Online Job Search and Matching Quality *

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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 to find 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). Our 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 and other channels.

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1 Introduction

An increasing number of people use the Internet to look for new jobs. One reason why online job search became so popular is that it considerably changed the search process. Employment websites like 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 on the labor market does not only become more efficient but the quality of job matches should increase.

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), we compare employees who found their job online with those who found their job through newspaper advertisements, friends and other channels. We show that Internet job finders can make better use of their skills, are more content with the type of their work, believe to have a higher chance of promotion and higher job security.

Our results indicate that the Internet is an especially valuable job search tool for workers who are distant to the labor market. Job seekers with employment interruptions have significantly better matching outcomes if they find their new job through the Internet. While women with children below the age of 16 have generally inferior results after starting a new job, this negative association is alleviated for those of them who use online job search. We find a similar relationship for job seekers in rural areas. The disadvantage due to remoteness is remedied if they find their job through the Internet. For workers who were unemployed before they found a new job, we 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, maybe due to a lack of necessary skills.

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

The reason why the Internet has a profound impact on the job matching process goes beyond the wider selection of job opportunities, better search possibilities and cheaper access to information. The Internet introduces new ways of passive job search and allows firms to easily search for applicants. Career oriented

social networks like LinkedIn and online job boards like 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 only feasible through headhunters and mainly used for executive positions. Allowing firms to tap into the large pool of passive job seekers with detailed information about their skills and experiences, leads to more informed hire 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 will induce workers and employers to learn more about each other and will thereby improve 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 will raise the minimum match quality they are willing to accept. The higher match quality will in turn lead 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 will potentially offset this effect. The increasing popularity of CV databases and career networks like LinkedIn, which was launched one year after Autor published this 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 durations, 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 unemployment durations and higher quality of job matches.

The empirical literature on Internet job search is mainly concerned with the characteristics of online job seekers as well as the effect of online job search on unemployment. Kuhn and Skuterud (2004) use US Current Population Survey (CPS) data from the years 1998 and 2000 to show that once observable characteristics are held constant, Internet job search does not lead to shorter unemployment durations and might even prolong them. Besides offering the explanation that the Internet is indeed 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) agues that limiting the focus on the unemployed can be misleading as the main effect of online job search could be improved matching outcomes through on-the-job search. Using similar data as Kuhn and Skuterud (2004), Stevenson finds that the Internet has lead to higher employer-to-employer worker flows which could indicate better job match quality for the employed. Kroft and Pope (2008) use data from the classified advertisements community Craigslist.com and find that the website's local expansion has to some degree crowded out newspaper advertisement but did not have 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 durations by about 25 percent. Even though the empirical evidence on the effect of online job search on unemployment remains inconclusive, many studies point out that there should be a substantial effect on matching quality. To our knowledge, however, there has been no study which tested this claim directly.

This paper is structured as follows: In the next section, we are going to describe the data as well as the estimation model. In section 3 we will present our results and in section 4 we thoroughly discuss possible selection concerns. Section 5 concludes.

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

Using individual level data, we can 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 the employment duration as an indicator for the quality of a match (for example Centeno, 2004). Measures that rely on job tenure assume that "good matches endure" (Bowlus, 1995), a statement that certainly holds in many cases but does not necessarily imply that all enduring matches are of high quality, especially when we examine relatively rigid labor markets like Germany. Another approach is to use the wage of a job as an indicator for matching quality (e.g. Simon and Warner, 1992, van Ours and Vodopivec, 2008). However, the wage of a job changer is typically 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. A problem is that variations in wage are to a large extent driven by supply and demand as well as 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) cannot find an effect of Internet job search on wage growth between jobs. We therefore use a different approach and take subjective matching quality measures as our outcome variables.

Our 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, we use the ability to apply own skills, the satisfaction with the type of work, the perspectives, job security, social benefits, work load, commute and working hours in the new job. Note that the dependent variables always indicate the evaluation of a person's new job compared to his 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. In order to limit the risk that we are merely observing a correlation based on the usage of the Internet in general, we include a dummy that indicates the availability of Internet in the household. Additionally, we include county, industry and year fixed effects. Since our dependent variables are binary, we estimate a probit model with robust standard errors.

The data used to estimate the model comes 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 in Germany. The Panel was started in 1984 and covers a wide range of topics including many employment related aspects. Most importantly for our analysis, people who changed their job are not only asked how they learned about their new job but also how their new job compares to their former job. There are several advantages of focusing on job changers instead of also including first-time employees. First of all, workers who had a job before have a reference point with which they can 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 substantial work experience before. Secondly, by comparing a new job with an old job of the same person, we can limit some selection problems, as discussed in section four of this paper. And thirdly, we can ignore the peculiarities of a person's first job which is not only related with occupational training but also associated with a high degree of insecurity concerning the occupational choice.

In the SOEP, the question "How did you find out about your new job?" leaves several answer possibilities, from employment office to the Internet, of which the respondent has to choose one. The variables which measure the matching quality are construed based on the question "How do you view your current position compared to your previous one?", followed by several sub-questions regarding, for example, "the type of work", "chances of promotion", "work hour regulations", "work load" and "commute" with the answer choices "improved, "about the same" and "better". There is a separate question which reads "Are you able to use your professional skills and abilities today more, about the same, or less than in your previous position?". The comparative variables are coded 1 when the answer is "improved" and 0 otherwise. Alternatively, we estimate an ordered logit model with all three answer choices and find similar results as in the binary choice model[1].

By limiting our focus on job changers, we substantially reduce our sample to about 2,000 observations per year between 2000 and 2007. As shown in table 1, the share of people who found their new job through the Internet rises from less than 1 percent in the year 2000 to above 6 percent in 2007. These relatively low

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[1]Results are available upon request

numbers are owed to the fact that we do not take into account 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 at any point during their job search, but more conservatively identify those who learned about the job through the Internet and chose to sign a contract with the employer later on. It is likely that for these two reasons, our 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 can not be used in our analysis because the SOEP did not include all relevant questions in the years following 2007.

Table 2 shows the sample means by the channel which was used to find a new job. Online job finders in our sample are on average 32.5 years old which is slightly younger than workers who found their 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 which is 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 their 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 better chances of promotion in their 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 also social benefits are significantly better for online job seekers.

In the last three columns of table 3 we see results for dependent variables which are not significantly correlated with online job search. Column 6, indicating the satisfaction with the work load in the new job, has an Internet coefficient which

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 further away from home than their previous job. A possible interpretation would be that the Internet opens up job opportunities outside the regional boundaries and thereby increases work mobility. Online job search is also hardly associated to work time, as shown in the last column. Unlike for 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 our first five outcome variables. This means that male job seekers evaluate their new job on average better than female job seekers. One explanation could be that men either get 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 can be argued whether older people get less attractive jobs, are matched worse or simply see a job change in a more negative light. A similar negative correlation can be observed for people with a migration background as well as job changers with a period of unemployment before they find a new job. The higher the education of a person, the better their matching outcome.

It should be emphasized that the Internet coefficient is positive for all dependent variables with the exception of commute. The reason why we see quite small and insignificant coefficients on the work load and working time variables could be that they are relatively poor measures of the matching quality. When a person changes to a challenging job that is different to his prior one, the work load might initially increase as the person has to become familiar with new tasks and processes. It is therefore unclear whether higher work load is a good or a bad sign for the matching quality. The working time in a particular job is not necessarily determined by the individual work contract but rather by firm-wide or union-wide agreements. Again, it is not surprising that the association of online job search with this variable is rather small. The four variables which are much more clearly measures of the matching quality, namely skill use, work type, perspective and job security all have high and significant Internet coefficients. In the next section, we will analyze heterogeneity effects on the skill use variable which is arguably the most interesting measure of job match quality. In the remaining parts of this paper we will usually refer to the first four dependent variables because we believe that they are most relevant for assessing matching quality.

3.1　Effect heterogeneity

Until now we were 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 differs depending on the subgroup we are looking at. 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 tells us the association of finding a job online and being able to use personal skills better in the new job, for workers that do not belong to the group described in the lead column. Column two 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 re-entered 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 we do not know the exact reason for their employment interruption, the high proportion of women in this group points into the direction of parental leave. Other possible reasons for such career breaks include educational leaves, national service, voluntary work, travel or rest. The literature on employment interruptions argues that the worker's human capital stagnates or even decreases during career breaks, with the exception of educational leaves[2]. The skills acquired in school and during previous occupations become increasingly outdated and depreciate during employment pauses. 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, also point out that during periods of childbearing, the erosion of market skills might lead women to revise their expectations and commitment towards employment. The strong negative coefficient for women with children in the second row of table 4 could support this finding. Besides the human capital effect, there is a signalling 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 with high responsibilities to workers with career breaks. Together with the depreciation of skills, this could explain the negative association of re-entry and being a mother with our outcome variable.

The third column of table 4 shows a significantly positive interaction effect for workers who just re-entered 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 employ-

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

ment interruptions. One explanation for this finding could be that the negative signalling 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 to the labor market. Women who are caring for their children instead of working are, for example, less likely to hear of current employment opportunities in the organization or industry they worked in before. The third row seems to confirm the hypothesis that distance to 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 with the book of the same title by Cairncross (1997). He argues that modern telecommunication networks will improve the access of rural areas to larger markets. The disadvantage of job seekers in remote areas is alleviated by the Internet which opens up new supraregional employment opportunities. It should be stressed that in all specifications of table 4, we 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 doubts on the Internet's ability to match unemployed workers more efficiently. There are different possible explanations 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. Especially in light of the passive job search opportunities enabled by the Internet, this hypothesis appears to be very plausible. It would, however, mean 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 under-representation 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. As a consequence of their lack of knowledge, they might use inferior Internet search tools. If, for example, they only visit the website of the employment agency but ignore many of the valuable resources that other job seekers use, this difference in usage could explain why they do not benefit from online job search. Hence, the problem for the unemployed could be insufficient knowledge and lack of the complementary skills that are necessary

to use the Internet to their advantage.

Another possible explanation for the unpromising results of the unemployed might be 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 get a better job. If a low 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 competencies. When he is matched to a new employer who is able to better observe his abilities, the worker could end up being less content even though the matching quality has objectively improved. 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 from applicants that they would not necessarily reveal in an offline application. Candidates can then 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 like LinkedIn allow employers to easily contact former employers of an applicant. In sum, the Internet could reveal unfavorable information about workers and thereby increase the matching quality but decrease the worker's satisfaction with his new job. Unemployed workers could be more prone to such revelation of negative information.

It is interesting to see that young job seekers below the age of 30 are not benefitting disproportionately from online job search. This indicates that the digital divide between younger and older workers does not have adverse consequences when it comes to using online job search tools. Although young people are on average able to use their skills better after a job change, this is not reinforced by the technology they used to find the job. Another concern that is often raised in context of the digital divide debate is that minorities are disadvantaged when it comes to the use of the Internet (e.g. Hoffman and Novak (1998), Fairlie (2004)). While we do observe a negative association of having a migration background and our 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% level. Similarly, workers with tertiary education do not benefit more than the average from online job search. This result can be interpreted as a sign 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

In the previous sections we 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

are public employment services. Holzer (1988), for example, finds that searching 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 of job matches that were facilitated by the public U.S. Employment Service (USES) are lower than those which were 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 smaller incentives for successful matching than private intermediaries, as Zweifel and Zaborowski (1996) argue.

We therefore want to analyze how different job search channels compare to finding a job through federal and local employment offices as well as so-called "Personalserviceagenturen" (PSAs) which are sort of temporal work 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 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 should normally assure a good matching result is less effective. The fact that the coefficient for job security is significantly positive does not contradict this hypothesis. In fact, someone who was offered a job by a friend who works for the same organization, might feel that his job is especially secure since it is protected by his supporter. 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 match makers fall in this category. The newspaper coefficients are also positive, although insignificant and much smaller than the Internet coefficients. We can therefore 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 their job through the employment office, private job agencies or undefined means are not of primary interest for our analysis. After all, these methods 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. In order to test this argument, we exclude all job changers who have used other channels 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 while 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 meth-

ods taken together but also compared specifically to the most similar channels, namely newspapers and friends.

4   Discussion of Potential Selection Issues

In the last section we found that our results are robust to a wide range of controls and sample restrictions. However, there are some obvious selection issues which could bias our results. Possible problems might arise if Internet finders were fundamentally different from the workers we compare them 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. In the following section we want to tackle these concerns.

4.1   Selection on Unobservables

In the specifications of the previous section, we have seen that the observed associations are not driven by factors like 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. Online job seekers could, for example, be generally more open to new technologies and adapt better to technological changes. This could in turn be a characteristic which is valued by employers and correlated with better matching outcomes.

One reason why the problem of selection on unobservables is less severe than it might appear at first, is that we basically compare two jobs of the same person. In our analysis, we focus on workers who have changed jobs and can therefore judge their current job in comparison to their former job. They are asked, for example, whether they can use their skills better, equally well or worse than in their previous job. Since we have the same person making assessments of two jobs, many typical selection issues are mitigated. It might well be the case that workers who find their job over the Internet are better able to use changes to their advantage and will therefore always have better career perspectives 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 better 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 many parts of our analysis.

There are, however, certain selection criteria that could still potentially bias

our results. If online job seekers would generally see a job change in a better light than offline job seekers, they could also believe that their new job fits better to them, simply because they changed it recently. Although testing for the personal attitudes towards a new job is very hard, 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 the overall life satisfaction and reads: "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 over the Internet are generally not more optimistic about the future and even slightly less satisfied with their life in general. Additionally, the SOEP also 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 are expected 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 factors. In the SOEP, openness is measured in terms of being original and coming up with new ideas as well as having an active imagination[3]. The third and fourth column 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 view the future or their life situation in general more favorably.

Although there are good reasons to believe that selection on unobservables is not the primary concern in our analysis, we can apply an additional test to eliminate possible selection biases. If people who find their job online are systematically different from others, this difference should not only affect the variables where we see a significant positive association, namely the usage of skills, the satisfaction with the type of work, the career perspectives and job security. The difference between online and offline job seekers should in the same way affect other variables, like the 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 little objective reasons why online job seekers should have more comforting working times, we can use the assessment of the working time as a reference point for all of the person's judgements. By including the "working time" variable in the specifications of table 8, we control for a possible selection effect on the evaluation of a given person. While the association of working time with our outcome variables is highly significant, the coefficients of the Internet variable remain stable. It therefore seems that the relationship between Internet job search and matching quality is not largely biased by a selection on unobserved characteristics.

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[3]The 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 spend more time than offline job seekers looking for a job. If workers who use the Internet for job search spend many hours looking for fitting vacancies while others just open up the newspaper and apply to the next best job advertisement, it not be too surprising if we saw the latter having inferior matching results. But is it realistic that online job seekers are the ones who search more intensively or are more serious about their search? In order to answer this question we need to differentiate the various kinds of offline job seekers in our analysis. It seems likely that people who find their 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 why friends and family do not perform very well could be that the affected job seekers put only little effort into the search process. However, the positive association of Internet job search and matching quality is not only driven by the comparison to job search through friends. As shown in table 5, there is no other channel besides the Internet that is associated with significantly higher matching quality compared to our 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 does not seem to be very convincing. One reason why it appears very unlikely that online searchers are in any way more serious about their search are the low search costs of the Internet. Looking for a job in a newspaper is much more costly than using online job boards. First of all, newspapers themselves cost money. Secondly, it is harder and takes more time to find advertisements that match own qualifications. And thirdly, compiling a classical job application including a printed photograph[4], a nice folder and a postal stamp is much more expensive than filling out an online application form or sending an email. These costs are one reason why the use of postal applications declined steadily over the last couple of years while the use of electronic applications increased over time, as shown in figure 1. Taking the low costs of online job search into account, it seems unlikely that online job seekers are generally more serious about their search compared to those who use newspapers as their search channel of choice.

Besides the lower costs, the Internet also offers passive job search opportunities, as discussed above. Over 135m people maintain online CVs on the worldwide largest professional network LinkedIn[5]. Xing, a German competitor of LinkedIn, has over 11m members[6]. Online CVs allow recruiters and headhunters to actively search for job candidates. Both LinkedIn and Xing offer premium memberships that are targeted to heavy users like recruiters and allow for more

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

[5]http://press.linkedin.com/node/1016

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

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 like Monster offer the possibility 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 like their name and address so that current employers do not realize that their employees look for a new job. The possibility 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 depicts, 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.

In order to further test whether people who use the Internet for job search are more active than others, we 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 our four dependent variables in table 9. By controlling for active job search, we provide additional evidence that workers who find their job through friends or newspapers are not only matched worse because they find a job without actively looking for it. The lower cost and lower effort necessary on the Internet implies that, if anything, online job searchers are less serious about their search.

4.3 Selection of Advertised Jobs

Although we intensively discussed the possible selection of job seekers, we have not addressed the employer side yet. Even if job seekers are neither selected on unobservables nor into search intensities, our results could be biased if only a certain kind of companies use 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 our results remain stable if we exclude the employment offices and job agencies from our analysis. When comparing the Internet with other offline channels it becomes more difficult to think of similar selection arguments. There is evidence that many high-end jobs are not advertised over the Internet but only through other

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[7]http://talent.linkedin.com/Recruiter

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channels. Specialized headhunters and HR consultancies definitely play an important role for executive jobs. 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 into the position. This kind of selection would however lead to an underestimation of the association we observe. If anything, the selection of companies make our results look more conservative.

Figure 3 provides further evidence that companies who advertise online are not necessarily the more attractive employers. It is striking that 40 percent of the companies who advertise on Monster are temporal work companies. Usually, these kind of companies are not among the favorites of job seekers and often pay less than other employers. At Stellenanzeigen.de the share of temporal 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 our results.

Companies choose the advertising channel where they hope to reach the best audience for a specific job advertisement. Different kinds of job positions are therefore advertised through different channels, a fact that gives rise to another selection concern. It leads to the question how job positions advertised through the Internet compare to job positions advertised offline. Figure 4 shows how well the search results at Monster.de fit to different job titles as search terms. On average, almost 80 percent of the search results are exact matches to the requests. There seems to be a tendency that jobs which require high qualifications, like General Manager, HR Director, lawyer and engineer, produce 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, we would underestimate our results.

Anecdotal evidence also suggests that while online advertisements lead to a high quantity of applications, many of them are of lower quality. This could be related to the low application costs that we discussed above. Even if applicants do not match the qualifications requested in an job advertisement, they still try their luck and send out an costless online application, no matter how low their chances of success are. From an employer perspective, this problem obviously becomes larger, the higher the requested qualifications are. Figure 5 shows the results of a study in which identical job advertisements for the position of a procurement director were placed in eight newspapers and eight 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 higher than the number of applications in response to the print advertisements. However, more than 50 percent of the Internet applicants were not suitable for the job at all while this share was considerably lower for

newspaper applicants. Although these numbers are purely descriptive and by no means representative, they reflect the cliche that online recruitment is more about the quantity and less about the quality of applicants. As a result, we might see less high qualification jobs online which again would lead us to an underestimation of our results.

5   Conclusion

In this paper, we investigate whether online job search is associated with higher job matching quality. While the question of how the Internet affects unemployment durations and other labor market outcomes has been repeatedly studied in the literature, this paper provides first empirical evidence on the quality of resulting job matches. We find that matching outcomes of online job seekers are superior along the dimensions of making better use of own skills, being more content with the type of work, having higher chances of promotion and higher job security. These results are not driven by the comparison of 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 newspapers, friends and family. Our results avoid bias from many possible sources of selection. As we focus our analysis on workers who found their previous job offline and their current job either offline or online, we are virtually able to compare two matching outcomes of the same worker by using retrospective data. Additionally, we tackle several selection issues by conducting robustness tests and we provide some descriptive evidence in order to alleviate remaining selection concerns. Even though we are 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.

Our results indicate that the Internet is especially important for job seekers who are distant to the labor market. Workers with employment interruptions are particularly 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 within many labor markets, it is important to know that the Internet helps to alleviate possible negative consequences of a maternity leave. Our 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 regards to the expansion of broadband Internet in rural areas. It is remarkable that online job search seems to compensate many disadvantages of job seekers who are distant to 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 complementary skills and knowledge to use the Internet for their advantage. If this was the case, it could be worth

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

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Table 1: Number of job changers and Internet finders in sample

Year	Observations	Job Changers	Changers / Observations	Internet	Internet / Changers
2000	24,576	2,560	10.42	22	0.86
2001	22,351	2,400	10.74	45	1.88
2002	23,892	2,263	9.47	71	3.14
2003	22,611	1,922	8.50	68	3.54
2004	22,019	1,744	7.92	81	4.64
2005	21,105	1,603	7.60	84	5.24
2006	22,358	1,791	8.01	99	5.53
2007	20,886	1,939	9.28	119	6.14
Total	179,798	16,222	9.02	589	3.63

Table 2: Sample means by job search method

	Internet	Newspaper	Friends	Private Agency	Job Center	Other	Back to former
age	32.51	35.02	33.43	35.71	33.11	34.60	36.31
	(9.35)	(10.55)	(11.23)	(11.22)	(11.95)	(10.38)	(10.75)
male	0.57	0.40	0.48	0.59	0.51	0.51	0.36
	(0.49)	(0.49)	(0.50)	(0.49)	(0.50)	(0.50)	(0.48)
migrated	0.15	0.18	0.22	0.22	0.19	0.14	0.16
	(0.36)	(0.38)	(0.41)	(0.42)	(0.40)	(0.35)	(0.37)
education	4.16	3.61	3.34	3.90	3.24	4.02	3.66
	(1.49)	(1.42)	(1.45)	(1.52)	(1.27)	(1.53)	(1.33)
unemployed	0.36	0.26	0.24	0.29	0.54	0.17	0.20
	(0.48)	(0.44)	(0.43)	(0.45)	(0.50)	(0.38)	(0.40)
N	512	1,774	3,902	167	894	2,093	1,274

Means of the respective subsample. Standard deviations in parentheses.

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

	(1) skill use	(2) work type	(3) perspective	(4) job security	(5) benefits	(6) work load	(7) commute	(8) work time
found via Internet	0.0645***	0.0798***	0.0812***	0.0455**	0.0687***	0.0095	-0.0070	0.0150
	(0.0214)	(0.0236)	(0.0202)	(0.0212)	(0.0205)	(0.0220)	(0.0235)	(0.0237)
male	0.0301***	0.0682***	0.0726***	0.0615***	0.0366***	0.0044	-0.0337***	-0.0726***
	(0.0106)	(0.0115)	(0.0103)	(0.0106)	(0.0104)	(0.0108)	(0.0112)	(0.0115)
age	-0.0074***	-0.0072***	-0.0096***	-0.0049***	-0.0030***	-0.0016***	-0.0010**	-0.0021***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
migrated	-0.0304**	-0.0292**	-0.0453***	-0.0271**	-0.0016	-0.0053	0.0070	-0.0296**
	(0.0130)	(0.0142)	(0.0124)	(0.0127)	(0.0127)	(0.0131)	(0.0140)	(0.0140)
education	0.0327***	0.0070*	0.0395***	0.0104***	0.0138***	-0.0069*	-0.0035	-0.0103**
	(0.0037)	(0.0041)	(0.0036)	(0.0037)	(0.0036)	(0.0038)	(0.0040)	(0.0041)
unemployed	-0.0305***	-0.0388***	-0.0534***	-0.0340***	-0.0232**	-0.0426***	-0.0239**	-0.0469***
	(0.0107)	(0.0116)	(0.0103)	(0.0106)	(0.0104)	(0.0106)	(0.0113)	(0.0115)
Internet available	0.0573***	0.0376***	0.0152	-0.0028	0.0179*	0.0057	0.0157	0.0326***
	(0.0109)	(0.0119)	(0.0108)	(0.0109)	(0.0106)	(0.0110)	(0.0116)	(0.0117)
job changes	0.0051	-0.0100**	-0.0037	-0.0128***	-0.0094***	-0.0008	-0.0018	-0.0057
	(0.0036)	(0.0040)	(0.0036)	(0.0037)	(0.0036)	(0.0037)	(0.0039)	(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	9045	9162	8888	8901	8922	9058	9076	9107
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*	-0.1031***	0.1397*	9037
	(0.0267)	(0.0130)	(0.0732)	
Female and children below age 16	0.0489*	-0.0991***	0.1463**	9037
	(0.0269)	(0.0141)	(0.0713)	
Rural area	0.0228	-0.0285***	0.1152**	9037
	-0.0334	-0.0109	-0.0487	
Unemployed during last 12 months	0.0850***	-0.0313***	-0.0284	9037
	(0.0325)	(0.0113)	(0.0474)	
Younger than 30	0.0833***	0.0472***	-0.0255	9037
	(0.0294)	(0.0160)	(0.0507)	
Tertiary education	0.0825**	0.0075	-0.0183	9037
	(0.0336)	(0.0227)	(0.0477)	
Migration backround	0.0580**	-0.0344**	0.1109	9037
	(0.0261)	(0.0139)	(0.0683)	

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	0.0486*	0.0782***	0.0659***	0.0605**
	(0.0256)	(0.0280)	(0.0245)	(0.0255)
found via friends	-0.0213	0.0135	-0.0169	0.0378**
	(0.0170)	(0.0183)	(0.0166)	(0.0171)
found via newspaper	0.0193	0.0266	0.0165	0.0233
	(0.0188)	(0.0203)	(0.0182)	(0.0189)
found via agenccy	-0.0531	0.0410	-0.0077	0.0126
	(0.0410)	(0.0438)	(0.0389)	(0.0402)
found via other	-0.0006	0.0194	0.0061	0.0258
	(0.0183)	(0.0198)	(0.0179)	(0.0186)
individual	Yes	Yes	Yes	Yes
county-fixed	Yes	Yes	Yes	Yes
industry-fixed	Yes	Yes	Yes	Yes
year-fixed	Yes	Yes	Yes	Yes
N	9045	9162	8888	8901
Pseudo R2	0.103	0.086	0.130	0.087

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	0.0562**	0.0574**	0.0637***	0.0193
	(0.0229)	(0.0247)	(0.0217)	(0.0232)
male	0.0224	0.0652***	0.0824***	0.0677***
	(0.0140)	(0.0150)	(0.0135)	(0.0141)
age	-0.0072***	-0.0078***	-0.0098***	-0.0052***
	(0.0006)	(0.0007)	(0.0006)	(0.0006)
migrated	-0.0221	-0.0337*	-0.0409**	-0.0364**
	(0.0168)	(0.0181)	(0.0159)	(0.0166)
education	0.0332***	0.0111**	0.0429***	0.0136***
	(0.0049)	(0.0053)	(0.0047)	(0.0050)
unemployed	-0.0267*	-0.0387**	-0.0456***	-0.0318**
	(0.0142)	(0.0153)	(0.0136)	(0.0143)
Internet availability	0.0508***	0.0193	0.0142	-0.0151
	(0.0142)	(0.0153)	(0.0139)	(0.0144)
job changes	0.0024	-0.0174***	-0.0118***	-0.0163***
	(0.0048)	(0.0052)	(0.0046)	(0.0049)
county-fixed	Yes	Yes	Yes	Yes
industry-fixed	Yes	Yes	Yes	Yes
year-fixed	Yes	Yes	Yes	Yes
midrule N	5341	5443	5265	5255
Pseudo R2	0.108	0.093	0.152	0.098

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	-0.1395	-0.0109	0.1806
	(0.1002)	(0.0771)	(0.1808)	(0.1905)
male	-0.1049*	-0.0739*	0.2503**	-0.0662
	(0.0481)	(0.0314)	(0.0862)	(0.0985)
age	0.0140***	-0.0197***	0.0013	-0.0101*
	(0.0023)	(0.0016)	(0.0042)	(0.0047)
migrated	-0.0790	0.0432	-0.0259	-0.1261
	(0.0657)	(0.0424)	(0.1179)	(0.1298)
education	-0.0733***	0.1149***	0.0490	0.0066
	(0.0181)	(0.0117)	(0.0312)	(0.0348)
unemployed	0.1075*	-0.3825***	-0.1721	-0.2463*
	(0.0532)	(0.0368)	(0.0974)	(0.1086)
Internet available	-0.0828	0.0981**	0.2099*	-0.0237
	(0.0558)	(0.0335)	(0.1051)	(0.1141)
job changes	-0.0097	-0.0715***	0.0398	0.0485
	(0.0179)	(0.0118)	(0.0316)	(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) skill use	(2) work type	(3) perspective	(4) job security
internet	0.0668***	0.0748***	0.0793***	0.0443**
	(0.0241)	(0.0230)	(0.0200)	(0.0208)
working time	0.0657***	0.1773***	0.0881***	0.1565***
	(0.0103)	(0.0099)	(0.0092)	(0.0090)
individual	Yes	Yes	Yes	Yes
county-fixed	Yes	Yes	Yes	Yes
industry-fixed	Yes	Yes	Yes	Yes
year-fixed	Yes	Yes	Yes	Yes
N	9108	9118	8857	8869
Pseudo R2		0.100	0.130	0.105

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.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
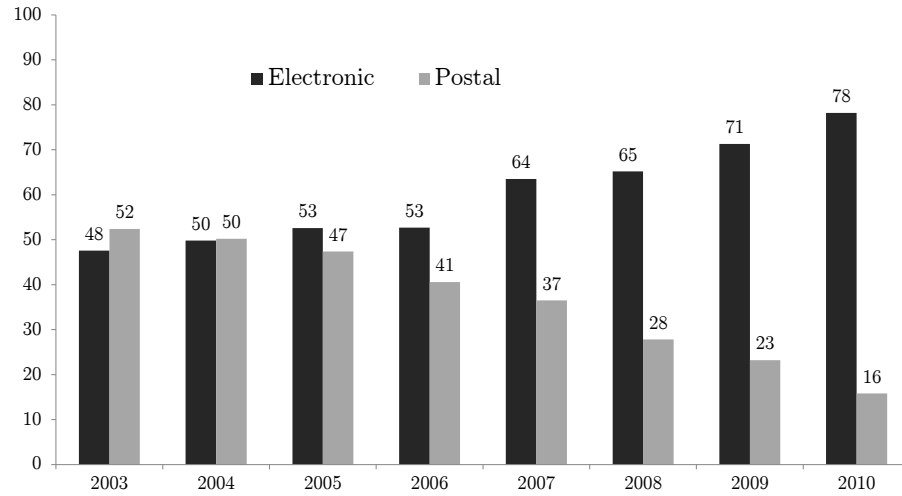
Table 9: Controlled for active search

	(1) skill use	(2) work type	(3) perspective	(4) job security
found via Internet	0.0469**	0.0557**	0.0608***	0.0322
	(0.0215)	(0.0238)	(0.0204)	(0.0214)
active search	0.0669***	0.0688***	0.0635***	0.0370***
	(0.0100)	(0.0108)	(0.0098)	(0.0100)
covariates	Yes	Yes	Yes	Yes
county-fixed	Yes	Yes	Yes	Yes
industry-fixed	Yes	Yes	Yes	Yes
year-fixed	Yes	Yes	Yes	Yes
N	8993	9114	8841	8854
Pseudo R2	0.101	0.080	0.126	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
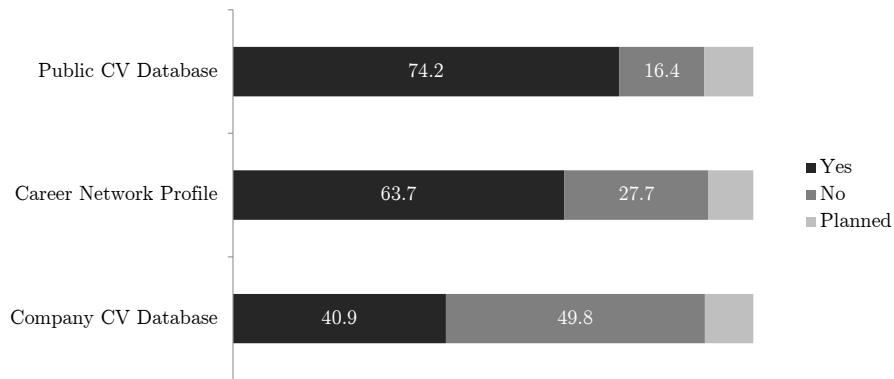covariates: male, age, migrated, education, unemployed, and Internet at home.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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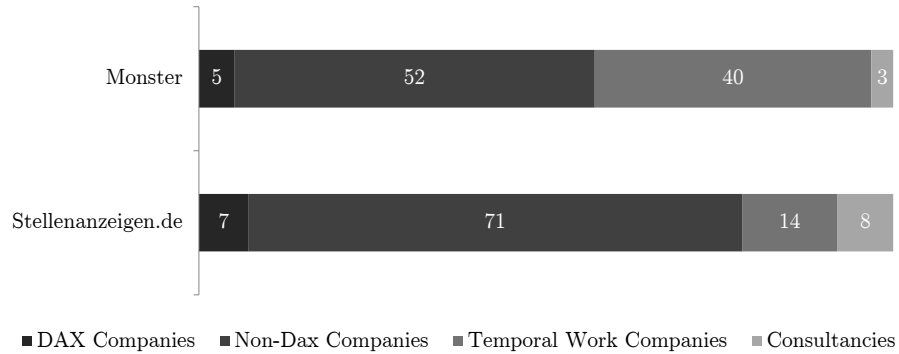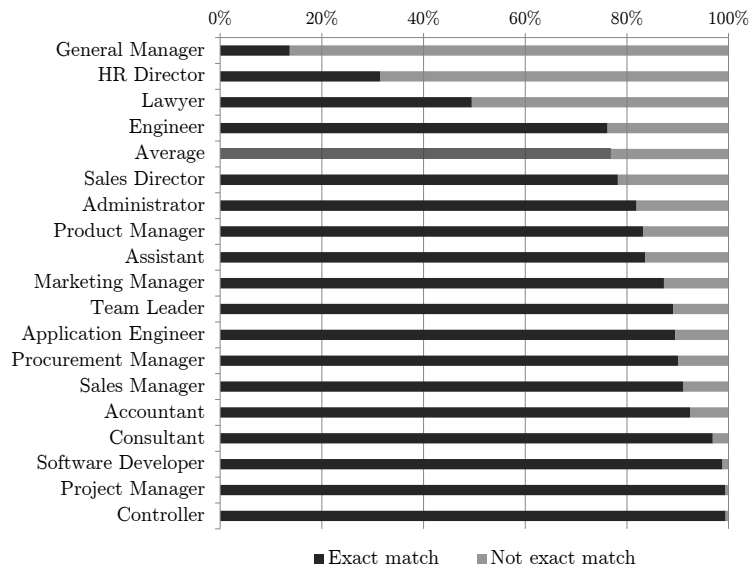

Source: Bewerbungspraxis 2011, Centre of Human Resources Information Systems (CHRIS). Based on 10,227 individuals interested in career opportunities.

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.

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

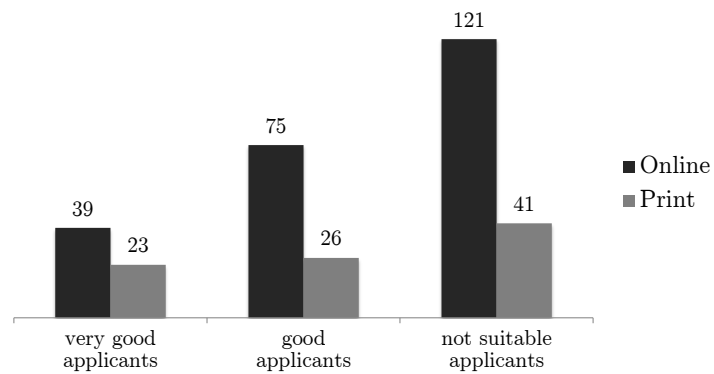|	DAX Companies	Non-Dax Companies	Temporal Work Companies	Consultancies
Monster	5	52	40	3
Stellenanzeigen.de	7	71	14	8

Source: Jobbörsen im Vergleich 2011, Fachhochschule Koblenz.
Based on 1,500 radomly 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).