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Working Paper

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ifo Working Paper, No. 147

Provided in Cooperation with:

Ifo Institute – Leibniz Institute for Economic Research at the University of Munich

Suggested Citation: Mang, Constantin (2012) : Online Job Search and Matching Quality, ifo Working Paper, No. 147, ifo Institute - Leibniz Institute for Economic Research at the University of Munich, Munich

This Version is available at:

<https://hdl.handle.net/10419/73796>

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ifo Working Papers

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Ifo Working Paper No. 147

November 2012

An electronic version of the paper may be downloaded from the Ifo website
www.cesifo-group.de.

Online Job Search and Matching Quality*

Abstract

The Internet has fundamentally changed the way workers and firms are matched on the job market. Compared to newspapers and other traditional employment resources, online job boards presumably lead to better matches by providing a wider choice of job advertisements and more sophisticated methods for finding suitable vacancies. This study investigates the association of online job search and matching quality using individual-level data from the German Socio-Economic Panel (SOEP). My results show that job changers who found their new job online are better matched than their counterparts who found their new job through newspapers, friends, job agencies, or other channels.

JEL Code: L86, J64.

Keywords: Internet, job search, matching quality.

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* Comments by Oliver Falck, Ludger Woessmann, and participants at the ITS Conference in Budapest, the ICTNET Workshop in Mannheim and the ZEW Conference on the Economics of ICT in Mannheim are gratefully acknowledged. The research underlying this paper was partially supported by Deutsche Telekom AG. The views expressed are those of the author and do not necessarily reflect the view of Deutsche Telekom AG.

1 Introduction

An increasing number of people use the Internet to look for new jobs. One reason online job search has become so popular is that it has changed the search process considerably. Employment websites such as Monster.com allow job seekers to access thousands of job offers and use intelligent filter mechanisms to find suitable vacancies. Additionally, online job descriptions provide more detailed information than traditional help-wanted ads in newspapers and magazines. Employers benefit from the better targeting options of Internet job advertisements and are able to screen online applications more efficiently. As a result, the matching process in the labor market has not only become more efficient, but the quality of job matches should be better.

This paper provides first evidence that online job search is associated with higher matching quality. Using micro-level data from the German Socio-Economic Panel (SOEP), I compare employees who found a job online with those who found a job through newspaper advertisements, friends, or other channels. I show that Internet job finders can make better use of their skills, are more content with their work, and believe themselves to have a higher chance of promotion and more job security.

My results indicate that the Internet is an especially valuable job search tool for workers who are distant from the labor market. Job seekers with employment interruptions have significantly better matching outcomes if they find a new job through the Internet. While women with children below the age of 16 generally have inferior results after starting a new job, this negative association is alleviated for those of them who use online job search. I find a similar relationship for job seekers in rural areas; the disadvantage due to remoteness is remedied if they find a job through the Internet. However, for workers who were unemployed before they found a new job, I do not observe a positive association with online job search. It seems that unemployed workers are not able to use the Internet to their advantage, perhaps due to a lack of necessary skills.

By restricting the sample to workers who found their previous job offline and their current job either offline or online, I can compare the improvement in match quality after a job change conditional on the job search channel. I show that my results hold even if I compare online job seekers only to those who found their job through newspapers and friends. When I compare different search channels to the employment office, I find that only the Internet is associated with significantly higher matching quality. I am able to mitigate numerous selection concerns by robustness tests and providing additional evidence from the German Internet job search market.

The reason the Internet has such a profound impact on the job matching process involves more than the wider selection of job opportunities, better search possibilities, and cheaper access to information. The Internet has introduced new ways of passive job search and allows firms to easily search for applicants.

Career-oriented social networks such as LinkedIn and online job boards such as Monster.com allow users to maintain online CVs that can be found by interested employers. Before the advent of the Internet, the direct targeting of talent by firms was feasible only through headhunters and mainly used to fill executive positions. Allowing firms to tap into a large pool of passive job seekers, all of whom provide detailed information about their skills and experiences, results in more informed hiring decisions and contributes to better match quality.

Krueger (2000b) was one of the first to note that by reducing the cost of information, the Internet allows workers and employers to learn more about each other and thereby improves the quality of job matches. Autor (2001) points out that due to the Internet, workers and firms are able to consider more potential match partners, which raises the minimum match quality they are willing to accept. The higher match quality in turn leads to higher output and earnings. While Autor acknowledges that better match quality should reduce job separations, he also states that the wider use of on-the-job search has the potential to offset this effect. The increasing popularity of CV databases and career networks such as LinkedIn, which was launched one year after Autor published his article, gives his on-the-job search argument additional weight. Freeman (2002) argues that better job matches might be the strongest macroeconomic consequence of online job search. Regarding unemployment duration, he suspects that the lower cost of search might ultimately lead to longer search times as workers and firms will consider more possible matching partners. Kuhn (2003) draws on classic partial-equilibrium search models and hypothesizes that by increasing the arrival rate of offers and decreasing search costs, online job search should lead to shorter periods of unemployment and higher-quality job matches.

The empirical literature on Internet job search is mainly concerned with the characteristics of online job seekers as well as with the effect of online job search on unemployment. Kuhn and Skuterud (2004) use U.S. Current Population Survey (CPS) data from 1998 and 2000 to show that once observable characteristics are held constant, Internet job search does not lead to shorter periods of unemployment and might even prolong them. In addition to explaining this finding by stating that the Internet may be an inferior job search tool, the authors raise selection concerns and hypothesize that the longer search time is compensated by improved job quality. Stevenson (2006) argues that limiting the focus to the unemployed can be misleading as the main effect of online job search could be improved matching outcomes through on-the-job search. Using data similar to those used by Kuhn and Skuterud (2004), Stevenson finds that the Internet has led to higher employer-to-employer worker flows, which could indicate better job match quality for the employed. Kroft and Pope (2012) use data from the classified advertisements community Craigslist.com and find that the website's local expansion has to some degree crowded out newspaper advertising but has not had an effect on unemployment rates. Using an instrumental variable approach, Czernich (2011) finds no evidence that broadband Internet affects unemployment rates. Replicating Kuhn and Skuterud (2004) with newer data, Kuhn and Mansour (2011) find that in the period between 2008 and 2009,

online job search reduced unemployment duration by about 25 percent. Even though empirical evidence on how online job search affects unemployment is inconclusive, many studies point out that there should be a substantial effect on matching quality. To my knowledge, however, there has been no study testing this claim directly.

This paper is structured as follows. Section 2 describes the data as well as the estimation model. Section 3 presents my results and Section 4 thoroughly discusses possible selection concerns. Section 5 concludes.

2 Individual-level Data on Job Search Methods and Matching Quality

Using individual-level data, I investigate the relationship between finding a job through the Internet and the matching quality. There are several different approaches to measuring the quality of a job match. One indirect approach is to use employment duration as an indicator of match quality (e.g., Centeno, 2004). Measures that rely on job tenure assume that "good matches endure" (Bowlus, 1995), which is often but not necessarily true, especially in a relatively rigid labor market like that of Germany. Another approach is to use wages as an indicator of match quality (e.g., Simon and Warner, 1992, van Ours and Vodopivec, 2008). However, the wage of a job changer typically is determined before the employment contract is closed and imperfect information will make it impossible to know the match quality *ex ante*. A way to circumvent this problem would be to consider wage increases in the years after a job change. Unfortunately, however, variations in wage are to a large extent driven by supply and demand as well as by other factors that are not necessarily related to the matching quality. Ferreira and Taylor (2011) find that the match quality explains less than 1 percent of wages and Kuhn and Mansour (2011) find no effect of Internet job search on wage growth between jobs. Therefore, I take a different approach and use subjective matching quality measures as outcome variables.

The estimation model has the following form:

$$M_i = \beta_0 + \beta_1 internet_i + \beta_2 X_i + \beta_3 county_i + \beta_4 industry_i + \beta_5 year_i + \epsilon_i$$

where M_i are the subjective matching outcome variables of a person. Specifically, they are an employee's evaluation of: ability to apply own skills, satisfaction with the type of work, career perspectives, job security, social benefits, workload, commute, and working hours. Note that the dependent variables always indicate how a person evaluates the new job compared to the prior job. $internet_i$ is a dummy indicating whether a person found the job through the Internet. X_i are individual-level covariates, including gender, age, migration status, education, number of job changes between 2000 and 2007, and a dummy

indicating whether the person was unemployed during the last year. To limit the risk of merely observing a correlation based on Internet usage in general, I include a dummy that indicates the availability of the Internet in the household. Additionally, I include county, industry, and year fixed effects. Since the dependent variables are binary, I estimate a probit model with robust standard errors.

The data used to estimate the model come from the German Socio-Economic Panel (SOEP). The SOEP is a representative annual panel survey of almost 11,000 households and more than 20,000 individuals. The SOEP was started in 1984 and covers a wide range of topics, including many related to employment. Most importantly for the analysis, people who changed their job are asked not only how they learned about their new job, but also how their new job compares to their former job. There are several advantages to focusing on job changers instead of also including first-time employees. First, workers who had a job before have a reference point with which to compare the new job. Their expectations about how well they can use their skills at work, for example, are likely to be more realistic than those of respondents who have not had much prior work experience. Second, by comparing a new job with an old job both held by the same person, I can limit some selection problems, as discussed in Section 4 of this paper. And third, I can ignore the peculiarities of a person's first job, which is often related to a high degree of insecurity concerning occupational choice and expectations.

The SOEP asks "How did you find out about your new job?" and provides several answer options from which the respondent must choose one. These options range from the employment office to the Internet. The variables that measure match quality are constructed based on the question: "How do you view your current position compared to your previous one?" This is followed by a list of sub-questions asking the same question in regard to, for example, "the type of work," "chances of promotion," "work hour regulations," "workload," and "commute," which can be answered by choosing "improved," "about the same," or "better." There is a separate question that reads: "Are you able to use your professional skills and abilities today more, about the same, or less than in your previous position?" The variables are coded 1 when the answer is "improved" and 0 otherwise. Alternatively, I estimate an ordered logit model with all three answer choices and find results similar to those from the binary choice model¹.

By limiting the focus to job changers, my sample is reduced to about 2,000 observations per year between 2000 and 2007. As shown in Table 1, the share of people who found a new job through the Internet goes from less than 1 percent in 2000 to more than 6 percent in 2007. These relatively low numbers are due to the fact that I do not include in the sample the young and often Internet-savvy workers who found their first job through the Internet. The numbers also do not reflect how many job seekers actually used the Internet

¹Results are available upon request

at any point during their job search, but only more conservatively reflect the number who learned about the job through the Internet and chose to sign a contract with the employer. Thus, it is likely that the estimates represent a lower bound of a potentially larger association. The relatively small number of observations makes it necessary to pool the observations between 2000 and 2007. Unfortunately, later years cannot be used in the analysis because the SOEP did not include all relevant questions in the years following 2007.

Table 2 shows the sample means by the channel used to find a new job. Online job finders in the sample are on average 32.5 years old, which is slightly younger than workers who found a new job through other channels, even though the difference is not significant. There are also more men among the online job finders compared to those who used the newspaper, for example. A large share of employees who returned to their former employer are women, a finding probably driven by mothers who were on parental leave. Surprisingly, Internet job finders are on average slightly better educated than those who found a job in the newspaper. The share of formerly unemployed job changers who used the Internet is slightly higher than the one of employees who found a job through friends or newspapers. Although some of these differences between groups are interesting, few of them are very large or even statistically significant.

3 The Association of Internet Job Search and Matching Quality

Table 3 presents the results of regressing different matching outcome variables on the Internet search dummy as well as other covariates. All reported coefficients are probit marginal effects. In the first column, the positive and significant Internet coefficient indicates that online job seekers are more than 6 percent more likely to use their skills better in their new job. They are also significantly more likely to be satisfied with the type of work they do, as the high Internet coefficient in the second column shows. The dependent variable with the highest Internet coefficient is the perspective variable in the third column. It shows that online job seekers are more than 8 percent more likely to have a better chance of promotion in the new job. Finding a job online is also associated with better job security, as shown in Column 4. Surprisingly, in Column 5 we see that social benefits also are significantly better for online job seekers.

In the last three columns of Table 3 we see results for dependent variables that are not significantly correlated with online job search. Column 6, indicating satisfaction with workload in the new job, has an Internet coefficient that is positive but below 1 percent and insignificant. In Column 7, Internet even has a very small negative coefficient. This could mean that online job seekers are more likely to find a job that is farther away from home than the previous job. A possible interpretation of this finding is that the Internet opens up job

opportunities outside regional boundaries and thereby increases work mobility. Online job search is also barely associated with work time, as shown in the last column. Unlike the other dependent variables in the Table men are significantly less likely to improve either their commute or working time compared to women. This might indicate that these dimensions are less important to men when they change jobs.

In most cases, the coefficients of the control variables have the same sign across dependent variables even though their size differs. Being male is positively associated with the first five outcome variables. This means that, on average, male job seekers evaluate their new job better than female job seekers do. One explanation could be that men either obtain better jobs or are more optimistic about a recent job change. The opposite can be observed for older job changers compared to younger ones. It is arguable whether this is due to older people obtaining less attractive jobs, being matched more poorly, or simply viewing job change in a more negative light. A similar negative correlation can be observed for people with a migration background as well as for job changers who experienced a period of unemployment before finding a new job. The more highly educated a person, the better the matching outcome.

Note that the Internet coefficient is positive for all dependent variables except for commute. The reason we see quite small and insignificant coefficients on the workload and working time variables might be that these are relatively poor measures of matching quality. When a person switches to a new job that is different from his or her previous one, the workload might initially be greater than at the old job as the person needs to become familiar with new tasks and processes. It is therefore possible that a higher workload could signal a good match in some cases but a poor match in others. The working time in a particular job is not necessarily determined by the individual work contract; it could be set by a firm-wide or union-wide agreement and so, again, it is not surprising that the association of online job search with this variable is rather small. The four variables that are much more clearly measures of matching quality—skill use, work type, perspective, and job security—all have high and significant Internet coefficients. In the next section, I analyze heterogeneity effects on the skill use variable, which is arguably the most interesting measure of job match quality. In the remainder of this paper I chiefly discuss the first four dependent variables because I believe they are most relevant for assessing matching quality.

3.1 Effect heterogeneity

To this point, we have been concerned with the average association of online job search and matching outcomes among all job changers. Table 4 shows that the strength of this association varies depending on the subgroup to which the job changer belongs. Each line in Table 4 represents one least squares regression with "skill use" as the dependent variable and the same control variables as in

Table 3. Additionally, each regression contains the variable in the lead column and an interaction effect of this variable with the "found via Internet" dummy. The first column shows the association between finding a job online and being able to use personal skills better in the new job for workers who do not belong to the group described in the lead column. Column 2 shows the main effect of the variable in the lead column on the ability to use own skills. The third column reports the estimates for the interaction term of Internet job search and the respective variable in the lead column.

Workers who just reentered the employment market are 10 percent less likely to feel that they can use their skills better in their new occupation, as shown in the second column of the first row. These workers were not unemployed before they found a new job. Although I do not know the exact reason for their employment interruption, the high proportion of women in this group points in the direction of parental leave. Other possible reasons for such career breaks include educational leaves, national service, volunteer work, travel, or rest. The literature on employment interruptions argues that a worker's human capital stagnates or even decreases during career breaks, with the exception of educational leaves². The skills acquired in school and during previous occupations become increasingly outdated and depreciate during employment interruptions. According to Williams (2000), even career breaks due to self-employment can have adverse effects as sector-specific human capital decreases over time. Mincer and Polachek (1974), who underline the importance of work history in human capital models, point out that during periods of childbearing, erosion of market skills might lead women to revise their expectations of and commitment to employment. The strong negative coefficient for women with children in the second row of Table 4 could be interpreted as support for this idea. Besides the human capital effect, there is a signaling effect induced by career breaks. Employers could interpret an employment interruption as a sign of low commitment or reliability. Consequently, they might be reluctant to offer jobs involving much responsibility to workers with career breaks. Along with skill depreciation, this could explain the negative association of reentry and being a mother with the outcome variable.

The third column of Table 4 shows a significantly positive interaction effect for workers who just reentered the employment market and found their job online. The same reversal takes place for women with children. This could mean that the Internet is an especially valuable job search tool for workers with employment interruptions. One explanation for this finding could be that the negative signaling induced by career breaks is less severe when the job is intermediated through the Internet. Another, probably more convincing, explanation is that the Internet is especially important for workers who are more distant from the labor market. For example, women who are caring for their children instead of engaging in formal employment are less likely to hear of current employment opportunities in the organization or industry in which they

²for a recent overview of the literature on career breaks see Theunissen et al. (2011)

previously worked. The third row seems to confirm the hypothesis that distance from the market matters. For those job changers who live in a county that has a population density below average, denoted as a rural county in Table 4, the Internet interaction term is sizable and significant. This finding relates to the "death of distance" hypothesis, which became popular from the book of the same title by Cairncross (1997). Cairncross argues that modern telecommunication networks will improve rural areas' access to larger markets. The disadvantage of job seekers in remote areas is alleviated by the Internet, which opens up new supraregional employment opportunities. Note that in all specifications of Table 4, I control for Internet availability in the household. The positive coefficient for online job seekers in rural areas is therefore more than a sign of being better connected due to Internet access; it indicates that online job search makes a difference for those who are distant from urban centers.

Workers who were unemployed before they changed jobs do not seem to benefit from online job search to the same extent as other job changers. This casts some doubt on the Internet's ability to match unemployed workers more efficiently. There are different possible explanations for why, in general, job seekers who are distant from the labor market seem to benefit from online job search but unemployed job seekers do not. Stevenson (2006) argues that the Internet leads to an increase in on-the-job search, which reduces transitions from employment to unemployment as workers can more easily find a new job online before their current job terminates. This hypothesis seems plausible in light of the passive job search opportunities enabled by the Internet. However, it implies that those who become unemployed are negatively selected with respect to their ability to use online job search to their advantage. In other words, someone who becomes unemployed nowadays might not have the capabilities to benefit from online job search in the first place.

This incapacity could be explained by a lack of exposure to the Internet at the former workplace. Krueger (2000a) argues that the digital divide with regard to race might be partially caused by a underrepresentation of minorities in positions that use computers. Similarly, unemployed job seekers might be less successful with online job search because they were less likely to use the Internet at their former workplace. Due to this lack of expertise, they might use inferior Internet search tools. For example, if such an Internet-naïve person visits only the employment agency website and ignores many other valuable resources, such crude and limited use of a sophisticated tool might very well explain why the person does not benefit from online job search. Hence, the problem for the unemployed could be insufficient knowledge and lack of skills necessary to use the Internet to their best advantage.

Another possible explanation for the unpromising results of the unemployed is that the increased transparency and information available through the Internet can in some cases work against an applicant. Even if the matching quality of workers and employers improves, this does not necessarily mean that every worker will be offered a better job. If a poorly qualified worker is hired for a

position that entrusts him with too much responsibility, the match is certainly not ideal. However, the worker might like this job and feel comfortable with his level of competence. Then, if the worker loses that job and needs to find another, and he is matched to a new employer who is able to better observe his abilities, the worker may end up being less content even though, objectively, the job is a better match to his abilities. The Internet offers numerous tools that allow employers to learn more about their online applicants. Application forms on websites, for example, are used by companies to request information that applicants would not necessarily reveal in an offline application. Candidates then can be easily compared on the basis of this information. In some cases, candidates are asked to perform an online aptitude test during the application process. Additionally, social networks such as LinkedIn allow employers to easily contact an applicant's former employers. In sum, the Internet could reveal unfavorable information about workers and thereby increase matching quality but decrease worker satisfaction. In short, if there is a good reason why a potential employee is currently unemployed, there is a good chance he or she will stay that way.

It is interesting that job seekers below the age of 30 are not benefitting disproportionately from online job search. This indicates that there is no digital divide based on age when it comes to using online job search tools. Although, on average, young people are able to use their skills better after a job change, this is not due to the method they used to find that job. Another concern often raised in context of the digital divide debate is that minorities are disadvantaged when it comes to use of the Internet (e.g., Hoffman and Novak (1998), Fairlie (2004)). While we do observe a negative association between having a migration background and the outcome variable, online job search is not less effective for migrants. In fact, the respective coefficient in Table 4 is relatively large and positive, but not significant at the 10 percent level. Similarly, workers with tertiary education do not benefit more than those with an average level of education from online job search. This result can be interpreted as implying that the higher educated are not necessarily the main beneficiaries of online job search.

3.2 How Internet Job Search Compares to other Search Methods

The previous sections compared the Internet with all other means of finding a new job. But what if the positive correlations shown in Table 3 are mainly driven by the comparison with job search tools that lead to especially poor matching results? One channel that could lead to mediocre matching results is public employment services. For example, Holzer (1988) finds that searching for a job through family, friends, and newspapers is associated with a higher probability of receiving an offer than searching through the state employment agency. Clark (1988) shows that the retention rates on jobs facilitated by the

public U.S. Employment Service (USES) are lower than those facilitated by other intermediaries. Using data from Portugal, Addison and Portugal (2001) also find that the public employment service is associated with shorter job retention. Additionally, they show that rewards for observable characteristics of job seekers are smaller in jobs found through the public employment service. One possible explanation for these differences could be that public employment services have less incentive to find good matches than do private intermediaries, as argued by Zweifel and Zaborowski (1996).

Therefore, I analyze how different job search channels compare to finding a job through federal and local employment offices as well as through so-called Personal service agenturen (PSAs), which are sort of temporary employment agencies attached to employment offices. Table 5 shows that the Internet is the only channel with significant positive coefficients across all outcome variables in comparison to the employment office. The friends variable, which indicates that the job was found through friends, acquaintances or family, is even negative for two of the four dependent variables. One possible reason could be that if someone finds a new job through personal connections, the formal job screening process, which would normally assure a good or at least reasonable match, is not taking effect. The significantly positive coefficient for job security does not contradict this hypothesis. In fact, someone who finds a job through a friend who works for the same organization might feel that the job is especially secure since it is protected by the friend. Another explanation is offered by Loury (2006) who argues that job seekers turn to informal search channels like family and friends as a last resort and have few alternative choices. Private job agencies also perform worse than the employment office for two of the four outcome variables, as shown in the fourth row. The "other" category has positive but insignificant coefficients for most of the matching outcomes. One explanation could be that headhunters and other personal matchmakers fall in this category. The newspaper coefficients are also positive, although insignificant and much smaller than the Internet coefficients. Therefore, I conclude that compared to the employment office, the Internet is the only channel that is associated with significantly better matching results.

One could argue that people who find a job through the employment office, a private job agency, or by some other undefined means are not of primary interest for the analysis. After all, these channels are very different from job search on the Internet and job seekers who use private job agencies, for example, might have different characteristics from those who use the Internet. To test this argument, I exclude all job changers who used channels other than the Internet, friends, and newspapers and repeat the estimations from Table 3. In Table 6, we see that the Internet coefficients remain relatively stable for the skill use variable, whereas they are considerably lower for the other three variables. Apart from the job security measure, however, they all remain significant at the 5 percent level, at least. This robustness of the Internet coefficients demonstrates that online job seekers are better matched not only compared to all other search methods taken together but also compared specifically to the most similar channels, namely,

newspapers and friends.

4 Discussion of Potential Selection Issues

The last section demonstrated the robustness of the results to a wide range of controls and sample restrictions. However, there are some obvious selection issues that could bias the results. Possible problems could arise if Internet job seekers are fundamentally different from workers they are compared with. A second cause of concern is that online job seekers search differently from job seekers who use other channels, and are therefore able to find better matches. A third issue is that the kind of companies that use online job tools could be different from companies that advertise in newspapers or through other more traditional channels. The following section tackles these concerns.

4.1 Selection on Unobservables

Above, we saw that the observed associations are not driven by factors such as age, job position, or industry. But what if there was a selection on unobserved characteristics? There are plenty of reasons why one could assume that workers who use the Internet for job search are different from workers who prefer to read job advertisements in newspapers. For example, online job seekers could be generally more open to new technologies and adapt better to technological changes. This could, in turn, be a characteristic valued by employers and correlated with better matching outcomes.

The problem of selection on unobservables is less severe than it might appear at first because I basically compare two jobs held by the same person. In the analysis, I focus on workers who have changed jobs and therefore can compare their current job to their former job. For example, they are asked whether they can now (i.e., in the current job) use their skills better, equally well, or worse than in their previous job. Since I look at the same person making assessments of two jobs, many typical selection issues are mitigated. It might well be the case that workers who find a job on the Internet are better able to take advantage and adapt to change and thus will always have a more positive perspective on his or her career than offline job seekers. But as long as this personal characteristic is constant over time, there is no reason to believe that the same person would have more optimistic perspectives in one job compared to another job for reasons that are unrelated to the job itself. In other words, the problem of selection on unobserved personal characteristics does not play a dominant role in much of my analysis.

Nevertheless, there are certain selection criteria that have the potential to bias the results. If, in general, online job seekers view a job change more positively than offline job seekers, they could also believe that their new job suits them

better simply because they changed it recently. Although testing for personal attitudes toward a new job is difficult, there are some questions in the SOEP that can be used as indicative evidence for a possible systematic difference in attitudes between online and offline job seekers. In one question of the SOEP, respondents are asked whether the statement "When I think about the future, I'm actually quite optimistic" applies to them. A second question is concerned with overall life satisfaction and asks: "How satisfied are you with your life" (scale 0-10). The first two columns of Table 7 show that people who found a new job on the Internet are generally not more optimistic about the future and are even slightly less satisfied with their life than others. Additionally, the SOEP incorporates rough measures of the so-called Big Five personality traits: openness, conscientiousness, extraversion, agreeableness, and neuroticism. These personality traits are fairly stable over time and found to change very little after the age of 30 (Terracciano et al., 2010). For our purposes, openness seems to be the most interesting of these traits. In the SOEP, openness is measured in terms of being original and coming up with new ideas as well as having an active imagination³. The third and fourth columns of Table 7 show that there is no significant difference between online and offline job seekers along these dimensions. This gives some indication that online job seekers are neither more open nor do they generally view the future or their life situation more favorably than others.

Although there are good reasons to believe that selection on unobservables is not a primary concern in my analysis, I can use an additional test to eliminate possible selection biases. If people who find a job online are systematically different from others, this difference should not only affect the variables where I see a significant positive association, namely, usage of skills, satisfaction with type of work, career perspectives, and job security; the difference between online and offline job seekers should also affect other variables, such as satisfaction with the working time. Let us assume, for example, that online job seekers view their new job more positively than others because of differences in personal attitudes. Then the generally better assessment of the job should make these workers more content with their tasks but also with their working time. Since there are few objective reasons why online job seekers should have more convenient working times, I can use the assessment of working time as a reference point for all of that person's judgments. By including the "working time" variable in the specifications of Table 8, I control for a possible selection effect on the evaluation of a given person. While the association of working time with the outcome variables is highly significant, the coefficients of the Internet variable remain stable. Therefore, it seems that the relationship between Internet job search and matching quality is not largely biased by a selection on unobserved characteristics.

³The original questions from the SOEP read: "I see myself as someone who is original, comes up with new ideas" and "I see myself as someone who has an active imagination".

4.2 Selection into Search Intensities

Another selection concern is that online job seekers may be spending more time looking for a job than do offline job seekers. If workers who use the Internet for job search spend many hours looking for suitable vacancies while others just open up the newspaper and apply for the next best job advertised, it would not be too surprising if we saw inferior matching results for the latter. But is it realistic to expect that online job seekers are searching more intensively or are more serious about their search? To answer this question we need to differentiate between the various kinds of offline job seekers in the analysis. It seems likely that people who find a job through friends and family, for example, spend considerably less time comparing different job offers than people who use the Internet for this purpose. Table 5 shows that finding a job through friends and family is not generally associated with superior matching quality. One possible reason friends and family do not perform very well on this front could be that the affected job seekers put very little effort into the search process. However, the positive association of Internet job search and matching quality is not driven only by the comparison to job search through friends. As shown in Table 5, the Internet is the only channel that is associated with significantly higher matching quality compared to the base category, the employment office.

Arguing that Internet job seekers are searching more intensively than workers who apply through newspaper advertisements and other offline media is not very convincing. One reason it appears very unlikely that online searchers are in any way more serious about their search is the low search cost of the Internet. Looking for a job in a newspaper is much more costly than using online job boards. First, newspapers themselves cost money. Second, it is more difficult and more time consuming to find advertisements in a newspaper that match own qualifications. And third, compiling a classic job application, including a printed photograph⁴, an attractive folder, and a postage stamp is much more expensive than filling out an online application form or sending an email. These costs are one reason why the number of postal applications has declined steadily over the last couple of years while the use of electronic applications has increased over time, as shown in Figure 1. Taking the low costs of online job search into account, it seems unlikely that, in general, online job seekers are more serious about their search compared to those who use newspapers as their search channel of choice.

In addition to being a less expensive search method, the Internet also offers passive job search opportunities, as discussed in the introduction. Over 175 million people maintain online CVs on the largest professional network LinkedIn⁵. Xing, a German competitor of LinkedIn, has over 11 million members⁶. Online CVs allow recruiters and headhunters to search for job candidates. Both LinkedIn

⁴in Germany it is standard practice to have a photograph on the CV

⁵as of August 2, 2012 (see <http://press.linkedin.com/About-Us>)

⁶<http://corporate.xing.com/deutsch/investor-relations/basisinformationen/qas/#c322>

and Xing offer premium memberships that are targeted at heavy users like recruiters and permit more sophisticated search and filter options. LinkedIn tries to attract recruiters with the slogan "Find the World's Best Passive Talent"⁷ and charges up to €359.95 per month for a "Talent Pro" premium subscription. Also, online job boards such as Monster offer the opportunity to upload CVs that can be viewed by recruiters. Since uploading a CV to Monster clearly signals interest in new job opportunities, users can choose to hide sensitive information, such as name and address, so that current employers do not realize that their employees are looking for a new job. The whole idea of passive job search clearly contradicts the argument that online job seekers spend more time or look more intensively for new job opportunities. As Figure 2 illustrates, a majority of people who are interested in career opportunities already use online career networks and CV databases. This shows that online job search can be almost completely effortless, which is not true for most other job search channels.

To further test whether people who use the Internet for job search are more actively searching than others, I use additional information from the SOEP. Respondents who changed their job are asked: "Were you actively looking for a job when you received your current position, or did it just come up?" Table 9 shows that the active search coefficient is positive and highly significant, indicating that people who search actively have considerably better matching outcomes than people who find a job by chance. The coefficient of online job search, however, remains positive and significant for the first three of the four dependent variables in Table 9. By controlling for active job search, I provide additional evidence that workers who find their job through friends or newspapers are not being matched more poorly simply because they found a job without actively looking for it. The lower cost of and lower effort needed to search on the Internet implies that, if anything, online job searchers are less serious about their search.

4.3 Selection of Advertised Jobs

Although I have extensively discussed the possible selection of job seekers, I have not yet addressed the employer side. Even if job seekers are neither selected on unobservables nor by search intensity, my results could be biased if only a certain kind of company uses the Internet for recruitment purposes. Like before, we have to differentiate between the various offline search channels when comparing their exposure to selection. Companies who advertise vacancies through the employment office, for example, might be less attractive than companies who use online job boards. This could lead to a negative bias unrelated to the matching process itself. However, we have seen in Table 6 that the results remain stable if I exclude employment offices and job agencies from the analysis. When comparing the Internet with other offline channels it becomes more difficult

⁷<http://talent.linkedin.com/Recruiter>

to think of similar selection arguments. There is evidence that many high-end jobs are not advertised over the Internet but only through other channels. Specialized headhunters and HR consultancies definitely play an important role in filling executive positions. Many people also believe that high-salary jobs are more often advertised in newspapers. Some companies prefer newspaper advertisements because they look more expensive and signal the value that the company puts on the position. This kind of selection, however, would lead to an underestimation of the association we observe. If anything, the selection of companies makes my results look more conservative.

Figure 3 provides more evidence that companies that advertise online are not necessarily the more attractive employers. It is striking that 40 percent of the companies who advertise on Monster are temporary work companies. Usually, this type of company is not a job seeker's most favorite and often pays less than other employers. At Stellenanzeigen.de, another popular German job board, the share of temporary work companies is significantly lower but still twice as high as the share of companies listed on the German DAX stock index. The dominance of the generally less attractive temporal work companies in online job boards would again lead to an underestimation of my results.

Companies choose the advertising channel that they expect will be most effective at attracting appropriately qualified applicants. Different types of jobs are therefore advertised through different channels, a fact that gives rise to another selection concern: How do job positions advertised through the Internet compare to job positions advertised offline? Figure 4 shows how well the search results at Monster.de match job titles used as search terms. Almost 80 percent of the search results exactly match the request. There seems to be a tendency that jobs requiring high qualifications, like general manager, HR director, lawyer, or engineer, obtain inferior results compared to more mid-range jobs like controller or project manager. This could be an indication that online job boards perform less well when it comes to top jobs. If the Internet serves as a better channel for mid-level jobs and top jobs are more often advertised through other channels, my results would be underestimated.

There is anecdotal evidence that although online advertisements attract a great quantity of applications, many of them are of lower quality. This could be related to the low costs of application discussed above. Even if applicants do not have the qualifications specified a job advertisement, they may still apply—after all, it costs next to nothing and nothing ventured, nothing gained. From an employer perspective, this problem becomes more severe, the higher the desired qualifications. Figure 5 shows the results of a study in which identical job advertisements for the position of procurement director were placed in eight German newspapers and eight German online job boards. The applicants were subsequently rated according to their qualifications. Overall, the number of applications in response to the online advertisements was more than 2.5 times the number of applications in response to the print advertisements. However, more than 50 percent of the Internet applicants were not all qualified for the job,

whereas this share was considerably lower for newspaper applicants. Although these numbers are purely descriptive and by no means representative, they do add some weight to the view that online recruitment is a bit more about the quantity and less about the quality of applicants. As a result, we might see fewer high-qualification jobs advertised online, which again would lead me to an underestimation of the results.

5 Conclusion

This paper investigates whether online job search is associated with better quality job matching. The question of how the Internet affects unemployment duration and other labor market outcomes is much studied in literature, but this paper provides the first empirical evidence as to the quality of resulting job matches. I find that matching outcomes of online job seekers are superior along several dimensions, including making better use of own skills, being more content with the type of work, having higher chances of promotion, and enjoying greater job security. These results are not driven by comparing the Internet with inferior search channels like the employment office. Online job search is associated with better matching quality even if it is directly compared to searching newspapers or asking friends and family for help. My results avoid bias from many possible sources of selection. As I focus my analysis on workers who found their previous job offline and their current job either offline or online, I can compare two matching outcomes for the same worker by using retrospective data. Additionally, I tackle several selection issues with robustness tests and provide some descriptive evidence to alleviate any remaining selection concerns. Even though I am able to rule out the most obvious threats to a causal interpretation of the associations presented in this paper, more work is needed to identify a clear causal relationship between online job search and matching quality.

The results indicate that the Internet is an especially important tool for job seekers distant from the labor market. Workers with employment interruptions are particularly likely to be well matched if they used the Internet to find their new job. Online job search also seems to play an important role for mothers with children. As gender inequality remains an issue in many labor markets, it is important to know that the Internet can alleviate possible negative consequences of a maternity leave. The results also show that job seekers in areas with lower population densities are better matched when they find their job online. This finding has important policy implications with regard to the expansion of broadband Internet in rural areas. It is remarkable that online job search seems to compensate for many of the disadvantages suffered by job seekers who are distant from the labor market. Formerly unemployed job seekers, however, do not appear to benefit from online job search to the same extent. One possible reason for this finding is that the unemployed lack the expertise necessary to use the Internet to their advantage. If this is indeed the case, it might be very

worthwhile to train unemployed job seekers in new technologies during their job search process. Further research is needed to better understand the relationship between online job search and Internet-related skills.

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Table 1: Number of job changer and Internet finder in sample

Year	All	Job Changer		Internet Finder	
	Observations	Observations	Percent	Observations	Percent
2000	24,576	2,102	8.55	21	1.00
2001	22,351	2,024	9.06	41	2.03
2002	23,892	1,901	7.96	64	3.37
2003	22,611	1,560	6.90	62	3.97
2004	22,019	1,378	6.26	75	5.44
2005	21,105	1,214	5.75	79	6.51
2006	22,665	1,380	6.09	89	6.45
2007	21,232	1,564	7.37	111	7.10
Total	180,451	13,123	7.27	542	4.13

Table 2: Sample means by job search method

	Internet	Newspaper	Friends	Private Agency	Job Center	Other	Back to former
age	33.97 (9.16)	36.61 (9.95)	35.39 (10.94)	37.41 (10.44)	36.07 (11.45)	35.17 (10.27)	36.83 (10.59)
male	0.58 (0.49)	0.40 (0.49)	0.46 (0.50)	0.62 (0.49)	0.53 (0.50)	0.48 (0.50)	0.34 (0.47)
migrated	0.13 (0.34)	0.18 (0.38)	0.22 (0.41)	0.20 (0.40)	0.19 (0.39)	0.16 (0.37)	0.16 (0.37)
education	4.13 (1.45)	3.66 (1.36)	3.39 (1.34)	3.96 (1.50)	3.28 (1.22)	3.79 (1.46)	3.63 (1.32)
unemployed	0.43 (0.50)	0.30 (0.46)	0.30 (0.46)	0.37 (0.48)	0.69 (0.46)	0.26 (0.44)	0.23 (0.42)
<i>N</i>	542	1849	4116	181	1,426	2,185	1,315

Means of the respective subsample. Standard deviations in parentheses.

Table 3: The association between online job search and several matching outcome variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	skill use	work type	perspective	job security	benefits	work load	commute	work time
found via Internet	0.0645*** (0.0214)	0.0798*** (0.0236)	0.0812*** (0.0202)	0.0455** (0.0212)	0.0687*** (0.0205)	0.0095 (0.0220)	-0.0070 (0.0235)	0.0150 (0.0237)
male	0.0301*** (0.0106)	0.0682*** (0.0115)	0.0726*** (0.0103)	0.0615*** (0.0106)	0.0366*** (0.0104)	0.0044 (0.0108)	-0.0337*** (0.0112)	-0.0726*** (0.0115)
age	-0.0074*** (0.0005)	-0.0072*** (0.0005)	-0.0096*** (0.0005)	-0.0049*** (0.0005)	-0.0030*** (0.0005)	-0.0016*** (0.0005)	-0.0010** (0.0005)	-0.0021*** (0.0005)
migrated	-0.0304** (0.0130)	-0.0292** (0.0142)	-0.0453*** (0.0124)	-0.0271** (0.0127)	-0.0016 (0.0127)	-0.0053 (0.0131)	0.0070 (0.0140)	-0.0296** (0.0140)
education	0.0327*** (0.0037)	0.0070* (0.0041)	0.0395*** (0.0036)	0.0104*** (0.0037)	0.0138*** (0.0036)	-0.0069* (0.0038)	-0.0035 (0.0040)	-0.0103*** (0.0041)
unemployed	-0.0305*** (0.0107)	-0.0388*** (0.0116)	-0.0534*** (0.0103)	-0.0340*** (0.0106)	-0.0232** (0.0104)	-0.0426*** (0.0106)	-0.0239** (0.0113)	-0.0469*** (0.0115)
Internet available	0.0573*** (0.0109)	0.0376*** (0.0119)	0.0152 (0.0108)	-0.0028 (0.0109)	0.0179* (0.0106)	0.0057 (0.0110)	0.0157 (0.0116)	0.0326*** (0.0117)
job changes	0.0051 (0.0036)	-0.0100** (0.0040)	-0.0037 (0.0036)	-0.0128*** (0.0037)	-0.0094*** (0.0036)	-0.0008 (0.0037)	-0.0018 (0.0039)	-0.0057 (0.0040)
county-fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
industry-fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
year-fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	9936	10065	9774	9796	9784	9994	9979	10022
Pseudo R2	0.098	0.076	0.121	0.079	0.073	0.058	0.050	0.067

Robust standard errors in parentheses.

Dependent variables take on the value 1 if the new job is evaluated better than the former one with respect to: the ability to use own skills, the type of work, the chances of promotion (perspective), the security against job loss, social benefits, work load, commute, and work time regulations.

Probit estimation with average marginal effects

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Effect heterogeneity with the dependent variable "skill use"

	Internet (1)	main effect (2)	interaction (3)	N
Re-entry into employment	0.0523* (0.0267)	-0.1031*** (0.0130)	0.1397* (0.0732)	9936
Female and children below age 16	0.0489* (0.0269)	-0.0991*** (0.0141)	0.1463** (0.0713)	9936
Rural area	0.0228 -0.0334	-0.0285*** -0.0109	0.1152** -0.0487	9037
Unemployed during last 12 months	0.0850*** (0.0325)	-0.0313*** (0.0113)	-0.0284 (0.0474)	9936
Younger than 30	0.0833*** (0.0294)	0.0472*** (0.0160)	-0.0255 (0.0507)	9936
Tertiary education	0.0825** (0.0336)	0.0075 (0.0227)	-0.0183 (0.0477)	9936
Migration background	0.0580** (0.0261)	-0.0344** (0.0139)	0.1109 (0.0683)	9936

Dependent variable "skill use" takes on the value 1 if the new job is evaluated better than the former one with respect to the ability to use own skills. Every line represents one probit estimation with average marginal effects according to Ai and Norton (2003), with column (1) showing the effect of the "found by Internet" variable, column (2) showing the main effect of the variable in the respective row and column (3) showing the interaction effect of that variable with the "found by Internet" variable. Robust standard errors in parentheses. Regressions control for: male, age, migrated, education, unemployed, Internet at home.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Different job search channels compared to the employment office

	(1) skill use	(2) work type	(3) perspective	(4) job security
found via Internet	0.0588** (0.0231)	0.0707*** (0.0256)	0.0676*** (0.0221)	0.0692*** (0.0231)
found via friends	-0.0123 (0.0145)	0.0024 (0.0156)	-0.0089 (0.0142)	0.0508*** (0.0146)
found via newspaper	0.0297* (0.0166)	0.0168 (0.0180)	0.0239 (0.0160)	0.0390** (0.0166)
found via agency	-0.0420 (0.0384)	0.0418 (0.0411)	0.0080 (0.0363)	0.0229 (0.0375)
found via other	0.0067 (0.0159)	0.0112 (0.0173)	0.0133 (0.0155)	0.0446*** (0.0161)
individual controls	Yes	Yes	Yes	Yes
county-fixed	Yes	Yes	Yes	Yes
industry-fixed	Yes	Yes	Yes	Yes
year-fixed	Yes	Yes	Yes	Yes
N	9936	10065	9774	9796
Pseudo R2	0.100	0.083	0.129	0.086

Robust standard errors in parentheses.

Probit estimation with average marginal effects. Dependent variables take on the value 1 if the new job is evaluated better than the former one with respect to: the ability to use own skills, the type of work, the chances of promotion (perspective), security against job loss and benefits. Individual-level covariates: male, age, migrated, education, unemployed, Internet at home and number of job changes.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Reduced sample for comparison of Internet with newspaper and friends

	(1) skill use	(2) work type	(3) perspective	(4) job security
found via Internet	0.0556** (0.0219)	0.0582** (0.0239)	0.0557*** (0.0209)	0.0125 (0.0221)
male	0.0214 (0.0135)	0.0651*** (0.0146)	0.0834*** (0.0131)	0.0676*** (0.0136)
age	-0.0073*** (0.0006)	-0.0079*** (0.0006)	-0.0096*** (0.0006)	-0.0052*** (0.0006)
migrated	-0.0152 (0.0164)	-0.0280 (0.0176)	-0.0409*** (0.0154)	-0.0359** (0.0160)
education	0.0316*** (0.0047)	0.0091* (0.0052)	0.0408*** (0.0046)	0.0128*** (0.0048)
unemployed	-0.0382*** (0.0134)	-0.0504*** (0.0146)	-0.0477*** (0.0130)	-0.0364*** (0.0135)
Internet availability	0.0479*** (0.0137)	0.0266* (0.0148)	0.0114 (0.0134)	-0.0189 (0.0139)
job changes	-0.0020 (0.0044)	-0.0178*** (0.0048)	-0.0128*** (0.0043)	-0.0150*** (0.0045)
county-fixed	Yes	Yes	Yes	Yes
industry-fixed	Yes	Yes	Yes	Yes
year-fixed	Yes	Yes	Yes	Yes
midrule N	5630	5739	5528	5565
Pseudo R2	0.108	0.093	0.150	0.099

Robust standard errors parentheses.

Probit estimation with average marginal effects. Dependent variables take on the value 1 if the new job is evaluated better than the former one with respect to: the ability to use own skills, the type of work, the chances of promotion (perspective), and the security against job loss.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Internet job finders and personality traits

	optimism	hapiness	originality	phantasy
found via internet	0.1105 (0.1002)	-0.1395 (0.0771)	-0.0109 (0.1808)	0.1806 (0.1905)
male	-0.1049* (0.0481)	-0.0739* (0.0314)	0.2503** (0.0862)	-0.0662 (0.0985)
age	0.0140*** (0.0023)	-0.0197*** (0.0016)	0.0013 (0.0042)	-0.0101* (0.0047)
migrated	-0.0790 (0.0657)	0.0432 (0.0424)	-0.0259 (0.1179)	-0.1261 (0.1298)
education	-0.0733*** (0.0181)	0.1149*** (0.0117)	0.0490 (0.0312)	0.0066 (0.0348)
unemployed	0.1075* (0.0532)	-0.3825*** (0.0368)	-0.1721 (0.0974)	-0.2463* (0.1086)
Internet available	-0.0828 (0.0558)	0.0981** (0.0335)	0.2099* (0.1051)	-0.0237 (0.1141)
job changes	-0.0097 (0.0179)	-0.0715*** (0.0118)	0.0398 (0.0316)	0.0485 (0.0374)
state-fixed	Yes	Yes	Yes	Yes
N	1038	11581	1021	1019
R-sq	0.060	0.053	0.027	0.022

Robust standard errors in parentheses. Ordinary least squares estimation.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Controlled for working time

	(1)	(2)	(3)	(4)
	skill use	work type	perspective	job security
internet	0.0619*** (0.0202)	0.0764*** (0.0222)	0.0736*** (0.0191)	0.0411** (0.0198)
working time	0.0666*** (0.0091)	0.1764*** (0.0094)	0.0831*** (0.0087)	0.1528*** (0.0085)
individual	Yes	Yes	Yes	Yes
county-fixed	Yes	Yes	Yes	Yes
industry-fixed	Yes	Yes	Yes	Yes
year-fixed	Yes	Yes	Yes	Yes
N	9810	10014	9738	9761
Pseudo R2	0.100	0.097	0.128	0.104

Robust standard errors in parentheses.

Probit estimation with average marginal effects. Dependent variables take on the value 1 if the new job is evaluated better than the former one with respect to: the ability to use own skills, the type of work, the chances of promotion (perspective), and the security against job loss. Individual-level covariates: male, age, migrated, education, unemployed, Internet at home and number of job changes.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Controlled for active search

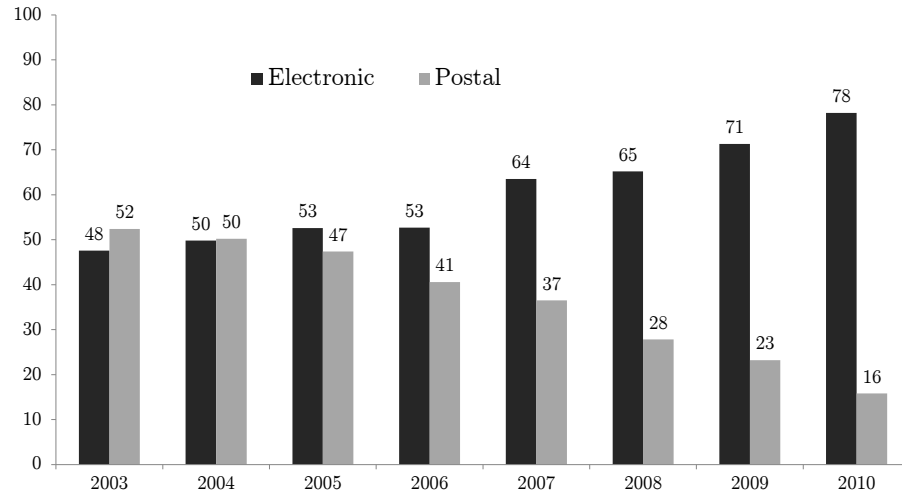
	(1) skill use	(2) work type	(3) perspective	(4) job security
found via Internet	0.0486** (0.0205)	0.0584** (0.0230)	0.0577*** (0.0195)	0.0316 (0.0203)
active search	0.0636*** (0.0095)	0.0692*** (0.0103)	0.0574*** (0.0093)	0.0328*** (0.0095)
covariates	Yes	Yes	Yes	Yes
county-fixed	Yes	Yes	Yes	Yes
industry-fixed	Yes	Yes	Yes	Yes
year-fixed	Yes	Yes	Yes	Yes
N	9880	10014	9724	9746
Pseudo R2	0.099	0.078	0.125	0.079

Robust standard errors clustered at the household level in parentheses

Probit estimation with average marginal effects. Dependent variables take on the value 1 if the new job is evaluated better than the former one with respect to: the ability to use own skills, the type of work, the chances of promotion (perspective), and the security against job loss. Individual-level covariates: male, age, migrated, education, unemployed, and Internet at home.

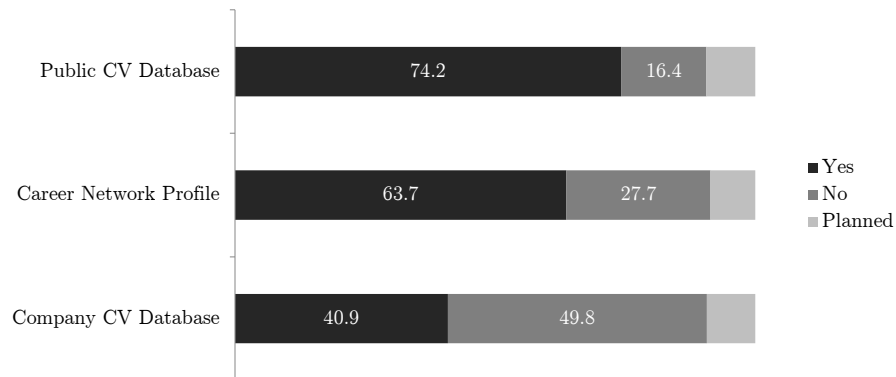
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 1: Preference of job searchers for electronic and postal applications over time



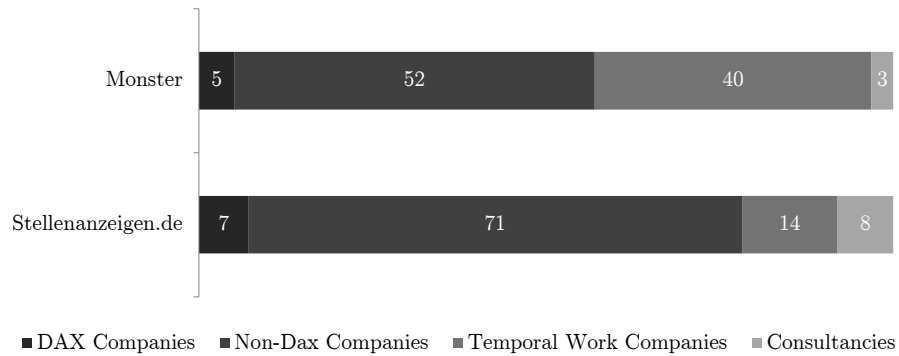
Source: Bewerbungspraxis 2011, Centre of Human Resources Information Systems (CHRIS). Based on 10,227 individuals interested in career opportunities.

Figure 2: Usage of CV databases and online career networks for passive job search



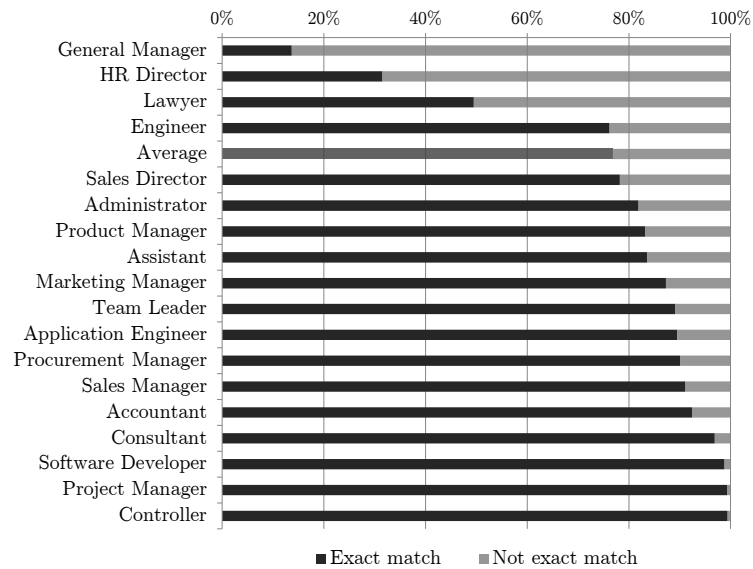
Source: Bewerbungspraxis 2011, Centre of Human Resources Information Systems (CHRIS). Based on 10,227 individuals interested in career opportunities.

Figure 3: Company types that advertise on two major German online job boards



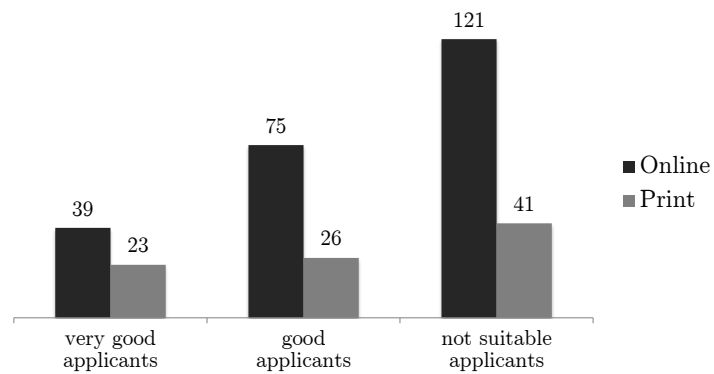
Source: Jobbörsen im Vergleich 2011, Fachhochschule Koblenz.
Based on 1,500 randomly selected German job advertisements per website.

Figure 4: Percentage of search results that match the search request on Monster.de



Source: Jobbörsen im Vergleich 2011, Fachhochschule Koblenz.
Based on 86,023 results of the "quick search" function on Monster.de.

Figure 5: Quality of applications in response to online and print job advertisements for "Head of Procurement"



Source: Medialeistungstest 2010, WESTPRESS GmbH & Co. KG.
Responses to job advertisements in 8 German newspapers (among others "Süddeutsche Zeitung" and "Der Tagesspiegel") and 8 German online job boards (among others monster.de and stellenanzeigen.de).

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