PERSPECTIVES

PHOENIX CENTER FOR ADVANCED LEGAL & ECONOMIC PUBLIC POLICY STUDIES

Mobile Broadband and Job Search: An Empirical Test

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Introduction

With extraordinarily high unemployment expected to continue for at least the next three years,[1] the significance of public policy on labor market outcomes is of significant interest. In that regard, I recently updated earlier research to affirm findings that Internet use is a powerful tool to help Americans remain in the labor force by continuing active job search.[2] With the rapid adoption growth of mobile communications services, particularly among the poor and minorities,[3] an interesting question is whether mobile Internet use also plays a meaningful role in labor market outcomes?

In this PERSPECTIVE, using the most recent *Computer and Internet Use Supplement* of the Census Bureau's *Current Population Survey*,[4] I answer this question by quantifying the effect of mobile broadband use on job search. I find, using Propensity Score Matching and regression methods, that mobile Internet use has a large and statistically significant effect on sustaining active job search, cutting in half the probability an unemployed person abandons efforts to find new employment due to discouragement about labor market prospects.[5] In fact, mobile use reduces labor market discouragement even more than broadband use at home.

This new evidence once again points to the importance of Internet use on job search. Significantly, we find that mobile broadband service *is at least as* potent a tool for job search as is either public use or broadband use at home. Given these new results, our research again reveals that a healthy commercial Internet ecosystem, supported by policies that encourage efficient investment in expanded availability, remains an important tool for helping the United States return to economic health.

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Background

Searching for work can be frustrating, particularly now at a time when unemployment is extraordinarily high and economic growth sluggish. For some, the prospects for employment are perceived to be so poor that discouragement sets in and search stops. According to government employment statistics, the numbers of such discouraged workers—a formal classification for workers that want to work and have searched in the prior 12 months, but not in the prior 4 weeks due to unfavorable beliefs about employment prospects—has more than doubled since 2007, just before the recession began.[6] If the discouraged were included in the calculation of the unemployment rate, then the nation's unemployment rate would well exceed 10%.[7] The termination of job search likely leads to prolonged spells of unemployment, an undesirable outcome both for the jobless and for the economy.

In prior work, my co-authors and I have shown that Internet use substantially decreases the probability that a person out of work gives up on job search due to discouragement about job prospects.[8] Most, if not all, of this Internet-based reduction in discouragement is related to Internet-based job search, and not simply to general Internet use, which supports the causal nature of our findings.[9] This research also indicated that broadband, dial-up and public use of the Internet all contributed positively to sustained job search, with the size of the effects being roughly equal in most cases. The statistical tests in these earlier papers were conducted using the 2003, 2007 and 2009 *Computer and Internet Use Supplements* of the *Current Population Survey*.

Given the survey questions contained in the 2007 and 2009 *Supplements*, we were unable to quantify the unique effect of mobile broadband connectivity, or to compare its effect to other connection modalities. Using the most recent *Computer and Internet Use Supplement*, dated October 2010, however, I have access to greater detail on Internet connection modalities. Therefore, it is now possible to quantify the effect of mobile broadband use on job search and labor market discouragement. By doing so, I shed light on the value of mobile broadband for sustaining job search, and its effect relative to other connection modalities such as broadband use at home or in public locations.

Data

The 2010 *Computer and Internet Use Supplement* contains a number of questions detailing Internet use and modes of connectivity. Respondents are asked not only if they have broadband, but whether they connect using dial-up, DSL, cable modem, fiber optic, satellite, and/or mobile technologies. The survey also provides information on persons using the Internet outside of the home, such as at work or public locations like libraries. Given an outcome of economic interest, this disaggregated information on connection modalities permits the assessment of the relative beneficial effects of different connection technologies. To that end, we address the same problem covered in PHOENIX CENTER POLICY PAPER NO. 39, PERSPECTIVE NO. 10-01 and, most recently, PERSPECTIVE NO. 11-04. In all three studies, we quantified the impact of Internet use on continued job search by persons out of work.

… our research again reveals that a healthy commercial Internet ecosystem, supported by policies that encourage efficient investment in expanded availability, remains an important tool for helping the United States return to economic health.

As the sample includes people of all ages (including small children), for the present analysis I label an Internet user as someone who lives in a household where the Internet is used. For the full sample, 76.6% of respondents indicate that the Internet is used in the home, while 8.9% of respondents do not connect at home but do so at some location outside of the home. In all, 85.5% of respondents indicate that they are in an environment where the Internet is used.

In an effort to pare down the analysis, I define broadband as including any home connection using DSL, cable modem, fiber optic, or satellite, as well as including the "other" category.[10] Mobile broadband is separated out into its own category. Based on sample means, 69.4% of persons connect with broadband (about 90% of the home users) and 2.9% with dial-up. About 7.1% indicate that they connect to the Internet using a mobile phone or similar device. Of course, some persons jointly subscribe to both mobile and fixed broadband. About 4.3% of persons connect only using a mobile service, so the data indicates that only about 3% of persons are using both broadband and mobile service (or, 4% of broadband users are also mobile users).[11]

As in earlier work, I limit the sample to jobless persons, including those defined by the BLS to be unemployed or marginally attached to the labor force. The discouraged are a part of this latter group. The final sample consists of 7,505 observations. As described below, this sample will be broken into numerous subsamples to facilitate pair-wise comparisons.

Statistical Model

In my earlier work on this topic, Internet use was divided into three categories: (1) broadband; (2) dial-up; and (3) public use. In this PERSPECTIVE, I add a fourth option which is mobile-only connectivity. By "mobile only", I mean that these respondents connect to the Internet using only a mobile service. Note that the "broadband" and "dial-up" groups include persons that connect to the Internet using a fixed technology and, in some case, a mobile technology as well. I include anyone having a broadband connection at home in the broadband group, whether or not they also have a mobile connection (unless otherwise indicated). Confirmatory analysis is conducted using a "broadband only" group, which includes broadband users that do not use a mobile connection, and a group that uses both broadband and mobile connection modalities.

In earlier work, we considered a trichotomous outcome: (1) unemployed; (2) discouraged; or (3) marginal but not discouraged. Our earlier work showed that in most cases, Internet use had a weak, if any, effect on being a "marginal but not discouraged" worker, since for these jobless persons search was abandoned due to external constraints such as family responsibilities (rather than job market prospects). As such, I limit our attention to the discouraged workers, providing for a more concise exposition.[12] As before, I employ both the BLS definition of discouraged worker as well as an alternative definition limited to those discouraged because they "believe no work is available" or "couldn't find any work," both being reasons clearly related to the information acquisition problem the Internet may solve.[13] (As opposed to beliefs about age and race discrimination, which also classify as a "discouraged" response in the government statistics.)

Given the larger number of connectivity modes, I do not use the same empirical approach of POLICY PAPER NO. 39 and PERSPECTIVE NO. 11-04, but rather adopt the approach used in PERSPECTIVE NO. 10-01, which is based on the work of Lechner (2002).[14] In that PERSPECTIVE, I conducted pair-wise estimation of the treatment effects using Propensity Score Matching, and I apply the same approach here.

The logic of the matching procedure is straightforward. In estimating the effect of Internet use, we are not interested simply in the difference between the outcomes of those that use the Internet relative to those that do not. Rather, the goal of the statistical analysis is to measure the change in outcomes as a result of Internet use for those that do use the Internet. Given the observational nature of the data, however, it is possible only to observe the outcome with Internet use. As a consequence, it is necessary to find a non-use proxy for Internet users. Naturally, non-users are the most obvious proxy, but some care must be taken to ensure that non-users are sufficiently comparable to users so that the non-users' outcomes serve as a good proxy for the non-use outcomes of Internet users.[15] In an experimental setting, random assignment solves this problem. For the observational data on Internet use and labor market outcomes, my plan is to mimic random assignment using Propensity Score Matching, a procedure that creates a control group that is matched to the treated group thereby ensuring the two groups are demographically the same.[16]

To estimate the conditional average treatment effect (on the treated), I proceed as follows. First, I create pair-wise samples, including a control group (no Internet) and a treated group (e.g., broadband use). Second, a Propensity Score is estimated using Logit regression with a large number of covariates (listed below). This score is a prediction of the probability of receiving the Internet use treatment. Third, a control sample is generated by matching observations from the control group to observations in the treated group based on this estimated Propensity Score, ensuring that the control and treated groups have approximately equal probabilities of receiving the treatment. Two matching algorithms are used: (1) Radius Matching and (2) Kernel Matching.[17] Both methods choose control observations based on an estimated Propensity Score. This process creates a weighting series. Fourth, the treatment effect is estimated by weighted Logit regression, using weights generated by the matching process, where the outcome is regressed on a treatment dummy variable and a set of covariates (listed below).

Covariates in the treatment model include: a dummy variable equal to 1 if there are children 18 or younger in the home; a dummy variable equal to 1 if the respondent is male; a dummy variable equal to 1 if the respondent has a college education; a dummy variable equal to 1 if the respondent does not have a high school degree; a dummy variable equal to 1 if the respondent is Caucasian; a dummy variable equal to 1 if the respondent is an immigrant; a dummy variable equal to 1 if the respondent lives in a metro area; a dummy variable equal to 1 if the respondent is a veteran; a dummy variable equal to 1 if the respondent is currently a full time student; a set of five income dummy variables indicating incomes ≤ $10,000, $10,000 to $20,000, $20,000 to $35,000, $35,000 to $50,000, and $50,000 to $100,000 (with a "> $100,000" dummy omitted); set of dummy age variables indicating persons 20 years or younger, between 20 and 40 years, and between 40 and 60 years (with a "> 60 years" dummy left out to avoid the dummy trap). Five additional variables are used for the purpose of estimating the Propensity Score including: a dummy variable equal to 1 if the respondent is married; a variable measuring household size, and three regional dummy variables (with the fourth excluded to avoid the dummy trap). All of these covariates are found in the *Supplement*.

Results

The effect of Internet use on job search is measured as the difference labor market classification when the Internet is used (Y_1) and when it is not (Y_0). To this end, I use the statistical model to generate the predicted probability that an unemployed person using the Internet becomes discouraged (Y_1), and the predicted probability that same unemployed person does not become discouraged if he or she does not use the Internet (Y_0). The treatment effect is just $T = Y_1 - Y_0$, averaged across the sample, where $T < 0$ if Internet use encourages continued job search.

I compute treatment effects for six pair-wise comparisons. The first four compare the outcomes between no Internet use and use by dial-up, public use, broadband, or mobile only connection modalities. As a fifth, I test whether mobile only (the treatment) has a statistically different effect on discouragement than broadband only (the control). Finally, I compare the outcomes between persons that use mobile only relative to those persons that use both broadband and mobile modalities. We would not expect to observe large differences between these two groups if mobile is as effective as is broadband on its own, since whatever advantage mobile use provides is experienced by both groups.

Comparing mobile-only use to broadband-only use, I find that the difference is statistically different from zero (at the 10% level), implying that mobile-only connectivity is a very effective tool for job search and more effective than even broadband use at home.

To begin, I summarize the (unconditional) means differences for discouragement across connection modalities. These means differences may not indicate causal differences across modalities in cases where the treated and control groups differ in their non-use outcomes (the Y_0) for reasons other than Internet use. These differences in the probability of falling into the "discouraged worker" category (versus being unemployed, thus still searching for work) are computed using Logit regression with pair-wise samples. The dependent variable of the regression has a dummy variable with a value of 1 for the discouraged (0 for the unemployed), which is regressed on a single dummy variable that equals 1 if there is Internet use of a given type (a constant term in included as well). The marginal effect is computed by comparing the predicted probability of the discouragement for non-use (Y_0) and for Internet use (Y_1). The null hypothesis of the statistical test is that this difference is zero.

Table 1. Unconditional Treatment Effects

	Y_0	Y_1	Diff	% Diff
Discouraged, BLS Definition				
Dial-up	0.19	0.165	-0.025	-12%
Public	0.19	0.107	-0.083*	-42%
Broadband	0.19	0.114	-0.076*	-37%
Mobile Only	0.19	0.073	-0.079*	-55%
Discouraged, Author Definition				
Dial-up	0.212	0.187	-0.025	-13%
Public	0.212	0.123	-0.089*	-44%
Broadband	0.212	0.133	-0.079*	-40%
Mobile Only	0.212	0.096	-0.116*	-61%

* Statistically Different from zero at 5% level or better; Null (Diff = 0).

From Table 1, we can see that about 20% of those that do not use the Internet in any form fall into the discouraged category (19% for BLS definition; 21.2% for my own).[18] Internet users, however, have much lower probabilities for becoming discouraged. The smallest difference is for dial-up (-0.025) and the largest difference for mobile-only users (-0.079 and -0.116). Indeed, a mobile-only user is half as likely to become discouraged as is a non-user (-55%, -61%). That said, mobile-only users are also much more educated and have much higher incomes than non-users, so these means difference may simply reflect the role of demographic differences rather than a treatment effect from Internet use. To quantify the treatment effect conditioned on such differences, we turn to Propensity Score Matching and Logit regressions.

Table 2 provides the conditional average treatment effects for the matched samples using the BLS definition of a discouraged worker.[19] As seen in the table, the probability that a jobless person (either unemployed or marginally attached) is classified as discouraged (Y_0) is about 20%, if that jobless person is not an Internet user. With the exception of dial-up, Internet users have a much lower probability of being classified as discouraged, and all of the differences in probabilities are statistically-significant.

Table 2. Conditional Avg. Treatment Effects

(BLS Discouraged)

	Y_0	Y_1	Diff	% Diff
None, Dial-up				
Radius	0.208	0.191	-0.017	-8.1%
Kernel	0.211	0.191	-0.021	-10%
None, Public				
Radius	0.177	0.127	-0.050*	-28%
Kernel	0.180	0.123	-0.057*	-32%
None, Broadband				
Radius	0.190	0.137	-0.053*	-28%
Kernel	0.198	0.135	-0.064*	-32%
None, Mobile				
Radius	0.199	0.105	-0.094*	-47%
Kernel	0.179	0.097	-0.081*	-46%
Broadband Only, Mobile Only				
Radius	0.126	0.097	-0.029**	-23%
Kernel	0.126	0.098	-0.028**	-22%
Mobile Only, Broadband and Mobile				
Radius	0.092	0.071	-0.022	-23%
Kernel	0.094	0.064	-0.030	-32%

Statistical Significance (* 5%, ** 10%); Null (Diff = 0).

Relative to no Internet use, public use (-28%, -32%) and broadband (-28%, -32%) reduce the probability of being discouraged by about one-third. Mobile-only use reduces that probability by about half (-47%, -46%), the largest of the effects. Comparing mobile-only use to broadband-only use, I find that the difference is statistically different from zero (at the 10% level), implying that mobile-only connectivity is a very effective tool for job search and more effective than even broadband use at home.

The "Broadband Only, Mobile Only" comparisons eliminates from the sample all broadband users that also use mobile broadband. Performing the matching tests, the results predict that about 12.6% of broadband only users will be discouraged, whereas the probability for mobile users is only 9.8%. The difference is statistically significant (at the 10% level). This result supports the hypothesis that mobile use is at least and possibly more effective as broadband use at home at promoting continued job search.

Next, I compare mobile only users to those persons accessing the Internet using *both* mobile and broadband at home. While the combined use of broadband and mobile has a smaller point estimate of the probability of becoming discouraged (-0.071), the difference between the two modalities is not statistically-significant (with a null hypothesis of zero difference). Thus, while broadband has a large effect versus no Internet use, I cannot reject the null hypothesis that it offers no advantage to those accessing the Internet with a mobile device.

Table 3 summarizes the test results based on my modified definition of discouragement.[20] This alternate measure of discouragement is more narrow than the BLS definition and includes, in my opinion, the most likely factors to be affected by Internet use (if such use reduces the cost of information acquisition). The results are comparable across these two definitions of discouragement (the BLS definition and my own).

Table 3. Conditional Avg. Treatment Effects

(Author Definition of Discouraged)

Control, Treated	Y_0	Y_1	Diff	% Diff
None, Dial-up				
Radius	0.171	0.169	-0.003	-1.5%
Kernel	0.196	0.169	-0.029	-15%
None, Public				
Radius	0.162	0.109	-0.053*	-33%
Kernel	0.163	0.107	-0.056*	-34%
None, Broadband				
Radius	0.182	0.117	-0.065	-36%
Kernel	0.182	0.115	-0.067	-37%
None, Mobile Only				
Radius	0.165	0.071	-0.094*	-57%
Kernel	0.167	0.075	-0.092*	-55%
Broadband Only, Mobile Only				
Radius	0.110	0.075	-0.035*	-32%
Kernel	0.108	0.074	-0.034*	-31%
Mobile Only, Broadband and Mobile				
Radius	0.104	0.076	-0.028	-27%
Kernel	0.075	0.075	-0.000	-0.0%

Statistical Significance (* 5%, ** 10%); Null (Diff = 0).

Again, dial-up has no statistically significant effect on discouragement. All other use modalities have large effects that are all statistically different from zero. Public use (-33%, -34%) and broadband (-36%, -37%) again reduce discouragement by about one-third, while mobile-only use cuts discouragement by just over half (-57%, -55%). As with the BLS definition, mobile-only use is found to have a statistically larger effect than broadband-only use. Moreover, the combination of both broadband and mobile use does not have a statistically larger effect than mobile use alone. It appears, from this analysis, that mobile Internet use is at least as efficacious for job search as broadband at home (and probably more so).

In Table 1, I presented the unconditional effects of Internet use based on simple means differences across users and non-users (in unmatched samples). For the most part, the unconditional treatment effects are larger than the conditional effects based on matched samples. This suggests that simple means differences tend to overstate the effectiveness of Internet use on job search. That said, the conditional treatment effects remain large.

These findings are generally comparable to earlier research on this same topic. In prior work, it was found that broadband and public use have large effects that statistically are, in most cases, equal. Relative to these two modalities, dial-up was found to have smaller effect, but in earlier work the effect was sometimes statistically different from zero. As dial-up use wanes and Internet content becomes more demanding in terms of bandwidth, we might expect to find the efficacy of dial-up to diminish over time. My findings here suggest that decay in that efficacy may have already set in. An important and consistent conclusion across all my work on this topic is that public shared use is a potent tool for job search and, as such, public policy should not ignore the importance of shared Internet use at libraries and other public locations.

Conclusion

Recent research shows that Internet use has a potent effect on active job search, reducing by a large degree the probability an unemployed person gives up searching because they become discouraged about new employment prospects. Using the most recent *Computer and Internet Use Supplement* of the *Current Population Survey* (dated October 2010), I again confirm these large effects for public use and broadband use modalities. But more significantly, the most recent data also permits an evaluation of the unique effect of mobile Internet use on job search. I find that mobile use strongly promotes continued job search, reducing the probability by half that a jobless person abandons looking for new employment due to discouragement about the labor market—the largest effect of any Internet modality (for the 2010 *Supplement* sample).

… consistent with prior research, our conclusions again indicate that policymakers should promote policies that provide incentives, rather than deterrents, to companies willing to make efficient investments in wireless broadband.

As mobile broadband becomes the connection modality of choice for many Americans, the study of the efficacy of such use in producing favorable economic outcomes is likely to grow in importance and public policy significance. This study provides some early evidence and suggests that mobile broadband may be as or more effective an economic tool as other forms of Internet connectivity. Accordingly, our conclusions again indicate that policymakers should promote policies that provide incentives, rather than deterrents, to companies willing to make efficient investments in wireless broadband.

NOTES:

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1 Congress of the United States – Congressional Budget Office, THE BUDGET AND ECONOMIC OUTLOOK: AN UPDATE (August 2011) (available at: http://www.cbo.gov/ftpdocs/123xx/doc12316/08-24-BudgetEconUpdate.pdf).

2 G.S. Ford, PHOENIX CENTER POLICY PERSPECTIVE NO. 11-04: *Internet Use and Labor Market Participation: Additional Insights from New and Old Data* (August 18, 2011) (available at: http://www.phoenix-center.org/perspectives/Perspective11-04Final.pdf); T.R. Beard, G.S. Ford and R.P. Saba, *Internet Use and Job Search*, PHOENIX CENTER POLICY PAPER NO. 39 (January 2010) (available at: http://www.phoenix-center.org/pcpp/PCPP39Final.pdf); G.S. Ford, *Internet Use and Job Search: More Evidence*, PHOENIX CENTER POLICY PERSPECTIVE NO. 10-01 (January 26, 2010) (available at: http://www.phoenix-center.org/perspectives/Perspective10-01Final.pdf).

3 *See* Prepared Remarks of FCC Commissioner Mignon L. Clyburn, *Robust Competition in the Wireless Industry is the Key to a Successful Marketplace*, National Conference for Media Reform Boston, MA (April 8, 2011) (available at: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-305663A1.pdf).

4 http://www.census.gov/cps. The data can be downloaded using DataFerrett (http://dataferrett.census.gov).

5 Discouragement is a formal classification of the jobless by the Bureau of Labor Statistics. Jobless persons that have searched for work in the past 12 months but not the past 4 weeks are labeled "marginally attached" to the labor force, but are not included in the unemployed or the labor force for the most commonly used measures of unemployment. These marginally attached workers are divided into two classes: discouraged, and marginally attached but not discouraged. A "discouraged" person is no longer seeking work because they believe either that there are no jobs available, or else no jobs for which they are qualified. The five specific reasons for discouragement are (1) thinks no work available; (2) could not find work; (3) lacks schooling or training; (4) employer thinks too young or old; and (5) other types of discrimination. Bureau of Labor Statistics, *Ranks of Discouraged Workers and Others Marginally Attached to the Labor Force Rise During Recession*, ISSUES IN LABOR STATISTICS, Summer 09-04 (April 2009)(available at: http://www.bls.gov/opub/ils/pdf/opbils74.pdf).

6 *The Employment Situation – July 2011*, Bureau of Labor Statistics (August 5, 2011) (available at: http://www.bls.gov/news.release/pdf/empsit.pdf).

7 Bureau of Labor Statistics, *The Employment Situation - December 2010*, USDL0-11-0002 (Jan. 7, 2011) at Table B and A-16.

8 *Supra* n. 2.

9 POLICY PERSPECTIVE NO. 10-01, *supra* n. 2.

10 Given the data, we could expand the list significantly by separating broadband into its components (DSL, cable, satellite, fiber) and group people by whether they use multiple connection modalities like mobile and broadband. As the problem is complex enough in the way we manage it, we save that more detailed analysis for future work.

11 These figures are not much different in the weighted sample. About 75.3% of respondents live in connected homes, 68.3% use broadband, 2.9% use dial-up, 6.6% use mobile, with 4% using mobile alone.

12 With a dichotomous outcome and L treatments, there are L(L - 1) pair-wise combinations. As such, we have 12 comparisons to make with 4 modalities.

13 This author definition is slightly different than before in that uses fewer explanations for discouragement. *See, e.g.*, POLICY PAPER NO. 38, *supra* n. 2, at Table 2. The goal is to select only those reasons for which the Internet was almost certain to impact. The BLS defines the discouraged as those who have stopped job search because: Believes No Work Available; Couldn't Find Any Work; Lacks Schooling/Training; Employer's Think Too Young/Old; and Other Discrimination. The marginally attached but not discouraged provide these responses: Can't Arrange Child Care; Family Responsibilities; In School/Training; Ill-Health, Disability; Transportation Problems; and Other.

NOTES CONTINUED:

14 M. Lechner, *Program Heterogeneity and Propensity Score Matching: An Application to the Evaluation of Active Labor Market Policies*, 84 REVIEW OF ECONOMICS AND STATISTICS 205-220 (2002).

15 The details of this problem are provided in POLICY PAPER NO. 39, *supra* n. 2.

16 *See, e.g.*, G. Imbens and J. Wooldridge, *Recent Developments in the Econometrics of Program Evaluation*, 47 JOURNAL OF ECONOMIC LITERATURE 5-86 (2009) at 41 and O. Baser, *Too Much Ado About Propensity Score Models? Comparing Methods of Propensity Score Matching*, 9 VALUE IN HEALTH 377-385 (2006). One goal of a matching algorithm is to ensure that the covariate distributions are comparable across treatment and control groups. In the full sample, we did observe some large differences in the covariate distributions, so the matching approach serves a useful purpose.

17 A general discussion of matching is provided in P. Rosenbaum and D. Rubin, *The Central Role of the Propensity Score in Observational Studies for Causal Effects,* 70 BIOMETRIKA 41-55 (1983). On Kernel matching, *see* J. Heckman, H. Ichimura, and P. Todd, *Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme*, 64 REVIEW OF ECONOMIC STUDIES 604-654 (1997) and J. Heckman, H. Ichimura, and P. Todd, *Matching as an Econometric Evaluation Estimator*, 65 REVIEW OF ECONOMIC STUDIES 261-294 (1997). There is no rule of thumb for choosing the tolerance level for radius matching. We choose 0.001 because it often appears in the literature. Kernel bandwidth is selected using the rule of thumb: $bw = 1.06 \cdot \mathrm{Min}\{\sigma, R/1.34\} \cdot n^{-0.2}$, where σ is the (estimated) standard deviation of the propensity score, R is the interquartile range (75% - 25%) of the propensity score, and n is sample size. I set the bandwidth at 0.025, which is consistent with this rule of thumb for most the comparisons. H. Engelhardt, H. Kohler, A. Fürnkranz-Prskawetz, CAUSAL ANALYSIS IN POPULATION STUDIES: CONCEPTS, METHODS, APPLICATIONS (2006), at 190.

18 All calculations based on the non-weighted sample.

19 Sample sizes for the comparisons are, in order (Radius, Matching), for BLS Discouragement: (178, 1122); (1652, 1877); (4512, 5013); (856, 1260); (4142, 4239); (298, 485).

20 Sample sizes for the comparisons are, in order (Radius, Matching), for my own definition of discouragement: (738, 1091); (1162, 1833); (4384, 4898); (829, 1226); (3932, 4142); (272, 429).