Post-hoc Control Group Analysis of Wyoming at Work Internet Browsers

by

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Introduction

Demonstrating the effects of interventions on outcomes for people requires experimental design. Under experimental design people are randomly assigned from a single population to two groups: (1) the treatment group which receives training, re-employment services, or some other form of intervention, and (2) the control group which receives no intervention. By making random assignment from one population to these two groups we can be assured of equivalency between them on all relevant factors (age, gender, aptitude, educational attainment ad infinitum) prior to the intervention, and that it is the intervention itself and no other factor, that results in greater skill attainment, a quicker return to work after unemployment, or some other desired outcome for the treatment group. However, in most situations, random assignment is not possible and we must attempt, after the treatment has been administered, to simulate or model experimental design. Such simulations are referred to as quasi-experimental designs.

In *Post-Injury Wage Loss: A Quasi-Experimental Design* (Glover, Saulcy, & Leonard, 2009), we described a process by which we could objectively compare the wage outcomes of injured and non-injured workers using Wyoming Workers' Compensation claims data and the demographics earning and other characteristics of non-injured workers. This approach allowed us to control for differences in age, sex, industry, and work history in our analysis thereby demonstrating the effect of injury on earnings.

Quasi-experimental methods can be used in a variety of contexts to determine treatment impact. This study uses the methods described in *Post-Injury Wage Loss: A Quasi-Experimental Design*

(Glover et al., 2009) to analyze the differences in worker wages and retention according to their use of the Wyoming Department of Workforce Services job board, Wyoming at Work (W@W or ES). The focus of the research was jobs filled by newly hired employees.[1] The goal was to examine how new hires use different programs/systems and to evaluate how wage outcomes may be improved.

The research questions are:

1. Is there any difference in wage progression or job retention rates between the treatment and control groups in total?
2. Does the amount of job time associated with energy efficient activities influence wage progression or job retention rates?

Methodology

The data frame for the analysis began with all the jobs into which people were hired (and surveyed) during fourth quarter 2009 (2009Q4) and first quarter 2010 (2010Q1). Employers were sent questionnaires for a sample of those jobs each quarter which focused on those jobs where individuals were predicted to be retained for at least two quarters as determined by a statistical model. The theoretical importance of the two-quarter requirement is that for all new hires, both job seeker and employer needed to put forward a certain amount of market effort to result in a successful candidate – job match. The question being asked is did ES help potential new hires? These new hires whose employers were surveyed were the individuals of interest. We

[1] A new hire is a job filled by a person during the reference quarters where the individual had no prior work history with that employer from first quarter 1992 to the reference quarter. The person serves only as the vector for the job.

then determined which surveyed new hires utilized either of the following services during the four quarters prior to being a new hire by matching to two administrative databases:

- Wyoming at Work database (Wyoming Department of Workforce Services (DWS), 2011)
- Wyoming Unemployment Insurance database (UI) (DWS/R&P, 2011)

With these two variables attached, four outcomes were possible:

1. Those who used both UI and ES
2. Those who used ES only
3. Those who used UI only
4. Those who used neither UI nor ES

The focus of this research was group two (ES only) and group four (Neither UI nor ES). ES Only was defined as the treatment group and the Neither UI nor ES group was defined as the control group. The new hires data were extracted from Research & Planning's (R&P's) new hires database. Documentation regarding new hires data collection and employment modeling can be found at http://doe.state.wy.us/lmi/0211/a1.htm.

The beginning number of cases (treatments plus controls) from 2009Q4 was 3,574. The number of beginning cases from 2010Q1 was 3,317 (treatments plus controls). These two panels were merged for analysis.

Several screens were applied to the data to remove statistical outliers (according to wages) and to perform other functions. They are described in Table 1. The rationale for using each screen is described below:

Table 1: Case Selection Criteria and Results

Screen	Beginning Cases	Ending Cases	Excluded Cases
Data Set: 2009Q4			
Employers with Unclassified Industry Assignments	3,574	3,574	0
Wage Outliers (Top and Bottom 1% of Wages in Quarter of Hire)	3,574	3,504	70
Use Primary New Hire Employer Record	3,504	3,467	37
Ending Cases		**3,467**	
Data Set: 2010Q1			
Employers with Unclassified Industry Assignments	3,317	3,314	3
Wage Outliers (Top and Bottom 1% of Wages in Quarter of Hire)	3,314	3,249	65
Use Primary New Hire Employer Record	3,249	3,212	37
Ending Cases		**3,212**	

1. Employers with unclassified industry assignments[2] – occasionally a final determination as to which industry an employer belongs was not made prior to data release. Since this is a statistical artifact and not a real event, these cases are eliminated from the analysis. As a result of this screen, three cases were removed from the 2010Q1 dataset and zero cases were removed from the 2009Q4 dataset.
2. Top and bottom 1% of wage earners – Extreme high or low observations can skew the analysis and lead to incorrect conclusions. This usually occurs when large bonuses are received or someone is hired to work in a position paying an unusually large amount of money.[3] As a result of this screen, an additional 70 cases were removed from the 2009Q4 dataset and an additional 65 cases were removed from the 2010Q1 dataset.
3. Primary new hire employer record – To avoid double-counting of the same individual (a person could be a new hire with more than one employer), we simplify the analysis by focusing on the job which paid the new hire the most wages in the quarter of hire. As a result of this screen an additional 37 cases were removed from each dataset. The net number of cases available for matching in each dataset were 3,467 for 2009Q4 and 3,212 for 2010Q1.

Once the base datasets were developed, the next step was to develop the statistically matched control groups. In order to obtain valid comparisons, three control group cases were matched to each treatment group case. Cases were matched based on age, sex, industry of the hiring employer, and the level of energy efficiency associated with the position, according to their

[2] Industries were assigned to employers by their North American Industrial Classification System (NAICS code) without consideration for ownership (e.g. private sector, public sector; Bureau of Labor Statistics, 2011).
[3] An alternative strategy of calculating wage progression using median values along with comparisons to the current strategy is shown in Appendix C.

Table 2: Final Distribution of Cases Used in Analysis

Date	Treatments	Controls	Total	Total Available
2009Q4	479	1,437	1,916	3,467
2010Q1	538	1,614	2,152	3,212
Totals	**1,017**	**3,051**	**4,068**	**6,679**

propensity scores.[4,5] The categories of energy efficiency were collapsed into 50% or greater green or less than 50% green.[6] In some instances, we were not able to match the required number of control cases to a treatment case. These treatment cases were also excluded along with their matching control cases. The distribution of cases used in the final analysis is shown in Table 2. The final number of cases used in the analysis from 2009Q4 was 1,916 and the total number of cases used in the analysis from 2010Q1 was 2,152. The cases from Panel I (2009Q4) and Panel II (2010Q1) were combined in the analysis.

Earnings during the quarter of new hire and for the three quarters following new hire were obtained from the DWS/R&P wage records database (WR; R&P, 2011). If a new hire was still attached to the same employer in subsequent quarters, that new hire was counted as retained. Average wages in subsequent quarters were based only on those new hires still working for the same employer.

Results

Table 3 displays the distributions of treatment and control cases by age and industry. This table is a simplified version of a more detailed table showing breakdowns by age, sex, and industry in Appendix A. The goal of case-control matching is to obtain a control group which is similar to

[4] The level of green activity associated with new hires was based on question 4c from the New Hires Survey: *4c. What percent of the time was this job involved in activities and duties related to increasing energy efficiency, utilizing or developing renewable energy resources, or preserving and/or restoring the environment (Please select one of the following)*
□ None of the time □ Less than 50% of the time □ More than 50% of the time □ Don't know
See http://doe.state.wy.us/lmi/energy/new_hires_survey.pdf for details

[5] For details on using propensity scores to perform a case-control analysis, see Appendix B of *Post-Injury Wage Loss: A Quasi-Experimental Design* at http://doe.state.wy.us/LMI/post_injury/app_b.htm

[6] These categories were used in the control group selection process but were expanded for analytical purposes (see Table 5).

Table 3: Distribution of Treatment and Control Cases Used in New Hires Analysis, From Panels I & II

Industry		(2) ES Only (Treatment Group)	(4) Neither ES Nor UI (Control Group)	Total
Agriculture, Forestry, Fishing, & Hunting	N	22	64	86
	Col%	2.2	2.1	2.1
Mining	N	52	161	213
	Col%	5.1	5.3	5.2
Construction	N	67	212	279
	Col%	6.6	6.9	6.9
Manufacturing	N	22	76	98
	Col%	2.2	2.5	2.4
Wholesale Trade, Transportation, Utilities, & Warehousing	N	104	310	414
	Col%	10.2	10.2	10.2
Retail Trade	N	100	290	390
	Col%	9.8	9.5	9.6
Information	N	35	106	141
	Col%	3.4	3.5	3.5
Financial Activities	N	74	222	296
	Col%	7.3	7.3	7.3
Professional & Business Services	N	116	340	456
	Col%	11.4	11.1	11.2
Educational Services	N	58	171	229
	Col%	5.7	5.6	5.6
Health Services	N	100	300	400
	Col%	9.8	9.8	9.8
Leisure & Hospitality	N	154	471	625
	Col%	15.1	15.4	15.4
Other Services	N	70	205	275
	Col%	6.9	6.7	6.8
Public Administration	N	43	123	166
	Col%	4.2	4.0	4.1
Total	N	1,017	3,051	4,068
	Col%	100.0	100.0	100.0
Age				
<25	N	325	960	1,285
	Col%	32.0	31.5	31.6
25 - 35	N	241	709	950
	Col%	23.7	23.2	23.4
35 - 45	N	164	495	659
	Col%	16.1	16.2	16.2
45 - 55	N	139	442	581
	Col%	13.7	14.5	14.3
55+	N	76	227	303
	Col%	7.5	7.4	7.4
N/A	N	72	218	290
	Col%	7.1	7.1	7.1
Total	N	1,017	3,051	4,068
	Col%	100.0	100.0	100.0

the treatment group in every important dimension. In this case, we show the distributional breakdowns by age and gender for both groups. The differences in the column percentages between treatment and control groups is less than 0.5% in almost all cases. The one exception was in the 45 – 55 age group where the difference was 0.8%. This result presents the challenge of matching groups when the number of cases is relatively small. The significance of these differences can be determined with a chi-square test. Details of these tests can be seen in Appendix B. None of the differences seen in Table 1 were significant for industry ($p<1.000$), or age group ($p<0.9923$). Additional tests for sex ($p<0.9800$), and level of green activity ($p<0.5311$) show that the distributions by these variables are statistically identical for the treatment and control groups. Thus, for all practical purposes, the treatment and control groups can be considered as equivalent on the variables available and on which there are sufficient data. While it is desirable to match on as many theoretically relevant variables as possible, small sample sizes make this very problematic.

With the treatment and control groups developed, the focus of research shifts to wage progression and job retention comparisons. These are contained in Figures 1 and 2 with additional data shown in Table 4. Figure 1 shows the wage progression for the treatment (ES only) and control (Neither ES or UI) groups. In the quarter people were hired (Quarter 0), workers in the control group earned $3,365 compared to $2,796 for the treatment group; a ratio of 83.1% (base = control group; see Table 1). The wage ratio increases to 85.8% and 90.7% one and two quarters after hire, then declines to 88.5% three quarters after hire. Figure 2 displays the retention rates for new hires in the treatment and control groups. One-quarter retention is virtually identical for the treatment (78.2%) and control groups (79.0%). However, from that

Table 4: Retention Rates and Average Wages for New Hires and Wage Ratios to Control Group, Panels I & II

Status	Statistics	Quarters After New Hire				Retention Rates and Ratios to Control Group Wages			
		0	1	2	3	0	1	2	3
(2) ES Only (Treatment Group)	Count	1,017	795	547	403	100.0%	78.2%	53.8%	39.6%
	Avg. Wage	$2,796	$4,706	$5,715	$6,403	83.1%	85.8%	90.7%	88.5%
(4) Neither ES Nor UI (Control Group)	Count	3,051	2,411	1,827	1,448	100.0%	79.0%	59.9%	47.5%
	Avg. Wage	$3,365	$5,482	$6,302	$7,238	100.0%	100.0%	100.0%	100.0%
Total	Count	4,068	3,206	2,374	1,851	100.0%	78.8%	58.4%	45.5%
	Avg. Wage	$3,223	$5,289	$6,167	$7,056	95.8%	96.5%	97.9%	97.5%

Figure 1: Average Quarterly Wage for New Hires in Matched Treatment and Control Groups

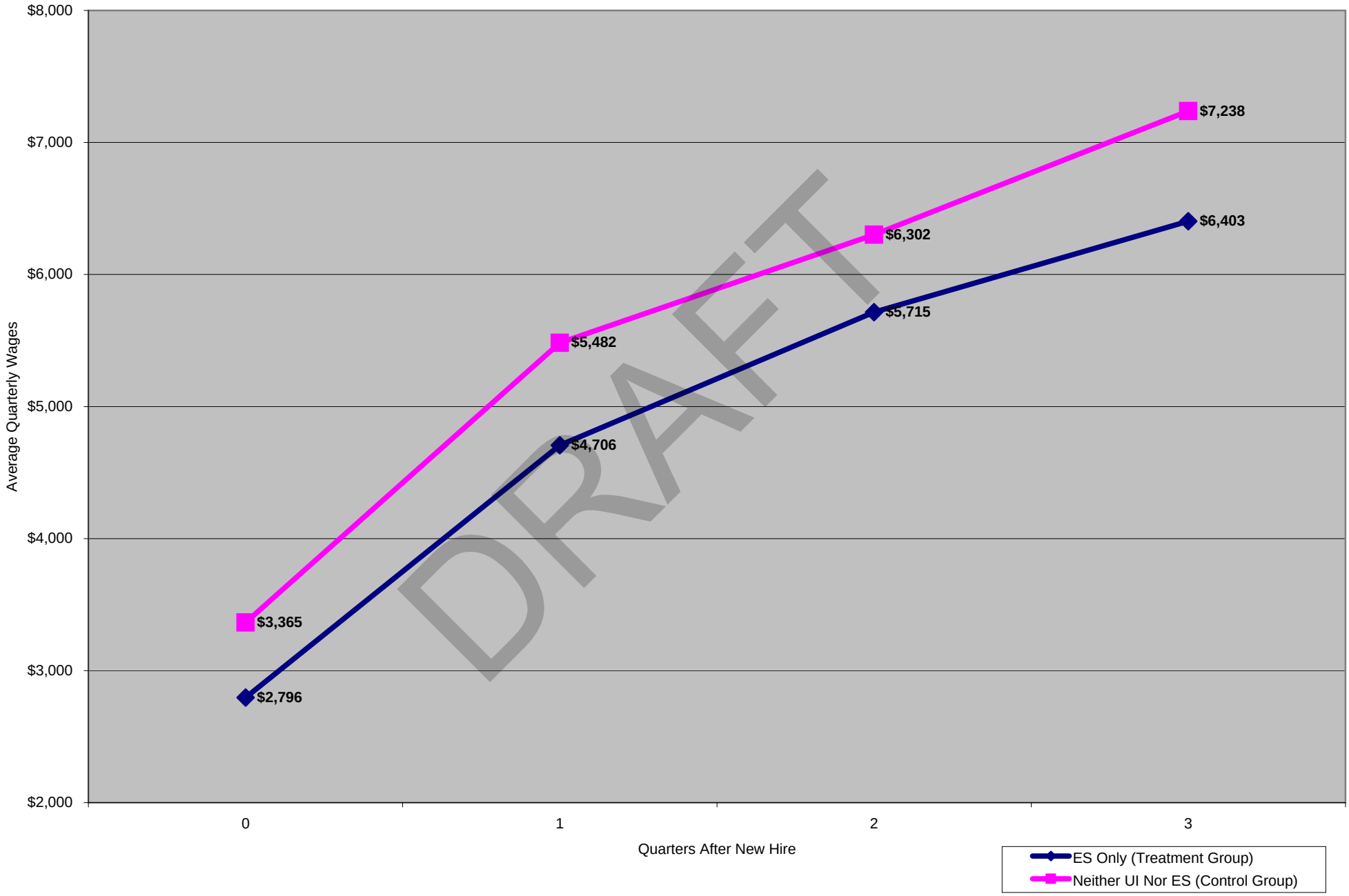

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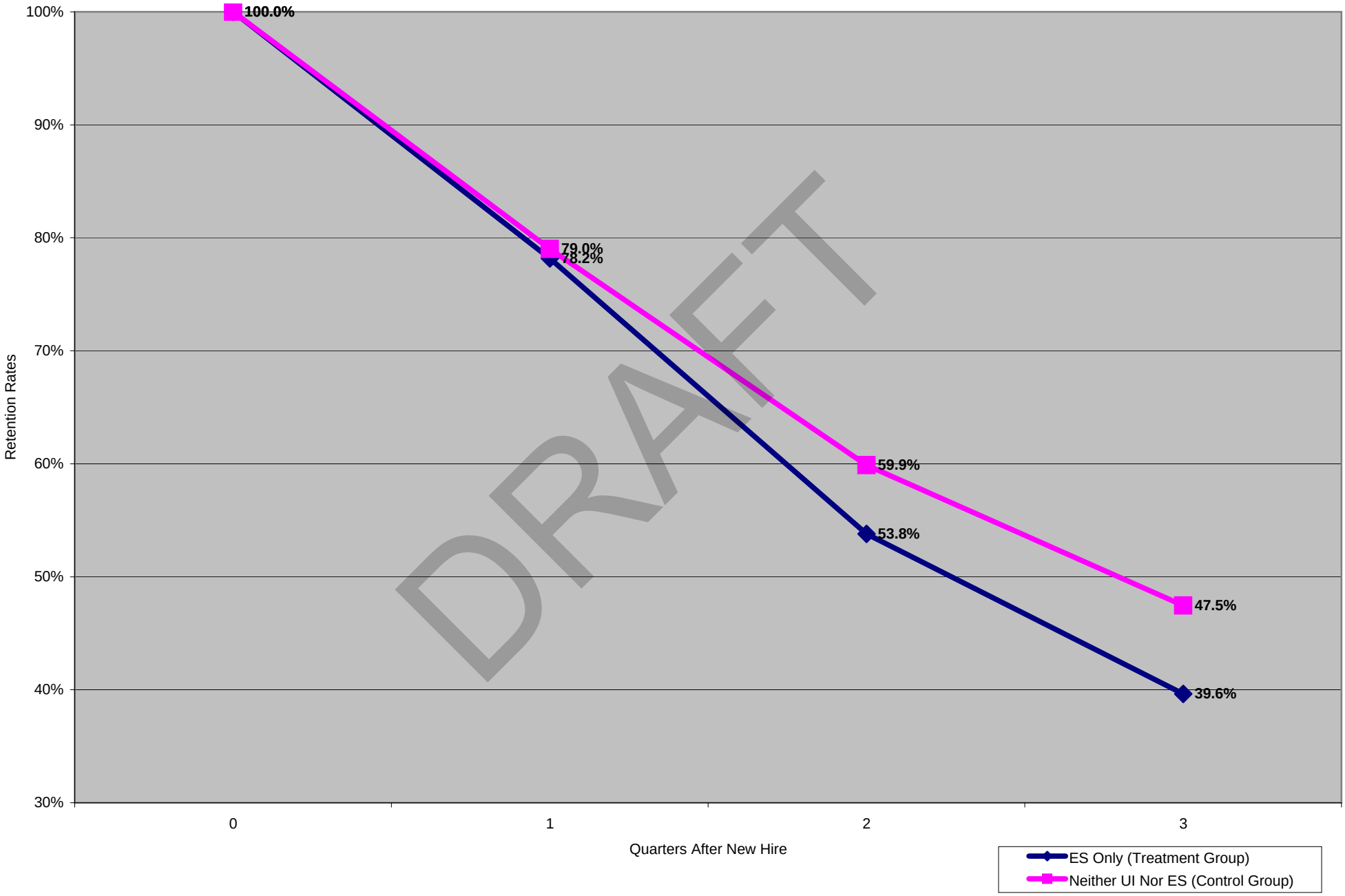
Figure 2: Retention Rates for New Hires in Matched Treatment and Control Groups



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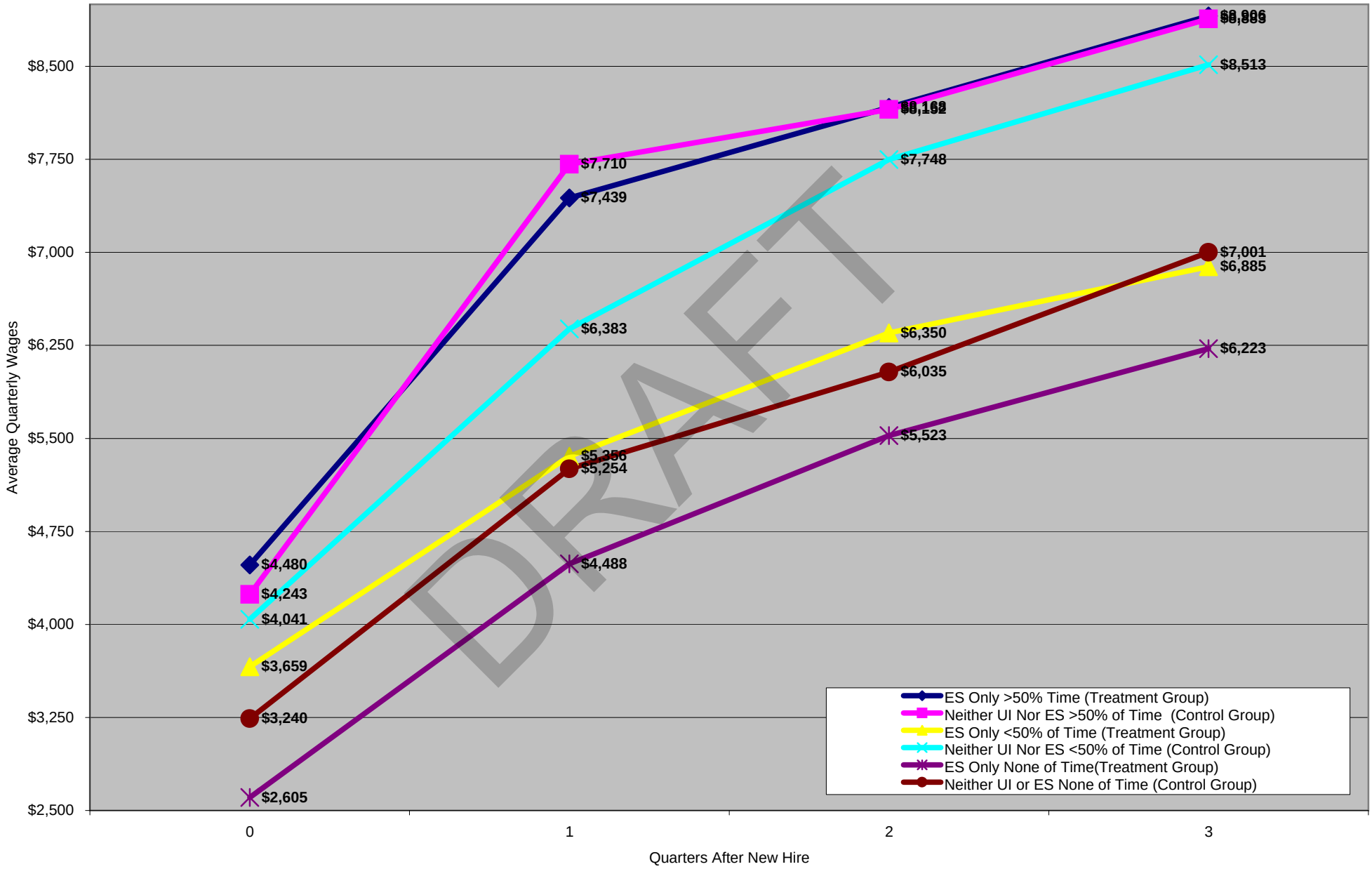
point forward, retention rates decline more rapidly for the treatment group than for the control group. By the time three quarters have passed since the date of hire, only 39.6% of ES only workers are still attached to their hiring employer. This is considerably less than the 47.5% retention rate estimated for workers in the control group. The difference in retention rates between the treatment and control groups was statistically significant at $p<.01$. The average wages for new hires in the control group were significantly greater than the treatment group at zero ($p<0.01$), one ($p<0.01$), two ($p<0.05$), and three quarters after new hire ($p<0.05$). Based on these findings, we conclude that the answer to the first research question is that both retention rates and average wages differ between the treatment and control groups overall. The retention rates and average wages for the control group were greater than the treatment group.

Question 4c of the New Hires Survey (R&P, 2010) requested in formation regarding the level of energy efficiency activities associated with the jobs new hires obtained (see footnote 3). Details of the breakouts are shown in Table 5. Figure 3 graphically displays the wage progression for treatment and control group new hires according to the level of energy efficient activities. Figure 3 shows that while workers in the control group generally earn more than those in the treatment group for all quarters, nearly all of the difference is accounted for in the level of energy efficiency. There was only $137/quarter difference for those in jobs with where >50% of job time was spent engaged in energy efficient activities when hired, but treatment and control group average wages were virtually identical three quarters after hire ($8,906 treatment, $8,883 control). Also note that the control group jobs with a low amount of energy efficient activity (<50%) were the third-highest paid group, making only $370/quarter less than those in high efficiency control group jobs. As Table 5 shows, wage ratios three quarters after new hire vary

Table 5: Retention Rates and Average Wages, and Wage Ratios to >50% of Time Spent in Energy Efficient Activities for New Hires, Panels I & II

Status	Amount of Time Spent in Energy Efficient Activties	Statistics	Qtr. After NH				Qtr. After NH (Retention Rates and Wage Ratios to >50% of Time Jobs)			
			0	1	2	3	0	1	2	3
(2) ES Only (Treatment Group)	None	Count	864	667	462	336	100.0%	77.2%	53.5%	38.9%
		Col %	85.0%	83.9%	84.5%	83.4%	N/A	N/A	N/A	N/A
		Avg. Wage	$2,605	$4,488	$5,523	$6,223	58.1%	60.3%	67.6%	69.9%
	<50%	Count	113	98	66	53	100.0%	86.7%	58.4%	46.9%
		Col %	11.1%	12.3%	12.1%	13.2%	N/A	N/A	N/A	N/A
		Avg. Wage	$3,659	$5,356	$6,350	$6,885	81.7%	72.0%	77.7%	77.3%
	>50%	Count	40	30	19	14	100.0%	75.0%	47.5%	35.0%
		Col %	3.9%	3.8%	3.5%	3.5%	N/A	N/A	N/A	N/A
		Avg. Wage	$4,480	$7,439	$8,168	$8,906	100.0%	100.0%	100.0%	100.0%
	Total	Count	1,017	795	547	403	100.0%	78.2%	53.8%	39.6%
		Avg. Wage	$2,796	$4,706	$5,715	$6,403	62.4%	63.3%	70.0%	71.9%
Neither UI nor ES (Control Group)	None	Count	2,610	2,054	1,562	1,237	100.0%	78.7%	59.8%	47.4%
		Col %	85.5%	85.2%	85.5%	85.4%	N/A	N/A	N/A	N/A
		Avg. Wage	$3,240	$5,254	$6,035	$7,001	76.4%	68.1%	74.0%	78.8%
	<50%	Count	307	247	181	145	100.0%	80.5%	59.0%	47.2%
		Col %	10.1%	10.2%	9.9%	10.0%	N/A	N/A	N/A	N/A
		Avg. Wage	$4,041	$6,383	$7,748	$8,513	95.2%	82.8%	95.0%	95.8%
	>50%	Count	134	110	84	66	100.0%	82.1%	62.7%	49.3%
		Col %	4.4%	4.6%	4.6%	4.6%	N/A	N/A	N/A	N/A
		Avg. Wage	$4,243	$7,710	$8,152	$8,883	100.0%	100.0%	100.0%	100.0%
	Total	Count	3,051	2,411	1,827	1,448	100.0%	79.0%	59.9%	47.5%
		Avg. Wage	$3,365	$5,482	$6,302	$7,238	79.3%	71.1%	77.3%	81.5%
Total	None	Count	3,474	2,721	2,024	1,573	100.0%	78.3%	58.3%	45.3%
		Col %	85.4%	84.9%	85.3%	85.0%	N/A	N/A	N/A	N/A
		Avg. Wage	$3,082	$5,066	$5,918	$6,835	71.7%	66.2%	72.6%	76.9%
	<50%	Count	420	345	247	198	100.0%	82.1%	58.8%	47.1%
		Col %	10.3%	10.8%	10.4%	10.7%	N/A	N/A	N/A	N/A
		Avg. Wage	$3,938	$6,091	$7,375	$8,077	91.6%	79.6%	90.4%	90.9%
	>50%	Count	174	140	103	80	100.0%	80.5%	59.2%	46.0%
		Col %	4.3%	4.4%	4.3%	4.3%	N/A	N/A	N/A	N/A
		Avg. Wage	$4,298	$7,652	$8,155	$8,887	100.0%	100.0%	100.0%	100.0%
	Total	Count	4,068	3,206	2,374	1,851	100.0%	78.8%	58.4%	45.5%
		Avg. Wage	$3,223	$5,289	$6,167	$7,056	75.0%	69.1%	75.6%	79.4%

Figure 3: Average Quarterly Wage for New Hires in Matched Treatment and Control Groups by Amount of Time Spent in Energy Efficient Activities



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considerably according to treatment/control group assignment and time spent in energy efficient activities. In the treatment group, those working jobs with "None" or "<50% of the time" in energy efficient activities on average earned 69.9% and 77.3% of those working jobs with ">50% of the time" in energy efficient activities. In the control group, these proportions were 78.8% and 95.8% respectively.

Differences in retention rates among between the groups and subgroups were also pronounced, as shown in Figure 4. Figure 4 shows two distinct clusters of new hires three quarters after they were hired. In the top group are all three types of control cases (None, <50%, >50%), plus treatment cases in the <50% group. The cohort with the greatest three-quarter retention was the control group spending <50% of job time in energy efficient activities (49.3%). Only treatment cases in the >50% group were in the top cluster (46.9%). In the bottom cluster were treatment cases in the None group (38.9%) and the >50% group (35.0%). The amount of time spent in energy efficient activities does not appear to have as much influence on new hire retention as it does on new hire wages.

Our previous tests for distributional differences by age, sex, industry and level of energy efficient activity were not statistically significant. This was expected since we controlled for those variables during the propensity scoring step of control group selection. However we did not control for occupation during selection. Tables 6 and 7 show the occupational distributions in addition to statistical tests for differences between the control and treatment groups. Occupations were grouped at the two-digit Standard Occupational Classification (SOC; Bureau of Labor Statistics, 2010) code level. In Table 6 we see the chi-square test result was insignificant

Figure 4: Retention Rates for New Hires in Matched Treatment and Control Groups by Amount of Time Spent in Energy Efficient Activities

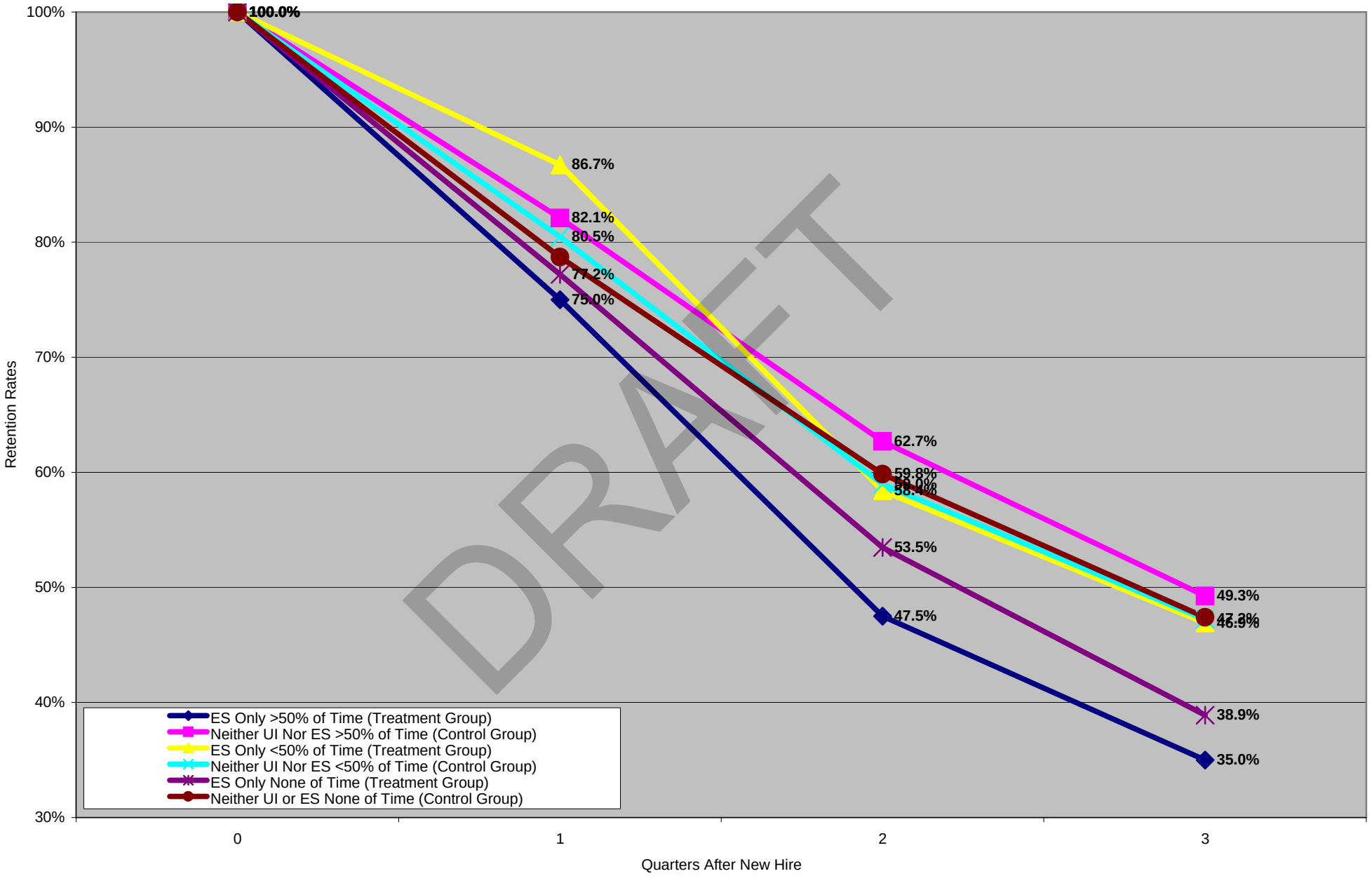

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Table 6: Statistical Tests for Occupation Ratios

Statistic	DF	Value	Prob
Chi-Square	22	33.1712	0.0595
Cramer's V		0.0903	

Table 7: Distribution of Occupations by Status, New Hires

Occupation	Status		
	(2) ES (Treatment Group)	(4) Neither UI Nor ES (Control Group)	Total
Management	10	50	60
Chi-Square	1.67	0.56	
Column %	0.98	1.64	
Business and Financial Operations	11	53	64
Chi-Square	1.56	0.52	
Column %	1.08	1.74	
Computer and Mathematical	5	19	24
Chi-Square	0.17	0.06	
Column %	0.49	0.62	
Architecture and Engineering	4	26	30
Chi-Square	1.63	0.54	
Column %	0.39	0.85	
Life, Physical, and Social Science	4	18	22
Chi-Square	0.41	0.14	
Column %	0.39	0.59	
Community and Social Service	12	42	54
Chi-Square	0.17	0.06	
Column %	1.18	1.38	
Legal	4	22	26
Chi-Square	0.96	0.32	
Column %	0.39	0.72	
Education, Training and Library	39	118	157
Chi-Square	0.00	0.00	
Column %	3.83	3.87	
Arts, Design, Entertainment, Sports, and Media	34	67	101
Chi-Square	3.03	1.01	
Column %	3.34	2.20	
Healthcare Practitioners and Technical	11	84	95
Chi-Square	6.84	2.28	
Column %	1.08	2.75	
Healthcare Support	29	69	98
Chi-Square	0.83	0.28	
Column %	2.85	2.26	
Protective Service	18	67	85
Chi-Square	0.50	0.17	
Column %	1.77	2.20	
Food Preparation and Serving Related	113	329	442
Chi-Square	0.06	0.02	
Column %	11.11	10.78	

Table 7: Distribution of Occupations by Status, New Hires

Occupation	Status		
	(2) ES (Treatment Group)	(4) Neither UI Nor ES (Control Group)	Total
Building and Grounds Cleaning and Maintenance	52	135	187
Chi-Square	0.59	0.20	
Column %	5.11	4.42	
Personal Care and	59	185	244
Chi-Square	0.07	0.02	
Column %	5.80	6.06	
Sales and Related	78	282	360
Chi-Square	1.6	0.5333	
Column %	7.67	9.24	
Office and Administrative Support	175	456	631
Chi-Square	1.89	0.63	
Column %	17.21	14.95	
Farming, Fishing, and Forestry	19	59	78
Chi-Square	0.01	0.00	
Column %	1.87	1.93	
Construction and Extraction	101	288	389
Chi-Square	0.14	0.05	
Column %	9.93	9.44	
Installation,	73	200	273
Chi-Square	0.33	0.11	
Column %	7.18	6.56	
Production	30	113	143
Chi-Square	0.92	0.31	
Column %	2.95	3.70	
Transportation and Material Moving	121	316	437
Chi-Square	1.26	0.42	
Column %	11.90	10.36	
Unable to Assign Code	15	53	68
Chi-Square	0.24	0.08	
Column %	1.47	1.74	
Total	1,017	3,051	4,068

($p<0.0595$). The Cramer's V value indicates that the distributions of occupations are not predictable by knowing to which group (treatment or control) a new hire belongs (0.0903). Table 7 shows that the occupational distribution does not differ significantly between the treatment and control groups. This is confirmed by the statistical tests shown in Table 6. Table 8 shows the expected frequencies of occupations by status. For the chi-square test we used, expected cell frequencies of five or greater are desired. Since we have cells in Table 7 with actual counts of four and five, Table 8 was developed as a check that our results were valid. In the cells of Table 7 where the smallest raw counts exist (Computer and Mathematical; Architecture and Engineering; Life, Physical and Social Science; Legal), all expected cell counts are greater than five. Therefore our conclusions regarding the occupational distributions by status are valid.

For some occupational groups (highlighted), there were differences in the distribution of occupations across treatment and control groups (see Table 7). These differences may explain at least some of the wage differentials. The list below details in which groups the differences occurred according to their column percentages (TG = Treatment Group, CG = Control Group), along with March 2011 Statewide Occupational Employment Survey (OES; R&P, 2011) average wages:

- Management: TG = 0.98%, CG = 1.64%; Avg. wage: $81,938
- Business and financial operations: TG = 1.08%, CG = 1.74%; Avg. wage: $60,412
- Architecture and Engineering: TG = 0.39%, CG = 0.85%; Avg. wage: $67,581
- Arts, design, entertainment, sports, and media: TG = 3.34%, CG = 2.20%; Avg. wage: $36,591
- Healthcare Practitioners and Technical: TG = 1.08%, CG = 2.75%; Avg. wage: $69,138

Table 8: Expected Frequencies of Occupations by Status

Occupation Code	Status		
	(2) ES (Treatment Group)	(4) Neither UI Nor ES (Control Group)	Total
Management	15.0	45.0	
Business and Financial Operations	16.0	48.0	
Computer and Mathematical	6.0	18.0	
Architecture and Engineering	7.5	22.5	
Life, Physical, and Social Science	5.5	16.5	
Community and Social Service	13.5	40.5	
Legal	6.5	19.5	
Education, Training and Library	39.3	117.8	
Arts, Design, Entertainment, Sports, and Media	25.3	75.8	
Healthcare Practitioners and Technical	23.8	71.3	
Healthcare Support	24.5	73.5	
Protective Service	21.3	63.8	
Food Preparation and Serving Related	110.5	331.5	
Building and Grounds Cleaning and Maintenance	46.8	140.3	
Personal Care and Service	61.0	183.0	
Sales and Related	90.0	270.0	
Office and Administrative Support	157.8	473.3	
Farming, Fishing, and Forestry	19.5	58.5	
Construction and Extraction	97.3	291.8	
Installation, Maintenance, and Repair	68.3	204.8	
Production	35.8	107.3	
Transportation and Material Moving	109.3	327.8	
Unable to Assign Code	17.0	51.0	
Total	1,017	3,051	4,068

- Office and Administrative Support: TG = 17.21%, CG = 14.95%; Avg. Wage : $31,680
- Transportation and Material Moving: TG = 11.91%, CG = 10.36%, Avg. Wage: $38,273

The control group has a greater proportion of new hires in the four highest paying occupational groups, management, business and financial operations, architecture and engineering, healthcare practitioners and technical. Conversely, the treatment group has greater proportions in the three lower-paying occupation al groups arts, design, entertainment, sports and media, office and administrative support, and transportation and material moving.

Conclusion and Directions for Future Research

In this study we used statistically-matched groups to analyze differences in earning and retention between new hires who utilized ES services and those who did not utilize ES nor UI services. We took this step because initial results using the entire population of new hires indicated those using neither service had a greater probability of retaining employment and earned greater wages than those who used ES. This finding was confirmed by the control group study for retention but not completely by average earnings. In fact, we found that for jobs which are highly green in nature, the earnings differences between the treatment and control groups were negligible. This indicates that differences in wages between the treatment and control groups are mitigated when the level of green activity is high. Wage differences appear to only be important when green activity is low.

The results of this study do not suggest that ES "causes" retention and wages to be different. The occupation distribution reveals that those in high wage occupations tend not to use ES while those earning less use ES. Recent research by R&P (Leonard, 2011) indicated that job boards such as W@W may not be appropriate recruiting tools for some workers. This applies to younger and tech-savvy workers in addition to recruiting for more highly-paid and highly-skilled workers. A similar finding was published by the United States Government Accountability Office in 2006 in a report which stated, "…their [one-stop centers] job candidates generally had either low skill or lacked the specialized skills needed by employers." Generally employers view labor coming from the ES system as low-skilled. Those in higher-paying professional occupations may have better developed informal contact networks and therefore do not require ES services. Those in healthcare positions may be more likely to change jobs more quickly than people in other occupations because their skills are in greater demand. All of these factors and others not researched in this paper influence peoples' choices regarding ES service usage.

The relatively small number of cases available to match in this study limited the number of control variables we could use and still obtain valid results. This is evidenced in Table 5, where by three quarters after new hire, our findings regarding retention and average wages were based on as few as 14 cases in the treatment group (3.5% of the total number retained). Expanding the analysis to combinations of four or more panels will allow us to construct control and treatment groups which are larger and have greater explanatory power.

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Appendix A – Detailed Case Distribution Table by Industry and Age

Table A1: Detailed Distribution of Cases in Treatment and Control Groups by Industry and Age by Amount of Time Spent in Energy Efficient Activities

			Amount of Time Spent								Total			
			<50%				>50%							
			Sex			Total	Sex			Total	Sex			Total
			F	M	U		F	M	U		F	M	U	
Status	Industry													
(2) ES Only (Treatment Group)	Agriculture, Forestry, Fishing, & Hunting	N	6	14	1	21	.	.	1	1	6	14	2	22
		Col%	1.3	3.1	1.5	2.1	.	.	25.0	2.5	1.3	2.9	2.8	2.2
	Mining	N	5	36	3	44	.	.	.	8	6	43	3	52
		Col%	1.1	8.0	4.4	4.5	.	.	.	20.0	1.3	9.0	4.2	5.1
	Construction	N	6	50	5	61	.	.	1	6	6	55	6	67
		Col%	1.3	11.2	7.4	6.2	.	.	25.0	15.0	1.3	11.5	8.3	6.6
	Manufacturing	N	7	10	5	22	.	.	.	.	7	10	5	22
		Col%	1.5	2.2	7.4	2.3	.	.	.	.	1.5	2.1	6.9	2.2
	Wholesale Trade, Transportation, Utilities, &	N	24	66	5	95	.	.	.	9	24	75	5	104
		Col%	5.2	14.7	7.4	9.7	.	.	.	22.5	5.2	15.7	6.9	10.2
	Retail Trade	N	55	36	9	100	.	.	.	.	55	36	9	100
		Col%	11.9	8.0	13.2	10.2	.	.	.	.	11.8	7.5	12.5	9.8
	Information	N	19	14	2	35	.	.	.	.	19	14	2	35
		Col%	4.1	3.1	2.9	3.6	.	.	.	.	4.1	2.9	2.8	3.4
	Financial Activities	N	34	28	10	72	.	.	1	2	34	29	11	74
		Col%	7.4	6.3	14.7	7.4	.	.	25.0	5.0	7.3	6.1	15.3	7.3
	Professional & Business Services	N	62	44	4	110	.	.	.	6	63	49	4	116
		Col%	13.4	9.8	5.9	11.3	.	.	.	15.0	13.5	10.2	5.6	11.4
	Educational Services	N	38	19	.	57	.	.	.	1	39	19	.	58
		Col%	8.2	4.2	.	5.8	.	.	.	2.5	8.4	4.0	.	5.7
	Health Services	N	73	15	11	99	.	.	.	1	74	15	11	100
		Col%	15.8	3.3	16.2	10.1	.	.	.	2.5	15.9	3.1	15.3	9.8
	Leisure & Hospitality	N	86	58	8	152	.	.	1	2	86	59	9	154
		Col%	18.7	12.9	11.8	15.6	.	.	25.0	5.0	18.5	12.3	12.5	15.1
	Other Services	N	31	33	4	68	.	.	.	2	32	34	4	70
		Col%	6.7	7.4	5.9	7.0	.	.	.	5.0	6.9	7.1	5.6	6.9
	Public Administration	N	15	25	1	41	.	.	.	2	15	27	1	43
		Col%	3.3	5.6	1.5	4.2	.	.	.	5.0	3.2	5.6	1.4	4.2
	Total	N	461	448	68	977	.	.	4	40	466	479	72	1,017
		Row%	45.3	44.1	6.7	96.1	.	.	0.4	3.9	45.8	47.1	7.1	100.0
	Age													
	<25	N	161	152	.	313	.	.	.	12	163	162	.	325
		Col%	34.9	33.9	.	32.0	.	.	.	30.0	35.0	33.8	.	32.0
	25 - 35	N	105	124	.	229	.	.	.	12	107	134	.	241
		Col%	22.8	27.7	.	23.4	.	.	.	30.0	23.0	28.0	.	23.7
	35 - 45	N	83	75	.	158	.	.	.	6	84	80	.	164
		Col%	18.0	16.7	.	16.2	.	.	.	15.0	18.0	16.7	.	16.1
	45 - 55	N	77	59	.	136	.	.	.	3	77	62	.	139
		Col%	16.7	13.2	.	13.9	.	.	.	7.5	16.5	12.9	.	13.7
	55+	N	35	38	.	73	.	.	.	3	35	41	.	76
		Col%	7.6	8.5	.	7.5	.	.	.	7.5	7.5	8.6	.	7.5
	N/A	N	.	.	68	68	.	.	4	4	.	.	72	72
		Col%	.	.	100.0	7.0	.	.	100.0	10.0	.	.	100.0	7.1
	Total	N	461	448	68	977	.	.	4	40	466	479	72	1,017
		Row%	45.3	44.1	6.7	96.1	.	.	0.4	3.9	45.8	47.1	7.1	100.0

Table A1: Detailed Distribution of Cases in Treatment and Control Groups by Industry and Age by Amount of Time Spent in Energy Efficient Activities

			Amount of Time Spent								Total			
			<50%				>50%							
			Sex			Total	Sex			Total	Sex			Total
			F	M	U		F	M	U		F	M	U	
(4) Neither UI Nor ES (Control Group)	Industry													
	Agriculture, Forestry, Fishing, & Hunting	N	16	39	3	58	.	3	3	6	16	42	6	64
		Col%	1.2	2.9	1.5	2.0	.	2.9	23.1	4.5	1.2	2.9	2.8	2.1
	Mining	N	22	115	9	146	1	14	.	15	23	129	9	161
		Col%	1.6	8.6	4.4	5.0	5.6	13.6	.	11.2	1.7	8.9	4.1	5.3
	Construction	N	18	153	15	186	.	23	3	26	18	176	18	212
		Col%	1.3	11.4	7.3	6.4	.	22.3	23.1	19.4	1.3	12.2	8.3	6.9
	Manufacturing	N	29	29	15	73	.	3	.	3	29	32	15	76
		Col%	2.1	2.2	7.3	2.5	.	2.9	.	2.2	2.1	2.2	6.9	2.5
	Wholesale Trade, Transportation, Utilities, &	N	54	210	15	279	1	29	1	31	55	239	16	310
		Col%	3.9	15.6	7.3	9.6	5.6	28.2	7.7	23.1	4.0	16.5	7.3	10.2
	Retail Trade	N	161	101	28	290	.	.	.	.	161	101	28	290
		Col%	11.8	7.5	13.7	9.9	.	.	.	.	11.6	7.0	12.8	9.5
	Information	N	53	46	6	105	1	.	.	1	54	46	6	106
		Col%	3.9	3.4	2.9	3.6	5.6	.	.	0.7	3.9	3.2	2.8	3.5
	Financial Activities	N	111	77	30	218	1	1	2	4	112	78	32	222
		Col%	8.1	5.7	14.6	7.5	5.6	1.0	15.4	3.0	8.1	5.4	14.7	7.3
	Professional & Business Services	N	171	137	12	320	4	16	.	20	175	153	12	340
		Col%	12.5	10.2	5.9	11.0	22.2	15.5	.	14.9	12.6	10.6	5.5	11.1
	Educational Services	N	114	57	.	171	.	.	.	.	114	57	.	171
		Col%	8.3	4.2	.	5.9	.	.	.	.	8.2	3.9	.	5.6
	Health Services	N	214	49	33	296	3	1	.	4	217	50	33	300
		Col%	15.6	3.6	16.1	10.1	16.7	1.0	.	3.0	15.6	3.5	15.1	9.8
	Leisure & Hospitality	N	254	180	24	458	1	8	4	13	255	188	28	471
		Col%	18.6	13.4	11.7	15.7	5.6	7.8	30.8	9.7	18.4	13.0	12.8	15.4
	Other Services	N	103	80	12	195	6	4	.	10	109	84	12	205
		Col%	7.5	6.0	5.9	6.7	33.3	3.9	.	7.5	7.9	5.8	5.5	6.7
	Public Administration	N	49	70	3	122	.	1	.	1	49	71	3	123
		Col%	3.6	5.2	1.5	4.2	.	1.0	.	0.7	3.5	4.9	1.4	4.0
	Total	N	1,369	1,343	205	2,917	18	103	13	134	1,387	1,446	218	3,051
		Row%	44.9	44.0	6.7	95.6	0.6	3.4	0.4	4.4	45.5	47.4	7.1	100.0
	Age													
	<25	N	482	438	.	920	9	31	.	40	491	469	.	960
		Col%	35.2	32.6	.	31.5	50.0	30.1	.	29.9	35.4	32.4	.	31.5
	25 - 35	N	300	378	.	678	2	29	.	31	302	407	.	709
		Col%	21.9	28.1	.	23.2	11.1	28.2	.	23.1	21.8	28.1	.	23.2
	35 - 45	N	247	224	.	471	4	20	.	24	251	244	.	495
		Col%	18.0	16.7	.	16.1	22.2	19.4	.	17.9	18.1	16.9	.	16.2
	45 - 55	N	238	187	.	425	3	14	.	17	241	201	.	442
		Col%	17.4	13.9	.	14.6	16.7	13.6	.	12.7	17.4	13.9	.	14.5
	55+	N	102	116	.	218	.	9	.	9	102	125	.	227
		Col%	7.5	8.6	.	7.5	.	8.7	.	6.7	7.4	8.6	.	7.4
	N/A	N	.	.	205	205	.	.	13	13	.	.	218	218
		Col%	.	.	100.0	7.0	.	.	100.0	9.7	.	.	100.0	7.1
	Total	N	1,369	1,343	205	2,917	18	103	13	134	1,387	1,446	218	3,051
		Row%	44.9	44.0	6.7	95.6	0.6	3.4	0.4	4.4	45.5	47.4	7.1	100.0

Table A1: Detailed Distribution of Cases in Treatment and Control Groups by Industry and Age by Amount of Time Spent in Energy Efficient Activities

			Amount of Time Spent								Total			
			<50%				>50%							
			Sex			Total	Sex			Total	Sex			Total
			F	M	U		F	M	U		F	M	U	
Total	Industry													
	Agriculture, Forestry, Fishing, & Hunting	N	22	53	4	79	.	3	4	7	22	56	8	86
		Col%	1.2	3.0	1.5	2.0	.	2.2	23.5	4.0	1.2	2.9	2.8	2.1
	Mining	N	27	151	12	190	2	21	.	23	29	172	12	213
		Col%	1.5	8.4	4.4	4.9	8.7	15.7	.	13.2	1.6	8.9	4.1	5.2
	Construction	N	24	203	20	247	.	28	4	32	24	231	24	279
		Col%	1.3	11.3	7.3	6.3	.	20.9	23.5	18.4	1.3	12.0	8.3	6.9
	Manufacturing	N	36	39	20	95	.	3	.	3	36	42	20	98
		Col%	2.0	2.2	7.3	2.4	.	2.2	.	1.7	1.9	2.2	6.9	2.4
	Wholesale Trade, Transportation, Utilities, &	N	78	276	20	374	1	38	1	40	79	314	21	414
		Col%	4.3	15.4	7.3	9.6	4.3	28.4	5.9	23.0	4.3	16.3	7.2	10.2
	Retail Trade	N	216	137	37	390	.	.	.	.	216	137	37	390
		Col%	11.8	7.6	13.6	10.0	.	.	.	.	11.7	7.1	12.8	9.6
	Information	N	72	60	8	140	1	.	.	1	73	60	8	141
		Col%	3.9	3.4	2.9	3.6	4.3	.	.	0.6	3.9	3.1	2.8	3.5
	Financial Activities	N	145	105	40	290	1	2	3	6	146	107	43	296
		Col%	7.9	5.9	14.7	7.4	4.3	1.5	17.6	3.4	7.9	5.6	14.8	7.3
	Professional & Business Services	N	233	181	16	430	5	21	.	26	238	202	16	456
		Col%	12.7	10.1	5.9	11.0	21.7	15.7	.	14.9	12.8	10.5	5.5	11.2
	Educational Services	N	152	76	.	228	1	.	.	1	153	76	.	229
		Col%	8.3	4.2	.	5.9	4.3	.	.	0.6	8.3	3.9	.	5.6
	Health Services	N	287	64	44	395	4	1	.	5	291	65	44	400
		Col%	15.7	3.6	16.1	10.1	17.4	0.7	.	2.9	15.7	3.4	15.2	9.8
	Leisure & Hospitality	N	340	238	32	610	1	9	5	15	341	247	37	625
		Col%	18.6	13.3	11.7	15.7	4.3	6.7	29.4	8.6	18.4	12.8	12.8	15.4
	Other Services	N	134	113	16	263	7	5	.	12	141	118	16	275
		Col%	7.3	6.3	5.9	6.8	30.4	3.7	.	6.9	7.6	6.1	5.5	6.8
	Public Administration	N	64	95	4	163	.	3	.	3	64	98	4	166
		Col%	3.5	5.3	1.5	4.2	.	2.2	.	1.7	3.5	5.1	1.4	4.1
	Total	N	1,830	1,791	273	3,894	23	134	17	174	1,853	1,925	290	4,068
		Row%	45.0	44.0	6.7	95.7	0.6	3.3	0.4	4.3	45.6	47.3	7.1	100.0
	Age													
	<25	N	643	590	.	1,233	11	41	.	52	654	631	.	1,285
		Col%	35.1	32.9	.	31.7	47.8	30.6	.	29.9	35.3	32.8	.	31.6
	25 - 35	N	405	502	.	907	4	39	.	43	409	541	.	950
		Col%	22.1	28.0	.	23.3	17.4	29.1	.	24.7	22.1	28.1	.	23.4
	35 - 45	N	330	299	.	629	5	25	.	30	335	324	.	659
		Col%	18.0	16.7	.	16.2	21.7	18.7	.	17.2	18.1	16.8	.	16.2
	45 - 55	N	315	246	.	561	3	17	.	20	318	263	.	581
		Col%	17.2	13.7	.	14.4	13.0	12.7	.	11.5	17.2	13.7	.	14.3
	55+	N	137	154	.	291	.	12	.	12	137	166	.	303
		Col%	7.5	8.6	.	7.5	.	9.0	.	6.9	7.4	8.6	.	7.4
	N/A	N	.	.	273	273	.	.	17	17	.	.	290	290
		Col%	.	.	100.0	7.0	.	.	100.0	9.8	.	.	100.0	7.1
	Total	N	1,830	1,791	273	3,894	23	134	17	174	1,853	1,925	290	4,068
		Row%	45.0	44.0	6.7	95.7	0.6	3.3	0.4	4.3	45.6	47.3	7.1	100.0

U = Demographic data for sex were not available

N/A: Age data not available

Appendix B – Chi-Square Tests for Independence of Demographic Distributions

Table B1: Chi-Square Test of Sex by Status

Statistic	DF	Value	Prob
Chi-Square	2	0.0404	0.98

Table B2: Chi-Square Test of Age by Status

Statistic	DF	Value	Prob
Chi-Square	5	0.496	0.9923

Table B3: Chi-Square Test of Industry by Status

Statistic	DF	Value	Prob
Chi-Square	13	0.8361	1

Table B4: Chi-Square Test of Time Spent in Energy Efficient Activities by Status

Statistic	DF	Value	Prob
Chi-Square	1	0.3923	0.5311

Appendix C – Median Method of Wage Progression Estimation

Although our earlier wage progression estimates focused on mean[7] values, other options exist for estimating wage progression. One of those methods is by using median[8] values. One weakness in the use of mean values is that a small number of extreme high or low observations can drastically affect the measure of central tendency. This was the reason for trimming the top and bottom one percent of values in the main report. In this section, we begin with a discussion of the cases used in the median wage analysis and then show the differences between the two methods for each cohort.

Table C1 shows the case breakdowns for each method. The mixture of cases is nearly identical from a numerical perspective, but this does not mean all the same cases were selected because of random assignments in the control group. This is shown to give readers confidence in the control group selection method.

Figure C1 shows the differences in the mean and median wage estimation methods. Note that for both the treatment and control groups, the mean wages were greater than the median wages at all points in time. Mean wages tend to be skewed to the right of median wages. There are some large wage values in both treatment and control groups which cause the mean values to be larger than the median values. We do see that at every point in time, the median wage values for the treatment group are greater than those of the control group. Why might this occur? It indicates that the 50th percentile for the treatment group is a greater value than the 50th percentile wage

[7] A mean is the arithmetic average of more than one value. For example, the mean of 1, 2, 3, 4, and 5 is (1+2+3+4+5)/5 = 3.2

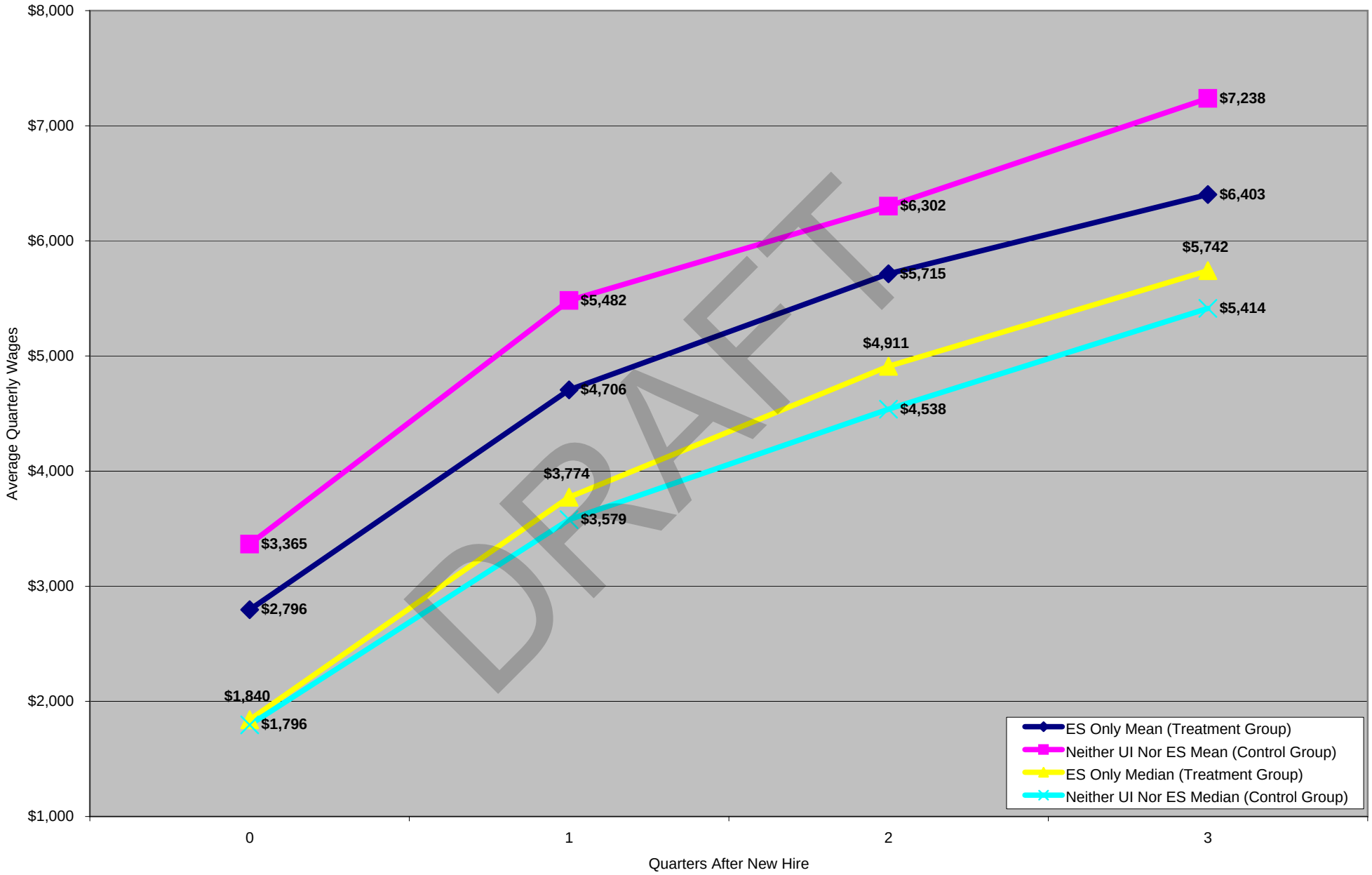
[8] A median value is the 50th percentile or middle value in a sorted series of numbers. For example, the median of the series 1,2,3,4,5 is 3 because it is the middle value.

value for the control group. Recall that our analysis showed greater concentrations of control group cases in higher wage occupations. This would cause more right-skewed mean values which would not affect the median value since median values are based on a count of values rather than on the magnitude of the values themselves.

Table C1: Final Distribution of Cases Used in Analysis

Method	Date	Treatments	Controls	Total	Total Available
Mean	2009Q4	479	1,437	1,916	3,467
Mean	2010Q1	538	1,614	2,152	3,212
	Totals	**1,017**	**3,051**	**4,068**	**6,679**
Median	2009Q4	487	1,461	1,948	3,467
Median	2010Q1	533	1,599	2,132	3,212
	Totals	**1,020**	**3,060**	**4,080**	**6,679**

Figure C1: Wages for New Hires in Matched Treatment and Control Groups, Mean and Median Value Comparisons



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