecise estimates—standard errors triple or quadruple in most cases. The within state variation yields a less clear story but suggests that perhaps relative prices of the different search methods have changed. Three of the job search

[14] State demographic characteristics include the proportion of the population who are white, female, married, ages 18 to 30, ages 30 to 50, ages 50 to 65, over age 65, and the share by years of education completed for those with less than 12, 12, 13-15, 16, and 17-20

[15] Because the unemployed, by definition, don't have Internet access from work, I use a slightly different definition of Internet access for these results, restricting online penetration to that at home only. This alternative definition is extraordinarily similar to the broader measure – a regression coefficient of the two is .90 and the two measures yield a correlation coefficient of .99.

methods – looking at ads, contacting an employer directly, and other active search – remain statistically significant and positive. Furthermore, the point estimate is now 4 times larger for contacting an employer directly. Because contacting an employer directly is the most common method of job search used and because previous studies have found that direct employer contact generates the most offers, this change alone could potentially have a large impact on job search activity.[16]

The two methods that show a statistically significant decrease in activity – sending out resumes or answering ads – suggest that increased search is also leading to increased selectivity by the unemployed. Alternatively, given relative price changes it is possible that this pattern simply reflects changing marginal costs with workers increasingly contacting an employer directly rather than sending in a resume.

Columns D and E replace the OLS estimates in columns B and C with instrumental variables estimates. The first stage uses the ownership rates of automatic washers and telephones in the 1960s interacted with year fixed effects as exogenous predictor for state online penetration through time. Instrumenting yields estimates that are qualitatively similar although typically of slightly larger magnitude. Specifications of year fixed effects are less precisely measured and in most cases we can reject neither a zero effect, nor the large effects estimated in columns B and D.

Overall the IV regressions suggest that the Internet has led the unemployed to increase total job search activity at least at the extensive margin, while it also led the unemployed to reallocate effort among various job search activities.

5. On-the-job Search and Employment-to-Employment Transitions

If the Internet reduces the cost of on-the-job search, thereby leading the currently employed to increase their search intensity then we should see an increase in employment flows as workers become more likely to accept outside offers. Further, wages may rise, reflecting both higher productivity matches and increased bargaining power of workers who may use outside offers to extract a higher share of the surplus. However, as long as the current firm has the ability to respond to outside offers, employment-to-employment flows will only reflect increasing match quality and not the bargaining power effect

[16] As in the CPS data presented here, Blau and Robins (1990) find that the most frequently used method of job search is direct employer contact and that this method generates the most employment

I measure employment-to-employment flows using the March CPS from 1988 to the present. The March CPS asks the employed "For how many employers did ... work in [previous year]?"[17] To measure individual employment-to-employment flows at a monthly rate for each person *i*, I calculated[18]:

$$Job\text{-}to\text{-}job\ flow_i = (Number\ of\ employers\ last\ year_i - 1)/12$$

where the sample was restricted to those who worked full-year. Aggregating this measure to state-year averages, I then ran: [19]

$$Job-to-job\ flows_{s,t} = \beta\ Online\ Penetration_{s,t} + \sum_{i=0}^{2}\mu_i\ unemployment\ rate_{s,t-i} + \sum_k State\ demographics_{s,t} + \psi\ \%\ of\ workers\ in\ large\ firms_{s,t} + \sum_s \eta_s State_s + \sum_t \chi Year_t + \varepsilon_{s,t} \quad (2)$$

Table 4 shows both OLS and IV estimates. Both the population-weighted and unweighted OLS regressions yield coefficients that are similar in magnitude and statistically significant. The results for all full-year employed workers suggest that an increase in Internet penetration of 10 percentage points led to a nearly .06 percentage point increase in monthly employment to employment flows, which is roughly a 5% increase. The second row restricts the sample to full-year workers who work in the private sector, slightly increasing the estimated response.

It is unlikely that Internet job search has affected the employment-to-employment flows of all workers equally. For instance, low skill workers already operate in thick labor markets, and the returns to search are unlikely to be large. Additionally, there is substantial variation in the types of jobs that are advertised online, and again there are few low-skill jobs advertised, potentially reflecting the fact that not all workers have similar access to the Internet and, therefore, propensities to search for jobs online (Appendix Table A). Thus, if Internet job search is the mediating mechanism for the increase in employment-to-employment flows, we should see a much smaller effect, or no effect, on those with a high school degree or lower and we should see a larger effect for those with some college education and beyond.

Panel B of Table 4 runs these regressions by education level while continuing to control for state-level worker demographics. The estimated effects of Internet access on employment-to-

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offers.

[17] Respondents are given instructions that if they have more than one employer at same time, they should only count it as one employer.

[18] This measure follows Shimer (2003).

[19] State demographic characteristics include the proportion of the population who are white, female, married, ages 18 to 30, ages 30 to 50, ages 50 to 65, over age 65, and the share by years of education completed for those with less than 12, 12, 13-15, 16, and 17-20

employment job flows are largely as expected, with large effects on those who have been to college and smaller effects on high school graduates. A 10 percentage point increase in Internet access for a full-year employed college graduate working in the private sector leads to more than 15% increase in job change.

The IV results yield less precise and more variable results. While the aggregate results in Panel A are disappointing, disaggregating by education level yields more consistent results, with a large and significant increase in flows among college graduates and little, if any, effect for those with less than a college degree.

Taken together, these results suggest an increase in employment-to-employment flows resulting from higher state-level Internet penetration particularly for those with college degrees. For the same reasons that the unemployed may have increased job search activity, so too there may have been increased search by those with jobs. Ideally, I would have started by examining an actual measure of on-the-job search over the period 1994-2003; however, data limitations are such that I can only examine the *outcome* of such search – employment-to-employment flows.

The shortcomings of an outcome-based measure are obvious – they reflect an equilibrium outcome in which the employed compete with the unemployed, rather than directly pointing to a change in behavior. However, given the inference (above) that the unemployed search more, the rise in employment-to-employment flows is strongly suggestive of a corresponding (and perhaps larger) increase in search intensity by those who are employed.

6. Cross-state Mobility

Thus far the paper has examined whether the Internet has changed job search. I now turn to examining whether the Internet has increased the geographic boundaries within which job seekers search for work.

Previous work has shown that cross-state differences in wages and unemployment are arbitraged away in about five years, but that barriers to US worker mobility limit the extent and speed of this adjustment.[20] These barriers ensure that regional labor market dynamics are both somewhat persistent and important. The Internet, by facilitating the flow of information across

[20] See Borjas (1992) for a summary of why non-immigrants may be slow to move to arbitrage away such differences and Blanchard and Katz (1992) for estimates of how long it takes for a state-specific shock to be arbitraged away.

space, may offset some of these costs.[21] First, job postings online allow jobseekers to investigate openings regardless of the distance to the potential job, and company Web sites allow job seekers to gather more information about the potential fit. Second, Web-based housing and community information reduces the cost of gathering data for a potential move. For instance, http://www.bestplaces.net/ offers cost-of-living calculators and other detailed information to allow side-by-side city comparisons. Finally, email, instant messaging, and Webcams allow for more geographically dispersed personal networks and referrals.

If the Internet does indeed lower the cost of finding information about jobs in distant locations, we would expect to find that those with Internet access are more likely to move than those without Internet access. While there are a myriad of reasons why online usage and the tendency to move may be correlated, Table 5 shows that in the cross-section those online were 14% more likely to move in 2002 than those not online when controlling for income, occupation, gender, age, state of residence, education, and marital status (see Column 2). [22]

Examining the relationship between aggregate changes in mobility and changes in Internet penetration effectively differences out many of the non-causal factors that may drive this correlation. Figure 4a plots state online penetration rates averaged over 1995 to 1999 (and given that prior to 1990 the online penetration rate is zero, this is also the change in penetration compared with a decade earlier) against the difference between 1990 and 2000 in the percent of people in the state that moved out of the state in the 5 years prior to the census. The figure shows that rises in online penetration rates are associated with rises in interstate mobility. The regression line indicates that a ten percentage point increase in online penetration between 1990 and 2000 led to a 1.4 percentage increase in the probability of moving out of state.[23] The result is statistically significant at the 1% level. In contrast, Figure 4b shows no such relationship with a plausible placebo: the change in state outflows from 1970 to 1990.

The results on employment-to-employment flows suggest that the Internet has not affected all workers equally. Since those with more education are more likely to change jobs as a result of Internet access, so too should they be more likely than those with less education to be induced to move. Furthermore, differences in the tendency to move for work, and differences

[21] Previous work on the relationship between cities and the Internet has postulated and shown evidence for the "death of distance". See Kolko (2001).
[22] Data are for the 48 states plus the District of Columbia and are from Forrester Research's 2003 Technographics Benchmark data. Respondents were asked if they had moved in 2002.
[23] Wyoming's decrease in mobility looks to be a puzzling outlier but is equally apparent when examining mobility trends using the CPS.

across groups in online access imply a differential impact across subpopulations. Table 6 provides summary statistics for different groups showing the percent online in 1998, the percent of those online who search for jobs online, the percent moving interstate, and the percent of those moving who cite job related motivations.

While those most likely to be online should also be those for whom the Internet has led to an increase in mobility, there is one caveat to this: those for whom a national job market was well established prior to the Internet should not be affected. For example, those in the top income categories are often in positions where national job searches were the norm prior to the Internet. A clear example of a pre-existing national market is that for university professors. Long before the Internet, aspiring academics sought positions around the country by looking at print versions of listings such as *Jobs for Economists (JOE)* or the *Chronicle of Higher Education*. Equally we should expect there to be little effect on unskilled labor, as these are occupations for which there is little online advertising.[24] Presumably the Internet has the most potential for those in positions that fall in the middle, those with specifically defined skills and for which there was not a well-developed pre-existing national market.

Table 7 reports decadal long difference OLS regressions of the change in state mobility on the change in aggregate state Internet penetration. The first column reports macro regressions in which each regression has 98 observations – one for each state in 1990 and 2000, with each receiving equal weight. The second column reports the same concept in the micro data – where the micro data are weighted to give each state equal weight. The third and fourth columns are similar, but apply state population weights.

The first row of Table 7 reports the results for the total sample. In each of the four specifications the result is statistically significant and large, showing that a 10 percentage point increase in online penetration leads to about a 1 to 1½ percentage point (or 10%) increase in interstate mobility. The second row shows that restricting the sample to those in the labor force yields significant and larger effects. The third row reports the results for those not in the labor force, showing little discernible effect of Internet access on the mobility of this group. Given this finding, the rest of the regressions focus on those who are in the labor force.

The fourth row of Table 7 groups professions such as nurses, dentists, veterinarians, accountants, architects, and dietitians and shows that higher Internet penetration is associated

[24] It should be noted however that Forrester data from 2003 shows that online job search is currently growing fastest among laborers.

with a statistically significant increase in mobility for this group. Alternatively, the next two rows of Table 7 show that the Internet has no statistically significant effect on the mobility of groups for which either there was a pre-existing national market (professors), or for which skills are sufficiently general that there is no need for a national market (laborers). In both cases estimated effects are slightly smaller.

The next group of results in Table 7 shows the mobility among people with different education levels. There is no statistically significant effect on those with less than twelve years of education, presumably because this group holds few specific skills and will therefore be unlikely to find a better job match through online job search. Effects are statistically significant and largest for those with some college education, although differences between the coefficients on those with some college and those with college degrees are minor. The effects on those with a high school degree are significant, but smaller in magnitude.

The same regressions are run for different wage groups. The effects of rising Internet penetration on mobility are largest for those with incomes between the 25th and 90th percentile. There is no statistically significant effect for those with incomes in the top or bottom deciles.

Finally, sample was split by age categories. Not surprisingly, the largest effects were found on those under 25, as that is the group most strongly impacted by rising Internet penetration rates. However, it should also be noted that these results might reflect the Web leading to increased mobility for college. Colleges have reported higher application rates stemming from the Web.[25] Rising Internet penetration also leads to increased mobility for those aged 25 to 45 with little effects on older labor force participants. There remains a smaller, statistically significant effect on those in all age groups when the regressions are run with the states equally weighted; for the population weighted regressions, there is no statistically significant effect on those over 35.

Table 8 replicates Table 7 running two-stage least squares regressions instrumenting for state online penetration averaged over 1995 to 1999 with state automatic washing machine and phone ownership rates in 1960. The results are qualitatively similar and show a similar pattern of coefficients, although instrumenting leads the standard errors to approximately double, making robust statistical conclusion elusive. Only the larger effects on the groups most likely to

[25] Autor (2002) reports a 30% rise in the number of college applicants between 1998 and 2000 are potentially due to electronic applications. While I do not believe there is existing research on whether or not these applicants are coming from a greater distance, it seems likely that this rise

be impacted, such as those younger, in well-defined occupations, and those with some college, are statistically significant.

Thus far I have been discussing state outflows under the assumption that it is the online access of the job seeker that changes the geographic scope of job search. However, employers must also be posting jobs for the seekers to find. Thus, inflows into a state may reflect firms' propensity to post jobs online. As discussed earlier, commercial use of the Internet was at near saturation by 2000 and the small amount of variation that did exist appears uncorrelated with consumer use in any period. Therefore, if firms' propensity to post jobs online is a function of their overall Internet use, then we should expect to see state inflows uncorrelated with the consumer online penetration rate and positively correlated with the firm usage.

Table 9a explores the relationship between state inflows and Internet usage by consumers. Table 9b presents the results of regressions of state inflows on commercial Internet use. While the relationship between mobility and commercial Internet usage are of the expected sign, these are very imprecise estimates reflecting the lack of variation in the independent variable. The results using consumer online penetration are more puzzling, showing a strong, negative relationship. I interpret these counterintuitive findings as perhaps suggesting that caution is required in interpreting the results on state out-migration.

7. Conclusion

In the past ten years Internet usage has risen from effectively zero to 70% of the population. This rapid rise in information technology has the potential to dramatically alter labor market outcomes. The Internet is perceived to have made job search more efficient for workers, yet research has lagged popular perception. This paper makes two main contributions. First, I uncover the driving forces of changing state Internet penetration rates. Second, I trace the effects of this variation on job search activity.

Because this paper analyzes the effect of changing state online penetration rates over time on job search behavior, I consider two alternative explanations for such a relationship. The first is whether state consumer Internet use merely reflects state commercial Internet usage, suggesting that the mediating mechanism may be the use of the Internet by industry (which may lead to sectoral shifts or productivity gains among other things). However, consumer penetration rates are shown to

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comes from students applying to a larger variety of colleges than an increase in those locally seeking admittance.

be uncorrelated with commercial penetration rates. Perhaps most revealing of the relevant driving forces is the fact that previous household appliance adoption predicts consumer Internet use, while state patent rates in 1975 predict commercial participation. Thus, household appliance ownership rates in 1960 provide a strong instrument that is used throughout the paper to attempt to disentangle whether changes in state labor markets reflect Internet usage or drive Internet adoption.

I find that over the past ten years the variety of job search methods used by the unemployed has increased and that the Internet has led to reallocation of effort among various job search activities. Perhaps most importantly, this paper points to an increase in employment flows resulting from the Internet. This finding suggests that the Internet is indeed leading to better job matches and highlights the need for further work to examine the implications of increased match quality. Finally, the mobility results are less conclusive and provide little evidence that the universal nature of the Internet has done little to alter the preference of workers for jobs in their local labor market.

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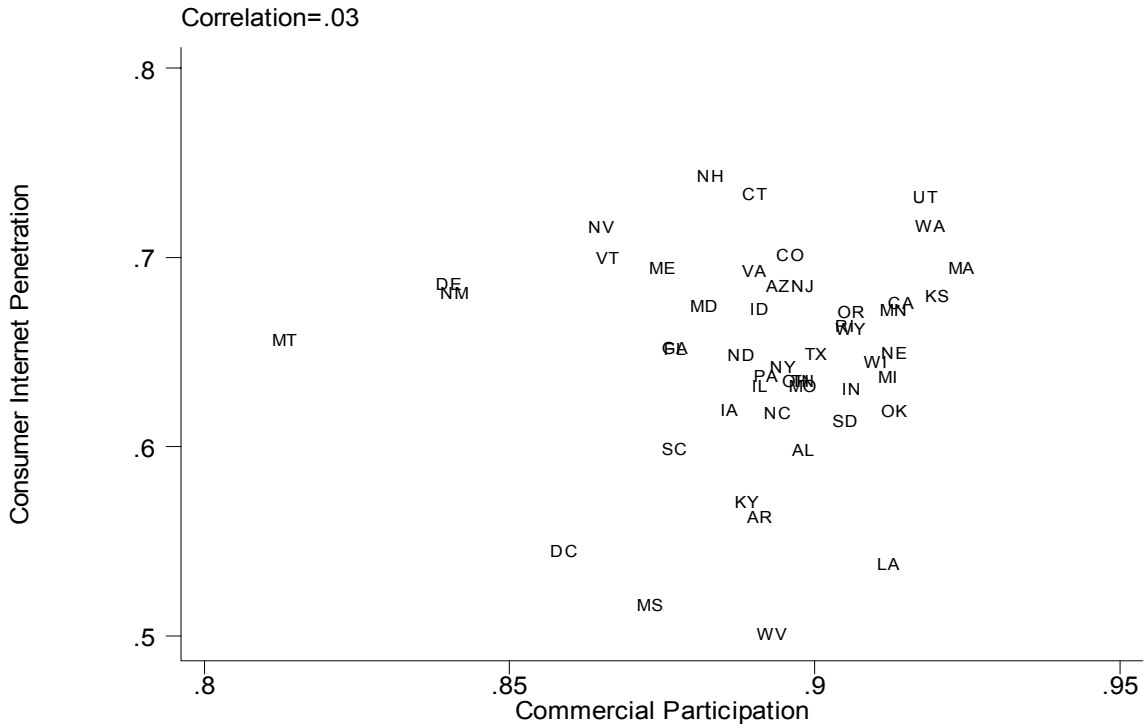
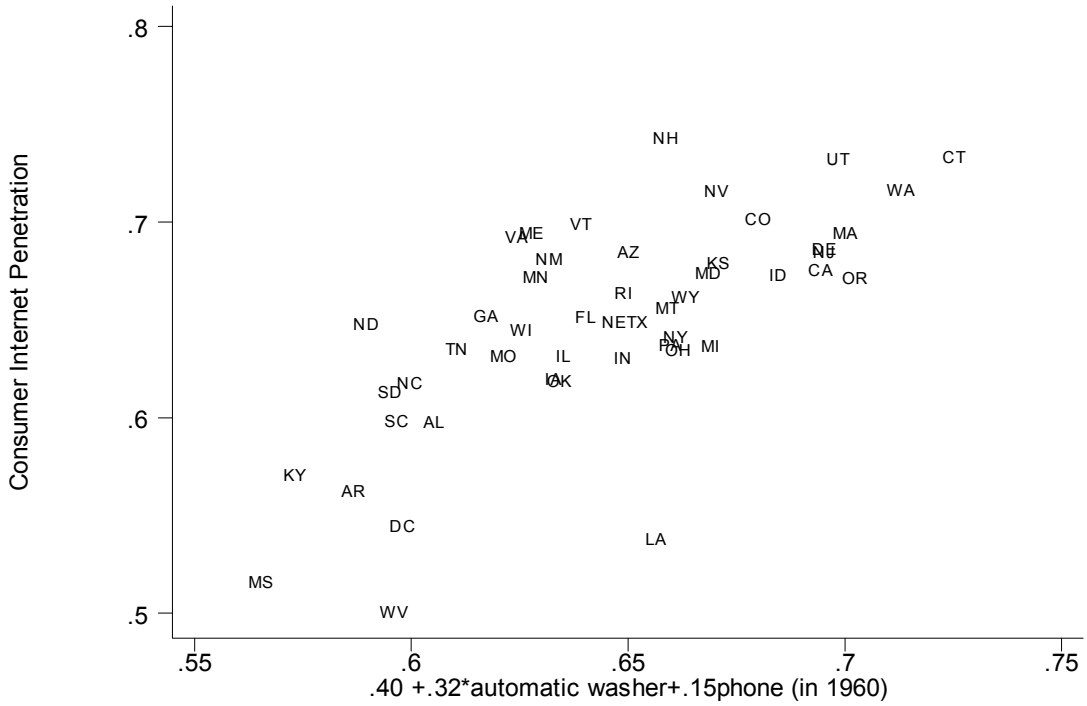
Figure 1: Internet Use: Consumers Versus Firms



Source: Consumer online penetration is state average online use by individuals for 2000 using data from Forrester Research. Commercial Internet participation rates are from Forman, Goldfarb, Greenstein (2002).

Figure 2: Consumer Internet Penetration Predicted by 1960 Phone and Automatic Washing Machine Ownership Rates

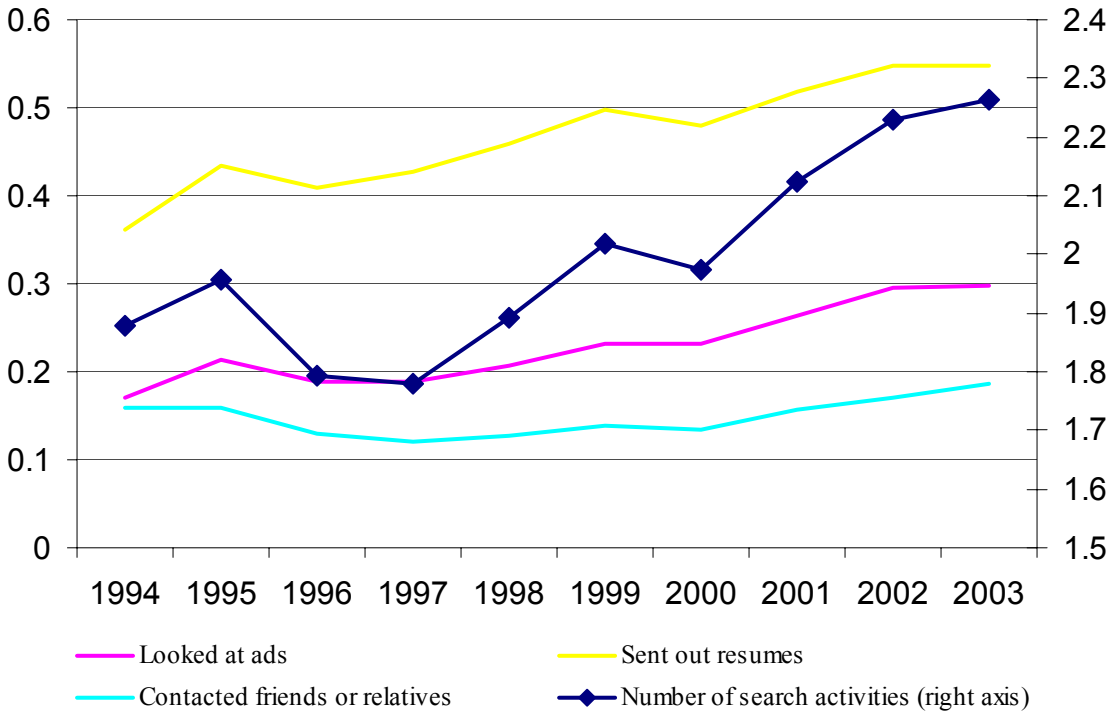


The graph compares actual online penetration measured in 2000 (shown on the y-axis) with that predicted by the following regression shown on the x axis:

$$\text{Online}_{s,\,t=2000} = \alpha + \beta * \text{Own Phone}_{s,\,t=1960} + \delta * \text{Own Automatic Washing Machine}_{s,\,t=1960} + \varepsilon$$

Source: Online penetration is from Forrester Research's proprietary Technographics Benchmark 2001 data. Online is defined to be "online at least 3 times in the last three months" from any location. Automatic washer and phone penetration data are from the Public Use Micro Sample (PUMS) of the 1960 Census of Population.

Figure 3: Job Search Methods of the Unemployed



Source: Monthly Current Population Statistics annual averages of the job search methods by those who are unemployed and looking for work in the four weeks prior to the interview. National unemployment rate is from the Bureau of Labor Statistics.

Figure 4a: Changes in State Migratory Outflows 1990-2000 and Online Penetration Rates

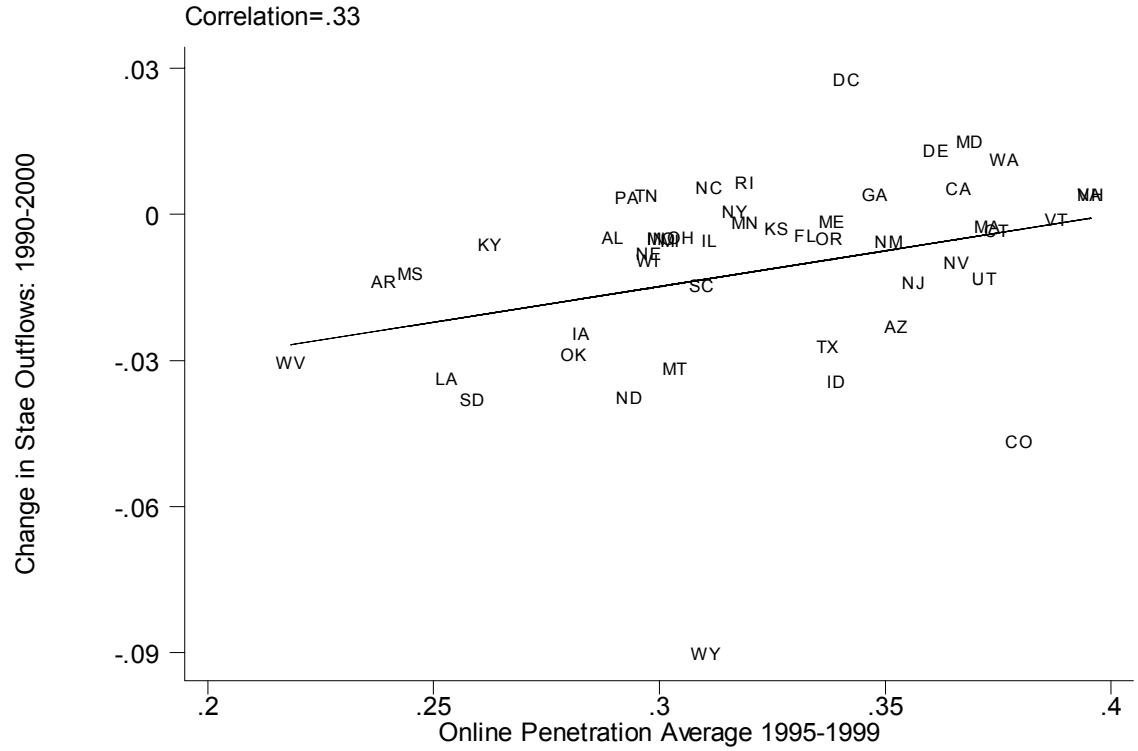
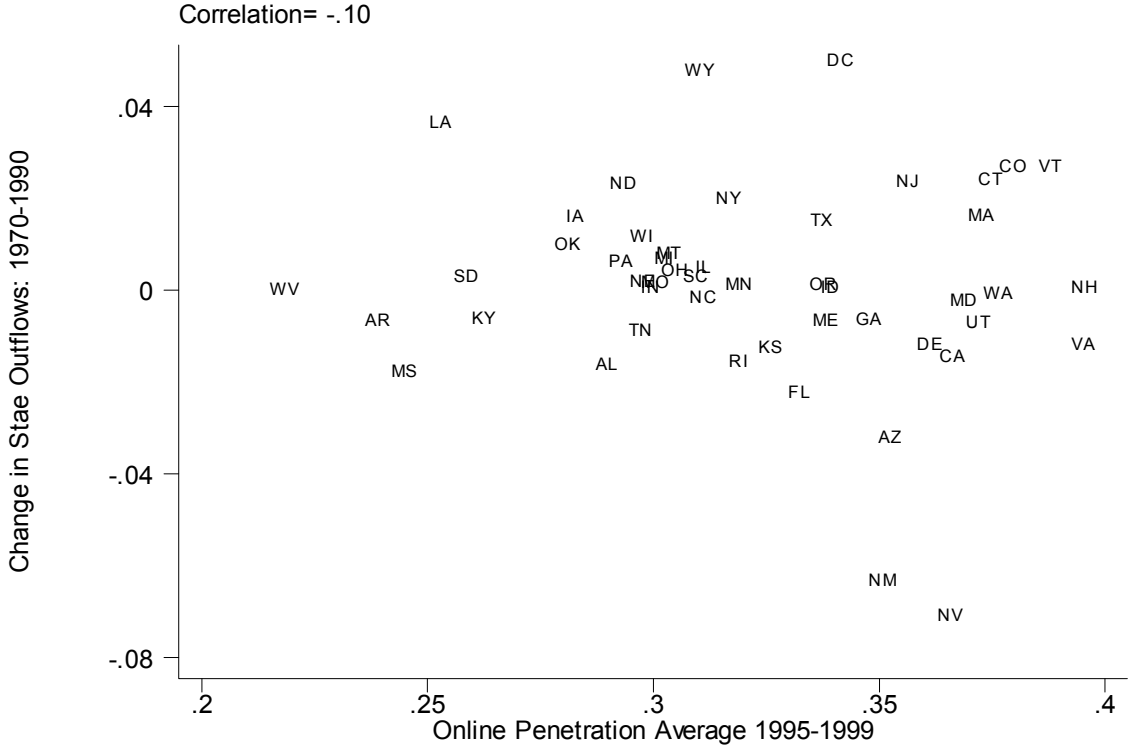


Figure 4b: Changes in State Migratory Outflows 1970-1990 and Online Penetration Rates



Source: State online penetration rates are an average of Forrester's state penetration rates from 1995 to 1999 – the time period over which moves are measured by the census. State migration is from the 5% Public Use Micro Sample (PUMS) of the 1990 Census of Population, the 1% PUMS of the 2000 Census of Population, and the Form 2 State PUMS of the 1970 Census of Population. State outflow is a measure of the proportion of the state's population five years prior who had left the state by census night.

TABLE 1: Online Job Search: Growth from 1998 to 2001

		Percent Searching for Jobs Online			
	Sample	Employed	Unemployed	Not in the labor force	Total
Total Population	1998	7.2%	14.0%	1.9%	5.7%
	2001	11.4%	31.2%	3.3%	9.4%
	Difference	*4.2%*	*17.2%*	*1.4%*	*3.3%*
Online	1998	17.1%	52.6%	11.2%	16.9%
	2001	17.2%	58.8%	9.6%	16.9%
	Difference	*0.1%*	*2.2%*	*-1.6%*	*0.0%*

Source: Data are from the Current Population Statistics Computer Supplement December 1998 and September 2001. Online are individuals who access the Internet from any location.

TABLE 2: State Online Penetration Rates

	Mean	Standard Deviation	Minimum	Maximum
1992	2%	1%	1%	3%
1993	4%	1%	2%	7%
1994	7%	2%	4%	12%
1995	12%	3%	7%	18%
1996	20%	4%	12%	27%
1997	30%	5%	19%	39%
1998	44%	5%	31%	54%
1999	56%	5%	41%	65%
2000	65%	5%	50%	74%
2001	68%	5%	54%	77%
2002	70%	6%	53%	80%

Source: Online penetration numbers are from come from Forrester Research's proprietary data where online is defined to be "online at least 3 times in the last three months" from any location. State-year penetration numbers are calculated from 5 years of survey data including retrospective data on how long the respondent had been online. For example, state data for 1999 is calculated by combining current reports in 1999 and retrospective reports in 2000-2003. Data for 1992 and 1993 is interpolated following Goolsbee and Brown (2002): by scaling 1994 online usage by the overall rate of growth of domain names. I applied their scaling to my estimates of 1994 online usage.

TABLE 3: Job Search Methods: The Effect of the Internet on the Extensiveness of Job Search

		Effect of the Internet on the probability of using each method			
Dependent Variable	**Mean**	**OLS Results**		**IV Results[#]**	
	Column A	*Column B*	*Column C*	*Column D*	*Column E*
Contacted employer directly	63%	.039**	.166***	.029	.176
		(.019)	(.064)	(.020)	(.136)
Contacted public employment agency	21%	.068***	-.019	.080***	.260*
		(.018)	(.061)	(.018)	(.148)
Contacted private employment agency	6%	.059***	-.012	.064***	-.028
		(.009)	(.027)	(.009)	(.066)
Contacted friends or family	13%	.070***	-.075	.083***	.047
		(.010)	(.050)	(.015)	(.123)
Sent resume	48%	.139***	-.159**	.169***	.210
		(.026)	(.077)	(.027)	(.207)
Contacted union or professional org	2%	.007*	-.016	.009*	.026
		(.004)	(.015)	(.004)	(.030)
Placed ad or answered ad	15%	.056***	-.167***	.071***	-.242***
		(.018)	(.051)	(.019)	(.111)
Looked at ads	23%	.170***	.114*	.174***	.125
		(.019)	(.070)	(.019)	(.132)
Other form of active search	5%	.066***	.077***	.065***	.101*
		(.008)	(.026)	(.008)	(.060)
Number of methods used	2.0	.681***	-.101	.766***	.663*
		(.058)	(.177)	(.061)	(.411)
Controls					
State unemployment rate		√	√	√	√
State demographic characteristics		√	√	√	√
Percent of state workers in firms with 1,000 or more employees		√	√	√	√
State fixed effects		√	√	√	√
Year fixed effects			√		√

*** and ** indicate statistically discernible from zero at the 1% and 5% levels, respectively.

[#] First stage regression for IV estimates: $Online_{s,t} = \alpha + \sum_t \phi_t Year_t * Washers_{1960_s} + \varphi \sum_t Year_t * Phone_{1960_s} + \sum_t \delta Year_t + \sum \upsilon_s State_s + X_{i,s,t}\lambda_s + \varepsilon_{s,t}$

Robust standard errors are in parentheses. State-level demographic characteristics control for the fraction of the state's total population who are white, married, ages 18 to 30, ages 30 and 50, ages 50 and 65, over age 65, and the share by years of education completed for those with less than 12, 12, 13-15, 16, and 17-20.

Source: Job search data reflect annual data from 1994 through 2003 created from the monthly Current Population Statistics by aggregating over 12 months, with the exception of 2003 for which only the first 9 months were available. Online penetration numbers are from come from Forrester Research's proprietary data where online is defined to be "online at least 3 times in the last three months" from any location. State-year penetration numbers are calculated from 5 years of survey data including retrospective data on how long the respondent had been online. Data on online use gathered in December were matched to job search behavior in January through December of the following year.

TABLE 4: Employment-to-Employment Flows

$$Job-to-job\ flows_{s,t} = \beta\, Online\ Penetration_{s,t} + \sum_{i=0}^{2} \mu_i\, unemployment\ rate_{s,t-i} + \sum_{k} State\ demographics_{s,t} + \psi\ \%\ of\ workers\ in\ large\ firms_{s,t} + \sum_{s} \eta_s State_s + \sum_{t} \chi Year_t + \varepsilon_{s,t}$$

		OLS Estimates		IV Estimates	
Sample	**Mean[1]**	**States weighted equally**	**Population-weighted**	**States weighted equally**	**Population-weighted**
Panel A: Aggregate Results	*Column A*	*Column B*	*Column C*	*Column D*	*Column E*
All full-year employed	1.0%	.592** (.279)	.611** (.312)	-.037 (.479)	.129 (.522)
Full-year employed in private sector	1.1%	.773*** (.308)	.780*** (.333)	.302 (.524)	.243 (.554)
Panel B: By education Status (full-time employed in private sector)					
High School Graduate	1.0%	-.030 (.449)	-.118 (.474)	-.843 (.766)	-1.13 (.851)
Some college	1.3%	1.23** (.625)	1.42** (.670)	.653 (1.02)	.281 (1.11)
College degree or higher	1.1%	1.71*** (.575)	1.39*** (.619)	1.94** (.950)	1.69* (.981)
Controls					
State fixed effects		√	√	√	√
Year fixed effects		√	√	√	√
Demographic characteristics of labor force		√	√	√	√
Percent of state workers in firms with 1,000 or more employees		√	√	√	√
State unemployment rate		√	√	√	√
Two lags of the state unemployment rate		√	√	√	√

*** and ** indicate statistically discernible from zero at the 1% and 5% levels, respectively.

Robust standard errors are in parentheses. State-level demographic characteristics control for the fraction of the state's employed population who are white, female, married, ages 18 to 30, ages 30 to 50, ages 50 to 65, over age 65, and the share by educational attainment for those with a high school degree or less and for those with a college degree or above.

Source: Job search data reflect annual data from 1988 through 2003 created from the March CPS. Online penetration numbers are from come from Forrester Research's proprietary data.

[1]Regression coefficients are multiplied by 100 to aid interpretability.

TABLE 5: Cross-sectional Data On Mobility and Internet Use

Dependent variable: Did you move in the past year?		
Independent Variable	**No Controls**	**Full Controls**
Online	.013***	.006***
	(.002)	(.002)
Implied Elasticity	22%	14%
Number of Observations	51,974	51,974
R^2	.00	.06
Controls		
State fixed effects		√
Age		√
Gender		√
Race		√
Education		√
Marital status		√
Household Income		√
Occupation		√

*** and ** indicate statistically discernible from zero at the 1% and 5% levels, respectively. Dependent variables is an indicator variable that represents whether the individual moved in the past year; the population mean of which is 5.9%. Robust standard errors are in parentheses. Controls are included as a saturated set of dummies.

Source: Data are from Forrester Research's 2003 Technographics Benchmark data.

TABLE 6: Online Job Search and Mobility by Demographic Group

	Sample	Percent Online 1998 CPS Supplement	Percent of Online Who Search for Jobs Online	Percent moving interstate (2000)	Moving For Job Related Reasons (% of interstate movers)
		Column A	*Column B*	*Column D*	*Column E*
	Total Population	33.6%	16.9%	11.6%	42.1%
Labor force status	Population in the Labor Force	41.5%	17.9%	12.3%	47.6%
	Population not in the labor force	16.7%	11.2%	10.4%	26.5%
Occupation Categories	Mid-level professionals	59.5%	20.1%	13.3%	60.4%
	Farm workers	13.6%	7.0%	17.0%	47.4%
	Professors	84.0%	19.8%	24.0%	87.1%*
Education Categories	High School Drop-Out	6.4%	12.3%	9.9%	28.9%
	High School Graduate	20.7%	13.0%	8.8%	35.7%
	Some college	42.5%	17.0%	11.8%	40.1%
	College	61.6%	19.1%	16.7%	57.1%
Wage Income Categories	Bottom 25%	32%	5%	13%	40
	25-50%	32%	6%	13%	44
	50-75%	46%	9%	11%	51
	75-90%	57%	11%	10%	58
	Top 10%	72%	14%	13%	70
Age Categories	18-25 year olds	44.0%	17.9%	19.6%	41.1%
	25-35 year olds	42.1%	23.1%	18.5%	50.5%
	35-45 year olds	39.8%	16.7%	10.7%	49.0%
	45-65 year olds	32.0%	12.0%	7.1%	36.0%
	Over 65	6.7%	3.2%	4.9%	3.3%

For Professors "attending college" is counted as a work-related moving reason. If Professors are further restricted to those with professional degrees or doctorates, and "attending college" as a reason to move is no longer relevant. Among this group, 77.8% of movers moved for work-related reasons.

Source: Percent online and percent searching for a job online are from the 1998 Current Population Statistics Computer Use Supplement. Percent moving is from the 2000 census. Percent moving for work related reasons is from the CPS March Supplements for 1998 and 1999.

TABLE 7: Long Differences Regressions
Change in State Outflows on Change in Online Penetration 1990-2000

	Sample	Macro (States equally weighted)	Micro (States equally weighted)	Macro (Population weighted)	Micro (Population weighted)
		Column A	*Column B*	*Column C*	*Column D*
	Total Population	.147*** (.048)	.140*** (.039)	.100* (.054)	.100* (.045)
Labor force status	Population in the Labor Force	.174*** (.064)	.184*** (.055)	.158** (.069)	.165*** (.058)
	Population not in the labor force	.094* (.055)	.056 (.039)	-.004 (.040)	-.022 (.033)
Occupation Categories	Mid-level professionals	.154** (.078)	.181** (.084)	.165** (.082)	.182** (.074)
	Unskilled Labor	.145 (.130)	.139 (.094)	.096 (.092)	.121* (.061)
	Professors	.141 (.310)	.045 (.193)	.083 (.175)	.054 (.122)
Education Categories	High School Drop-Out	.042 (.075)	.053 (.055)	.127 (.100)	.162 (.097)
	High School Graduate	.178*** (.059)	.171*** (.047)	.164** (.074)	.143*** (.053)
	Some college	.223*** (.068)	.234*** (.061)	.215*** (.069)	.214*** (.060)
	College	.205* (.119)	.237*** (.096)	.187** (.089)	.198*** (.075)
Wage Income Categories	Bottom 10%	.055 (.069)	.043 (.056)	.045 (.074)	.056 (.063)
	10-25%	.147* (.088)	.148 (.075)	.111 (.072)	.117* (.061)
	25-50%	.292*** (.067)	.272*** (.058)	.284*** (.080)	.269*** (.068)
	50-75%	.193** (.083)	.211*** (.070)	.183** (.075)	.189*** (.061)
	75-90%	.160* (.093)	.234*** (.069)	.132 .112	.183*** (.073)
	Top 10%	.059 (.140)	.095 (.100)	.017 (.112)	.055 (.080)
Age Categories	18-25 year olds	.477*** (.123)	.466*** (.102)	.426*** (.102)	.407*** (.082)
	25-35 year olds	.169** (.083)	.210*** (.066)	.178** (.086)	.220*** (.071)
	35-45 year olds	.127** (.065)	.132*** (.053)	.109* (.065)	.113** (.058)
	45-65 year olds	.071* (.040)	.077** (.034)	.043 (.034)	.042 (.029)

Standard errors (shown in parentheses) are clustered at the level of 98 state-year cells. ***, **, and * indicate statistically significant at the 1%, 5% and 10% levels.

Source: 1990 and 2000 Censuses of Population, IPUMS, 5% sample (Ruggles and Sobek 1997). Data are for 48 states plus the District of Columbia. Online penetration numbers are from come from Forrester Research's proprietary data where online is defined to be "online at least 3 times in the last three months".

Specifications: Micro regressions include as controls a saturated set of dummy variables for year of sample, state of previous residence, age, race, gender, marital status, and education. Age category regressions do not include controls for age and education category regressions do not include controls for education.

TABLE 8: IV Estimates of the Change in State Outflows on Change in Consumer Online Penetration 1990-2000

	Sample	Macro (States equally weighted)	Micro (States equally weighted)	Macro (Population weighted)	Micro (Population weighted)
		Column A	*Column B*	*Column C*	*Column D*
	Total Population	.029 (.095)	.035 (.079)	.051 (.078)	.068 (.066)
	Population in the Labor Force	.011 (.132)	.035 (.112)	.102 (.101)	.124 (.084)
	Population not in the labor force	.050 (.072)	.011 (.050)	-.048 (.068)	-.059 (.056)
Occupation Categories	Mid-level professionals	.137 (.142)	.191* (.111)	.197* (.113)	.220** (.092)
	Unskilled Labor	-.271 (.455)	.113 (.157)	-.012 (.171)	.146* (.085)
	Professors	-.347 (.621)	-.637 (.479)	.120 (.269)	.016 (.209)
Education Categories	High School Drop-Out	-.182 (.160)	-.159 (.121)	.100 (.164)	.153 (.163)
	High School Graduate	.077 (.115)	.061 (.090)	.147 (.109)	.103 (.077)
	Some college	.099 (.151)	.108 (.136)	.159 (.101)	.159* (.085)
	College	.138 (.189)	.124 (.171)	.227** (.116)	.244*** (.093)
Wage Income Categories	Bottom 10%	-.042 (.092)	-.088 (.077)	-.000 (.084)	.037 (.084)
	10-25%	-.003 (.154)	.034 (.130)	-.013 (.111)	.001 (096)
	25-50%	.082 (.156)	.100 (.130)	.218*** (.130)	.213** (.114)
	50-75%	.026 (.190)	.046 (.166)	.141** (.103)	.161** (.082)
	75-90%	.013 (.178)	.104 (.139)	.122 .133	.210** (.104)
	Top 10%	-.057 (.202)	-.100 (.208)	-.028 (.134)	.039 (.103)
Age Categories	18-25 year olds	.333*** (.213)	.309** (.183)	.432*** (.124)	.405*** (.106)
	25-35 year olds	-.058 (.149)	.018 (.114)	.038 (.119)	.135*** (.095)
	35-45 year olds	-.070 (.143)	-.048 (.121)	.053 (.105)	.078*** (.092)
	45-65 year olds	-.106 (.121)	-.088 (.101)	-.032 (.066)	-.022 (.050)

Standard errors (shown in parentheses) are clustered at the level of 98 state-year cells. ***, **, and * indicate statistically significant at the 1%, 5% and 10% levels.

Source: 1990 and 2000 Censuses of Population, IPUMS, 5% sample (Ruggles and Sobek 1997). Data are for 48 states plus the District of Columbia. Online penetration numbers are from come from Forrester Research's proprietary data where online is defined to be "online at least 3 times in the last three months" from any location.

Specifications: Micro regressions include as controls a saturated set of dummy variables for year of sample, state of previous residence, age, race, gender, marital status, and education.

TABLE 9a: Long Differences Regressions
Change in State Inflows on Change in Consumer Online Penetration 1990-2000

	Sample	Macro (States equally weighted)	Micro (States equally weighted)	Macro (Population weighted)	Micro (Population weighted)
	Total Population	-.118***	-.099***	-.196***	-.194***
		(.044)	(.032)	(.100)	(.072)
Labor force status	Population in the Labor Force	-.165***	-.145***	-.251**	-.240***
		(.053)	(.041)	(.111)	(.080)
	Population not in the labor force	-.010	-.013	-.074	-.139**
		(.049)	(.036)	(.083)	(.066)

TABLE 9b: Long Differences Regressions
Change in State Inflows on Change in Industry Online Penetration 1990-2000

	Sample	Macro (States equally weighted)	Micro (States equally weighted)	Macro (Population weighted)	Micro (Population weighted)
	Total Population	.173	.097	.029	.040
		(.153)	(.113)	(.390)	(.274)
Labor force status	Population in the Labor Force	.165	.136	.035	.043
		(.169)	(.113)	(.447)	(.297)
	Population not in the labor force	.156	.034	011	.042
		(.143)	(.126)	(.286)	(.254)

Robust standard errors (shown in parentheses) are clustered at the level of 98 state-year cells. ***, **, and * indicate statistically significant at the 1%, 5% and 10% levels.
Source: 1990 and 2000 Censuses of Population, IPUMS, 5% sample (Ruggles and Sobek 1997). Data are for 48 states plus the District of Columbia. Online penetration numbers are from come from Forrester Research's proprietary data where online is defined to be "online at least 3 times in the last three months" in any location. Commercial Internet penetration rates are from Forman, Goldfarb, Greenstein (2002).
Specifications: Micro regressions include as controls a saturated set of dummy variables for year of sample, state of previous residence, age, race, gender, marital status, and education.

APPENDIX TABLE 1: Percent Searching For A Job Online Among Demographic Groups

		Sample	Percent Searching for Jobs Online 1998 CPS Supplement			Percent Searching for Jobs Online 2001 CPS Supplement		
			Employed	Unemployed	Not in the labor force	Employed	Unemployed	Not in the labor force
Gender	**Total population**	Women	6.4%	13.4%	1.9%	11.8%	31.1%	3.4%
		Men	7.6%	12.9%	2.3%	10.9%	28.6%	3.1%
	Online population	Women	15.1%	47.6%	8.2%	16.8%	54.9%	9.2%
		Men	18.0%	43.8%	10.5%	17.0%	54.7%	8.5%
Race	**Total population**	White	7.1%	14.1%	1.8%	11.2%	32.2%	3.1%
		Black	6.3%	8.7%	1.6%	11.3%	20.0%	4.2%
		Asian	9.0%	17.8%	3.6%	13.9%	43.9%	5.2%
	Online population	White	15.9%	44.7%	8.5%	16.2%	54.8%	8.1%
		Black	23.0%	48.9%	15.5%	21.8%	52.3%	16.9%
		Asian	20.5%	49.4%	12.0%	19.8%	65.5%	10.2%
Education Categories	**Total population**	High School Drop-Out	1.5%	3.4%	0.9%	3.2%	8.3%	1.6%
		High School Graduate	3.2%	8.9%	1.1%	6.9%	20.1%	2.3%
		Some college	8.1%	22.8%	3.6%	12.6%	40.1%	5.7%
		College	13.5%	36.2%	4.1%	19.3%	68.8%	5.8%
		Post graduate	12.7%	50.3%	2.7%	16.4%	66.6%	4.7%
	Online population	High School Drop-Out	7.4%	16.3%	5.1%	9.5%	23.5%	6.2%
		High School Graduate	12.4%	45.7%	10.2%	13.1%	45.7%	8.3%
		Some college	17.3%	52.1%	11.8%	17.1%	60.9%	11.3%
		College	20.5%	63.1%	12.1%	21.6%	77.5%	9.7%
		Post graduate	17.3%	85.0%	7.6%	17.9%	75.2%	8.1%

APPENDIX TABLE 1 CONTINUED: Percent Searching For A Job Online Among Demographic Groups

		Sample	Percent Searching for Jobs Online 1998 CPS Supplement			Percent Searching for Jobs Online 2001 CPS Supplement		
			Employed	Unemployed	Not in the labor force	Employed	Unemployed	Not in the labor force
Household Income Categories	**Total Population**	Less then $20K	4.6%	7.3%	1.5%	9.2%	18.0%	2.0%
		$20K to $40K	6.4%	13.8%	1.6%	11.4%	30.4%	2.9%
		$40K to $60K	7.5%	19.5%	2.9%	11.9%	32.4%	4.4%
		Above $60K	9.5%	26.6%	2.9%	13.9%	49.5%	5.5%
	Online Population	Less then $20K	20.9%	41.5%	16.3%	24.2%	54.1%	12.4%
		$20K to $40K	20.3%	47.0%	9.7%	21.2%	58.7%	9.1%
		$40K to $60K	16.6%	54.0%	9.4%	17.1%	48.6%	8.5%
		Above $60K	15.2%	45.8%	5.9%	15.3%	59.0%	7.8%
Age Categories	**Total Population**	18-25 year olds	8.4%	10.7%	5.9%	16.6%	28.7%	9.9%
		25-30 year olds	12.1%	14.4%	6.1%	19.3%	36.0%	7.7%
		30-35 year olds	8.9%	12.3%	4.4%	14.8%	34.7%	7.6%
		35-40 year olds	7.0%	14.6%	3.2%	11.5%	31.0%	6.5%
		40-45 year olds	6.9%	18.3%	2.8%	10.0%	33.5%	4.9%
		45-50 year olds	6.5%	17.3%	2.4%	8.9%	32.8%	5.4%
		50-55 year olds	4.0%	24.7%	1.6%	6.1%	36.2%	2.4%
		55-65 year olds	2.6%	12.5%	0.5%	4.0%	25.7%	1.1%
		65 year olds	0.8%	3.7%	0.1%	3.1%	27.9%	.8%
	Online Population	18-25 year olds	18.5%	33.8%	13.9%	24.3%	46.8	15.0
		25-30 year olds	25.8%	61.9%	22.3%	27.5	66.0	15.6
		30-35 year olds	20.0%	56.6%	15.8%	20.9	67.7	14.3
		35-40 year olds	16.4%	69.0%	12.6%	16.6	63.1	13.7
		40-45 year olds	15.6%	65.2%	12.2%	14.5	68.2	11.4
		45-50 year olds	14.7%	59.4%	10.9%	13.1	69.6	12.8
		50-55 year olds	10.3%	72.0%	9.3%	9.4	71.2	6.5
		55-65 year olds	8.6%	54.7%	3.7%	7.2	59.1	3.6
		65 year olds	4.8%	41.8%	2.4%	3.9	31.6	1.4

Source: Data are from the Current Population Statistics Computer Supplement December 1998 and September 2001.