



**PHOENIX CENTER FOR ADVANCED LEGAL  
& ECONOMIC PUBLIC POLICY STUDIES**

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*Lawrence J. Spiwak, President*

8 December 2009

Marlene Dortch  
Secretary  
Federal Communications Commission  
445 Twelfth Street S.W.  
Washington, DC 20554

RE: Ex Parte Filing – *A National Broadband Plan for Our Future*, GN Docket No. 09-51

Dear Ms. Dortch:

On December 2, 2009, Phoenix Center Chief Economist Dr. George S. Ford and I presented our current research on Internet use and the reduction of discouragement in labor markets to Commission Staff at the specific invitation of Dr. John Horrigan, Consumer Research Director – Omnibus Broadband Initiative. FCC Staff attending the presentation were: Ian Dillner (WCB); B.J. Neal (Deployment); Rob Curtis (Deployment); Steve Rosenberg (Deployment); Tom Koutsky (Deployment); Jing Vivatrat (National Purposes); Ellen Satterwhite (Adoption) and Dave Vorhause (Adoption).

A copy of Dr. Ford's slide presentation is attached hereto, which will also be posted on our webpage ([www.phoenix-center.org](http://www.phoenix-center.org)). We anticipate releasing a new PHOENIX CENTER POLICY PAPER summarizing our results shortly, which will be available to the public at no cost both on our webpage and on the Social Science Research Network.

If you have any questions or comments, please do not hesitate to contact us.

Sincerely,

Lawrence J. Spiwak  
President, The Phoenix Center

# Internet Use and the Reduction of Discouragement in Labor Markets

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**GEORGE FORD  
CHIEF ECONOMIST  
THE PHOENIX CENTER**

**[WWW.PHOENIX-CENTER.ORG](http://WWW.PHOENIX-CENTER.ORG)**

**December 2, 2009  
Federal Communications Commission  
Washington DC**

# Purpose of Research

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- Add to the evidence on the effects of Internet use on economic and social outcomes
  - Policy Relevance
  - Academic Relevance
- Evaluate Internet effects on a *micro-level*
  - Macro-level Studies are of Low Credibility
- Apply statistical and econometric techniques intended to render “causal” effects
  - Outcome =  $f(\text{Treatment})$

# Projects

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- **Internet Use and Depression Among the Elderly**
  - POLICY PAPER NO. 38 ([www.phoenix-center.org](http://www.phoenix-center.org)) (By: George Ford and Sherry Ford)
  - We employ a dataset of over 7,000 elderly retired persons to evaluate the role of Internet use on mental well-being.
  - Well-being is measured using the eight-point depression scale developed by the Center for Epidemiologic Studies (CES-D).
  - Empirical techniques include single equation regression, instrumental variables and propensity score methods.
  - All procedures indicate a positive contribution of Internet use to mental well-being of elderly Americans, and estimates indicate that Internet use leads to about a 20% reduction in depression classification.

# Projects

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- **Internet Use and Labor Market Outcomes**
  - Forthcoming as a POLICY PAPER (By: Randy Beard, George Ford, and Richard Saba)
  - As many, such as Autor (2001), have noted, the Internet surely reduces the direct costs of searching for jobs, both by job seekers and employers.
    - ✦ In most plausible circumstances, this will lead to increased job search.
    - ✦ Second, the Internet serves as a source of information about jobs, employers, and relevant economic conditions.
    - ✦ Internet allows for at-home work which may be useful for elderly and those with ill-health.
  - We examine the effects of Internet connectivity on worker status by analyzing the pool of workers who are **jobless**.
  - Data: CPS, *Internet & Computer Use Supplement 2007*

# Caveat

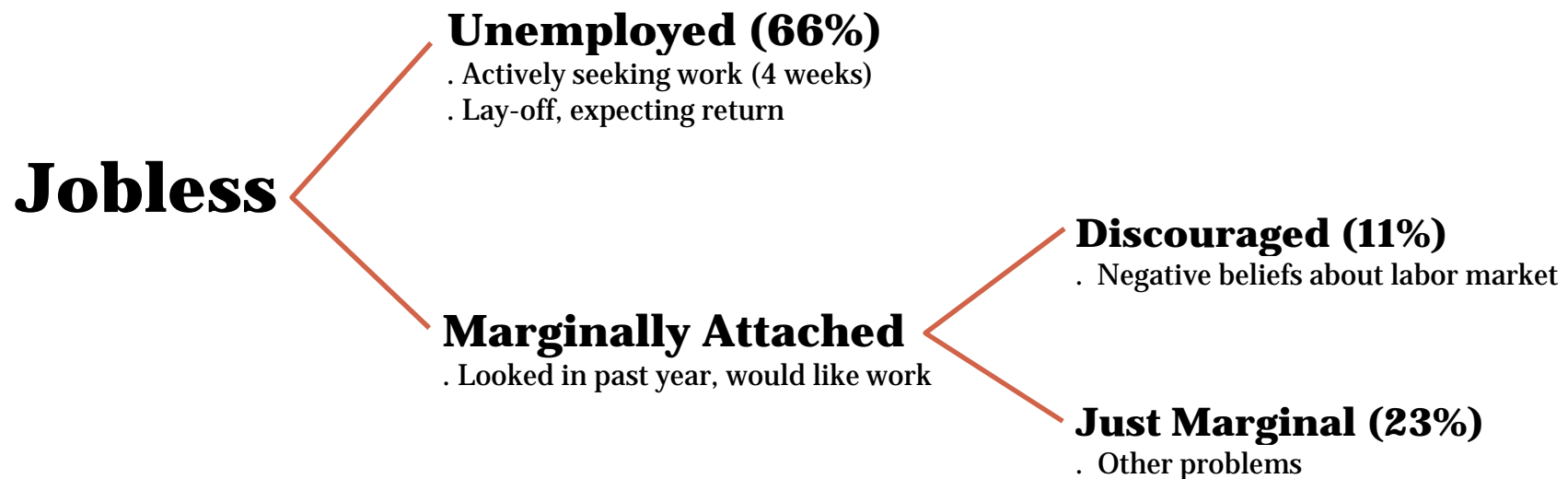
5

**These results are preliminary.**

**Please do not cite or quote without permission.**

# Jobless Status: BLS Definitions

6



*We have a trichotomous, unordered outcome,  
requiring multinomial Logit or Probit.*

# Marginally Attached to the Labor Force

7

<b>PEDWRSN</b>	<b>Labor Force -(not in, discouraged) reason not looking</b>	<b>Observations</b>
1	Believes No Work Available	71
2	Couldn't Find Work	113
3	Lacks Schooling/Training	23
4	Think Too Old/Young	31
5	Other Discrimination	8
6	Can't Arrange Child Care	35
7	Family Responsibilities	296
8	In School/Training	213
9	Ill Health, Disability	187
10	Transportation Problems	42
11	Other	422
	<b>Unemployed</b>	<b>2,788</b>



# BLS Categories of Marginally Attached

8

- **Discouraged**
  - 1 Believes No Work Available
  - 2 Couldn't Find Any Work
  - 3 Lacks Necessary Schooling/Training
  - 4 Employers Think Too Young Or Too Old
  - 5 Other Types Of Discrimination
- **Just Marginal**
  - 6 Can't Arrange Child Care
  - 7 Family Responsibilities
  - 8 In School Or Other Training
  - 9 Ill-Health, Physical Disability
  - 10 Transportation Problems
  - 11 Other

# Information Related Discouragement

Author Definitions

9

- **Information Type**
  - 1 Believes No Work Available
  - 2 Couldn't Find Any Work
  - 3 Lacks Necessary Schooling/Training
  - 6 Can't Arrange Child Care
  - 9 Ill-Health, Physical Disability
  - 10 Transportation Problems
- **Not Information Type**
  - 4 Employers Think Too Young Or Too Old
  - 5 Other Types Of Discrimination
  - 7 Family Responsibilities
  - 8 In School Or Other Training\*
  - 11 Other

# Information Related Discouragement

## Author Definition

10

- **BLS DEFINITION**

- Discouraged

- ✦ 1 Believes No Wrk Avl
- ✦ 2 Couldn't Find Any Work
- ✦ 3 Lacks Schooling/Training
- ✦ 4 Emps Think Too Young/Old
- ✦ 5 Other Discrimination

- Just Marginal

- ✦ 6 Can't Arrange Child Care
- ✦ 7 Family Responsibilities
- ✦ 8 In School/Training
- ✦ 9 Ill-Health, Disability
- ✦ 10 Transportation Problems
- ✦ 11 Other

- **INFORMATION RELATED**

- Information Type

- ✦ 1 Believes No Wrk Avl
- ✦ 2 Couldn't Find Any Work
- ✦ 3 Lacks Schooling/Training
- ✦ 6 Can't Arrange Child Care
- ✦ 9 Ill-Health, Disability
- ✦ 10 Transportation Problems

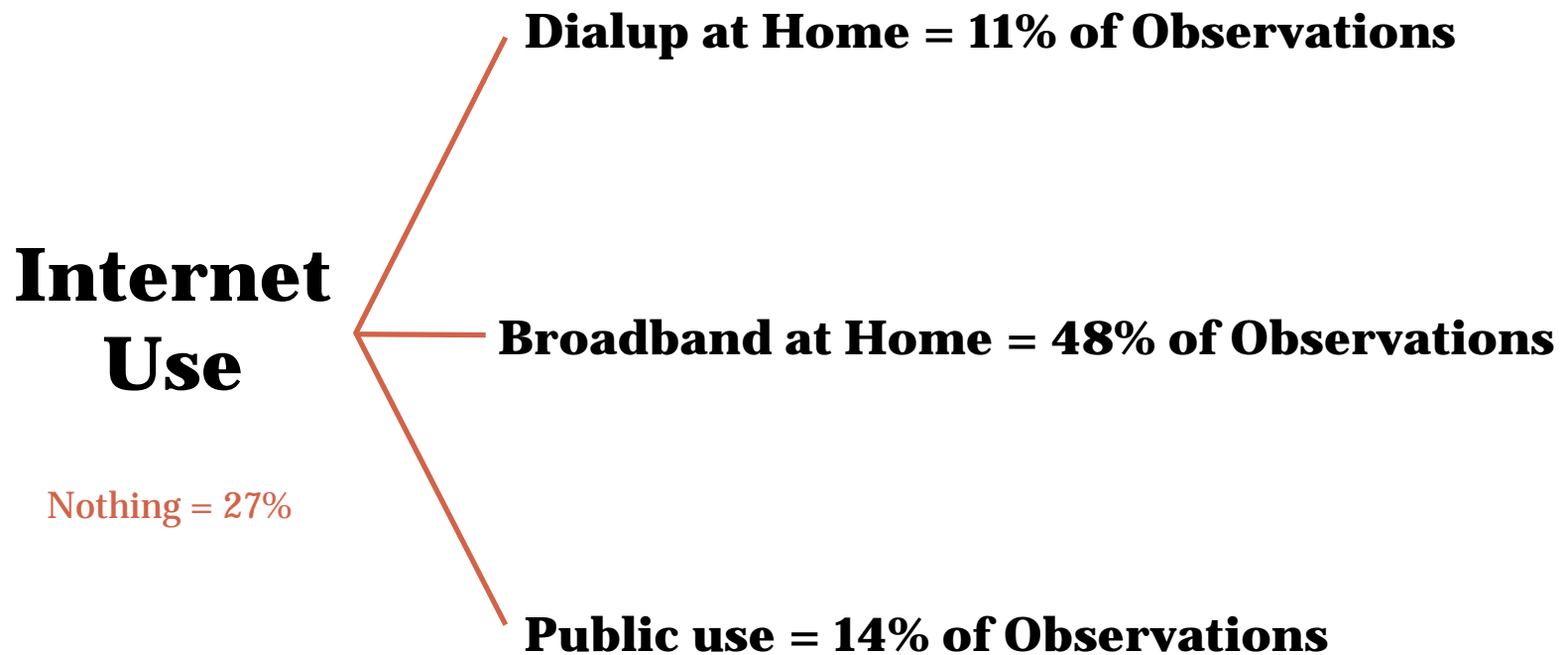
- Not Information Type

- ✦ 4 Emps. Think Too Young/Old
- ✦ 5 Other Discrimination
- ✦ 7 Family Responsibilities
- ✦ 8 In School/Training\*
- ✦ 11 Other

\* Most, but not all, of those "in school" use some type of Internet access. It may make sense to exclude this category altogether.

# Treatment Variable

11



*We have a trichotomous, unordered treatment.*

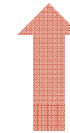
# General Empirical Setup

## BLS Definitions

12

$$\text{Outcome} = f(\text{Treatment})$$

$$\text{Pr} \left\{ \begin{array}{l} \text{Unemployed} \\ \text{Discouraged} \\ \text{Just Marginal} \end{array} \right\} = f \left\{ \begin{array}{l} \text{Dialup at Home} \\ \text{Broadband at Home} \\ \text{Public Use} \end{array} \right\}$$



*Treatment is not  
randomly assigned.*

# General Empirical Setup

Author Definition of Information-Related Discouragement

13

$$\text{Outcome} = f(\text{Treatment})$$

$$\text{Pr} \left\{ \begin{array}{l} \text{Unemployed} \\ \text{Information Type} \\ \text{Not Information Type} \end{array} \right\} = f \left\{ \begin{array}{l} \text{Dialup at Home} \\ \text{Broadband at Home} \\ \text{Public Use} \end{array} \right\}$$



*Treatment is not  
randomly assigned.*

# Selection Bias

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Outcome  $Y_1$ ,  $Y_0$  with and without treatment  $T$ :

$$Y_i = \begin{cases} Y_{1i} & \text{if } T_i = 1 \\ Y_{0i} & \text{if } T_i = 0 \end{cases}$$
$$= Y_{0i} + (Y_{1i} - Y_{0i})T_i$$

With expected difference:

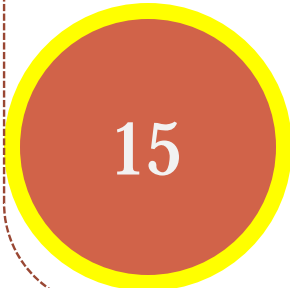
$$E[Y_i | T_i = 1] - E[Y_i | T_i = 0] = \underbrace{E[Y_{1i} - Y_{0i} | T_i = 1]}_{\text{Causal Effect}} + \underbrace{E[Y_{0i} | T_i = 1] - E[Y_{0i} | T_i = 0]}_{\text{Selection Bias}}$$

# Selection Bias

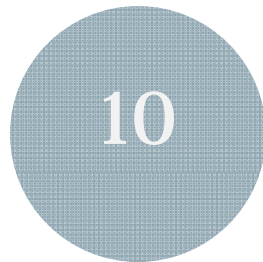
15

## Treated Sample

With  
Treatment

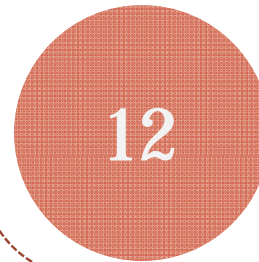


Without  
Treatment

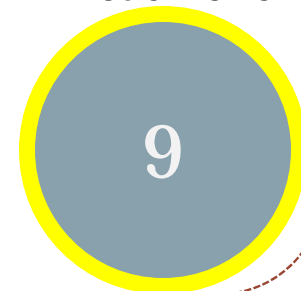


## Control Sample

With  
Treatment



Without  
Treatment



*we only observe these outcomes*

$$\begin{aligned} E[Y_i | T_i = 1] - E[Y_i | T_i = 0] &= E[Y_{1i} - Y_{0i} | T_i = 1] \\ &\quad + E[Y_{0i} | T_i = 1] - E[Y_{0i} | T_i = 0] \\ &= (15 - 10) + (10 - 9) = 6 \\ &\quad \text{but 5 is the causal effect!} \end{aligned}$$



# Statistical Assumptions

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- **Conditional Independence Assumption**

- Outcomes are independent of the treatment conditional on factors  $X$
- $Y_0, Y_1 \perp T \mid X$
- Random Assignment:  $Y_0, Y_1 \perp T$  (don't need the  $X$ )
- Weaker Form:  $Y_0 \perp T \mid X$
- Also called Unconfoundedness; Ignorability; Exogeneity; ...
- Motivates **Regression**, **Matching** or **Propensity Score Matching**
- “Unconfoundedness implies that we have a sufficiently rich set of predictors for the treatment indicator, contained in ...  $X$ , such that adjusting for differences in these covariates leads to valid estimates of the causal effect (Imbens & Wooldridge 2009, at 24)”

- **Overlap**

- For each value of  $X$ , there are both treated and untreated cases:
- “once one is committed to the [CIA], [covariate overlap] may well be the main problem facing the analysts (Imbens & Wooldridge 2009, at 43)”
- Regression and Matching use a lot of Extrapolation (untreated outcome is projected onto treated group from untreated group)
- “although locally linearity of the regression functions may be a reasonable approximation, in many cases the estimated average treatment effects based on regression methods can be severely biased if the linear approximation is not accurate globally. ... [The] best practice is to combine linear regression with [matching] in ways that explicitly rely on local, rather than global, linear approximations to the regression functions (Imbens & Wooldridge 2009, at 24-5)”

# Empirical Strategy

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- **Use Regression Analysis**
  - Multinomial Logit (There are 3 outcomes)
- **Trim the Sample to improve Covariate Overlap**
  - Lechner (2002): Propensity Score with Multiple Treatments
  - Crump, Hotz, Imbens and Mitnik (2009): Trimming
    - ✦ “we find that a simple ad hoc selection rule based on discarding all units with an estimated propensity score outside the interval [0.1, 0.9] can capture most of the precision gains from selecting the sample optimally for a wide range of distributions (Crump et al. 2009)”
  - Use Propensity Score for systematic sample selection as a precursor to regression, trimming at  $0.10 \leq p(X) \leq 0.90$ .
  - For discussion, see Angrist and Pischke, *MOSTLY HARMLESS ECONOMETRICS* (2009) at Ch. 3.

# Empirical Strategy Implementation

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- **#1: Estimate probability of receiving treatment**
  - Predicted probability of Logit is the Propensity Score [ $p(X)$ , of which there are six)
  - First Stage ignores Outcomes
- **#2: Trim the sample**
  - $0.10 \leq p_j(X) \leq 0.90$  where  $j = 1, 2, \dots, 6$
  - Check covariate overlap
- **#3: Estimate mlogit on trimmed sample**

# Propensity Score Model(s)

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- “A growing empirical literature suggests that a logit model for the propensity score with a few polynomial terms in continuous covariates works well in practice ... (Angrist and Pischke 2009: 83)”.
- **Covariates**
  - Married, Male, Immigrant, Kids, White, NoCollDeg, NoHighSchl, Metro, Veteran, Income (Dummies), HH Size, Age (Dummies), Northeast, Midwest, South

# Propensity Score Model

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- **“Structural” Approach**
  - Multinomial Logit estimates all propensities in one “big” model
  - Can compute the probability for each Internet Use type
- **“Reduced Form” Approach**
  - Estimate a Logit model for each pair of types
  - Get probability for each observation
- **The two outcomes are highly correlated**
  - $\rho > 0.99$  for all
  - Results are almost identical results

# Covariate Overlap: Full Sample

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	<b>None/ DU</b>	<b>None/ BB</b>	<b>None/ Public</b>	<b>DU/ BB</b>	<b>DU/ Public</b>	<b>BB/ Public</b>
White				0.25		
NoHighSch	0.29		0.35			0.28
Inc20	0.45		0.49	0.37		0.42
Inc40						
Inc60						
Inc100	0.30		0.42			0.33
HH Size			0.26			
Inschool			0.32			

$$\text{Standardized Difference} = \frac{|X_1 - X_0|}{\sqrt{S_1 + S_2}} > 0.25$$

Imbens and Wooldridge, JEL 2009.

# Covariate Overlap: After Trimming

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- **No Standardized Differences  $> 0.25$**

# General Empirical Setup

## BLS Definitions

23

$$\Pr[\text{Unem, Disc, JustMarg}] = f(\text{Dialup, BBHome, PublicUse, Kids, Male, AgeDummies, NoCollDeg, NoHighSchl, White, Metro, Immig, Veteran, IncomeDummies, Inschool})$$

**Multivariate Logit (mlogit) with Unemployed as Base**



# Results: BLS Definitions

Full Sample = 4229

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Int Type	Coef	Marg. Eff.	E(Y T=0)	E(Y T=1)	% Diff
<i>Discouraged</i>					
Public Use	-1.11*	-0.052*	0.091	0.036	-60%
BB Home	-0.95*	-0.045*	0.091	0.042	-54%
Dialup Home	-0.51*	-0.023*	0.091	0.061	-33%
<i>Just Marginal</i>					
Public Use	-0.32*	-0.043	0.310	0.269	-13%
BB Home	-0.28*	-0.039*	0.310	0.273	-12%
Dialup Home	-0.19	-0.017	0.310	0.284	-8%

## Null Hypotheses:

Internet has no effect on Discouraged : Prob <0.01  
 Discouraged [BB Home = Dialup] : Prob =0.052  
 Discouraged [Public Use = Dialup] : Prob =0.053  
 Discouraged [BB Home = Public Use] : Prob =0.55  
 Internet has no effect on Just Marginal : Prob = 0.02

\* Reject Null = 0 at the 5% level

# Results: BLS Definitions

Trimmed Sample = 2562

25

Int Type	Coef	Marg. Eff.	E(Y T=0)	E(Y T=1)	% Diff
<i>Discouraged</i>					
Public Use	-1.34*	-0.065*	0.092	0.029	-68%
BB Home	-0.92*	-0.040*	0.092	0.044	-52%
Dialup Home	-0.47	-0.020	0.092	0.065	-29%
<i>Just Marginal</i>					
Public Use	-0.37*	-0.044	0.292	0.246	-16%
BB Home	-0.34*	-0.045*	0.292	0.248	-15%
Dialup Home	-0.26	-0.029	0.292	0.254	-13%

## Null Hypotheses:

Internet has no effect on Discouraged : Prob <0.01  
 Discouraged [BB Home = Dialup] : Prob =0.10  
 Discouraged [Public Use = Dialup] : Prob <0.03  
 Discouraged [BB Home = Public Use] : Prob =0.23  
 Internet has no effect on Just Marginal : Prob = 0.03

\* Reject Null = 0 at the 5% level. Bootstrapping does not alter the significance levels.

# Information Related Discouragement

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- **BLS DEFINITION**

- **Discouraged**

- ✦ 1 Believes No Wrk Avl
- ✦ 2 Couldn't Find Any Work
- ✦ 3 Lacks Schooling/Training
- ✦ 4 Emps Think Too Young/Old
- ✦ 5 Other Discrimination

- **Just Marginal**

- ✦ 6 Can't Arrange Child Care
- ✦ 7 Family Responsibilities
- ✦ 8 In School/Training
- ✦ 9 Ill-Health, Disability
- ✦ 10 Transportation Problems
- ✦ 11 Other

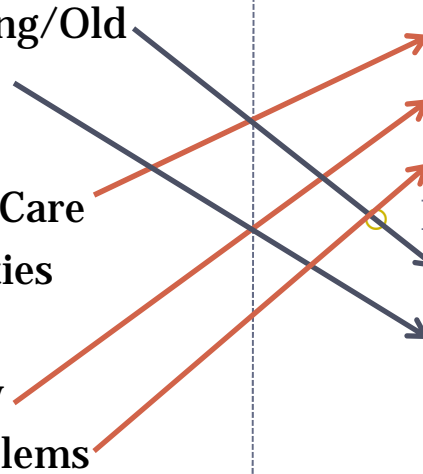
- **INFORMATION RELATED**

- **Information Type**

- ✦ 1 Believes No Wrk Avl
- ✦ 2 Couldn't Find Any Work
- ✦ 3 Lacks Schooling/Training
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- ✦ 10 Transportation Problems

- **Not Information Type**

- ✦ 4 Emps. Think Too Young/Old
- ✦ 5 Other Discrimination
- ✦ 7 Family Responsibilities
- ✦ 8 In School/Training\*
- ✦ 11 Other



# Results: Information Discouragement

Full Sample = 4229

27

Int Type	Coef	Marg. Eff.	E(Y T=0)	E(Y T=1)	% Diff
<i>Information Type</i>					
Public Use	-1.05*	-0.095*	0.163	0.068	-58%
BB Home	-0.49*	-0.070*	0.163	0.086	-47%
Dialup Home	-0.42*	-0.037*	0.163	0.117	-28%
<i>Non Information Type</i>					
Public Use	-0.127	0.006	0.23	0.23	0%
BB Home	-0.156	-0.005	0.23	0.24	4%
Dialup Home	-0.105	0.006	0.23	0.23	0%

## Null Hypotheses:

Internet has no effect on Info Type : Prob <0.01  
 Discouraged [BB Home = Dialup] : Prob = 0.03  
 Discouraged [Public Use = Dialup] : Prob <0.01  
 Discouraged [BB Home = Public Use] : Prob = 0.20  
 Internet has no effect on Non-Info Type : Prob = 0.54

\* Reject Null = 0 at the 5% level

# Results: Information Discouragement

Trimmed Sample = 2562

28

Int Type	Coef	Marg. Eff.	E(Y T=0)	E(Y T=1)	% Diff
<i>Information Type</i>					
Public Use	-1.03*	-0.093*	0.158	0.068	-57%
BB Home	-0.66*	-0.057*	0.158	0.096	-39%
Dialup Home	-0.48*	-0.041*	0.158	0.111	-30%
<i>Non Information Type</i>					
Public Use	-0.26	-0.015	0.224	0.207	-8%
BB Home	-0.30*	-0.029	0.224	0.196	-13%
Dialup Home	-0.19	0.017	0.224	0.208	-7%

## Null Hypotheses:

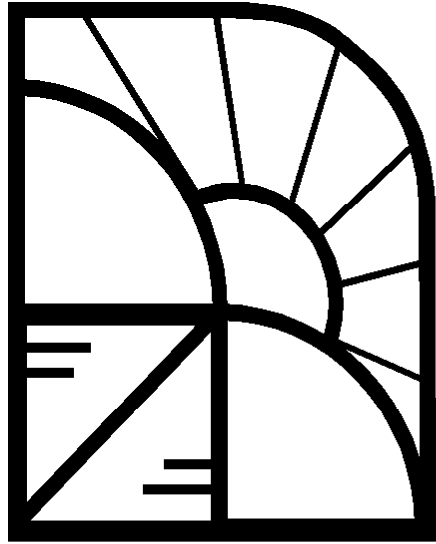
- Internet has no effect on Info Type : Prob < 0.01
- Discouraged [BB Home = Dialup] : Prob = 0.26
- Discouraged [Public Use = Dialup] : Prob = 0.02
- Discouraged [BB Home = Public Use] : Prob = 0.07
- Internet has no effect on Non-Info Type : Prob = 0.47

\* Reject Null = 0 at the 5% level. Bootstrapping does not alter the significance levels.

# Summary

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- **Internet Use reduces job search costs, thereby keeping individuals from leaving the labor market due to Discouragement**
  - Using broadband at home or in a public setting reduces the probability of abandoning the labor market due to Discouragement by 50% (i.e., the Internet keeps people looking for work)
  - Effect of Dialup is smaller (about 30%)
- **Public Use is at least as effective as home broadband use for both types of Discouragement**
- **Stronger and more sensible results are obtained when switching to an “Information-Related Discouragement” from the BLS Definition of Discouragement**



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