

Econometrics

MIT (14.32)
Spring 2003

Review Problem Set

A. Table 622 from the 1992 *Statistical Abstract of the United States* (attached) reports features of the joint distribution of age, sex, race, and employment status. Age is grouped into 7 categories and race is grouped into 3 categories. The labor force is defined as the sum of the employed and the unemployed. Compute:

1. The joint distribution of race and sex for people in the labor force and the marginal distributions of race and sex.
2. The distribution of employment status for all workers (men and women) conditional on race.
3. Define a dummy random variable for employment status. Graph the conditional expectation function for this variable given age group by race.
4. Assuming Table 622 reports population proportions, decide whether employment status and race are independent. Explain your calculations. Perform the same calculation conditional on sex.

B. An "At Home Test Kit for Illicit Drugs" has generated the following results in field studies:

90% of those using drugs test positive; 10% of those not using drugs test positive.

Assuming that 10% of the population actually uses illicit drugs

1. What is the probability that an individual who tests positive uses drugs?
2. What is the maximum probability of observing at least 20 drug users in a random sample of 100 test subjects? (Hint: use Chebyshev or Markov inequalities)

C. A 1981 social experiment offered tax credit vouchers and direct rebate vouchers to unemployed job seekers on the welfare rolls in Dayton, Ohio. The job seekers were randomly divided into 3 groups. The tax credit voucher group received a voucher that employers could use to reduce their federal tax liability if they hired a someone in this group. The direct rebate voucher group received a voucher that employers could cash in with the program administrator after the job seeker was employed for 3 months. Results of the experiment are reported in Table 1 (attached¹).

1. Construct separate t-tests comparing each of the two treatment groups with the control group. Did the treatments have statistically significant effects? If so, in what direction?
2. Test whether the employment rates in the two treatment groups differ from each other.
3. Construct 95% confidence intervals for the two treatment-control contrasts.
4. Footnote 11 reports a chi-square statistic for independence between group (tax credit, rebate, and control) and job placement. Explain how this was constructed.

D. Assuming that the probability of conception in any given month among newlywed couples is constant at $p=.05$ per month, and that conception is independent from month to month, what is the expected waiting time to first birth among newlyweds?

E. From Wooldridge: B.3, B.6, B.10, C.1, C.3

¹Gary Burtless, "Are Targeted Wage Subsidies Harmful? Evidence from a Wage Voucher Experiment," *Industrial and Labor Relations Review* 39 (October 1985), 105-111.

Employment Status—Weekly Hours

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No. 622. Civilian Labor Force—Employment Status, by Sex, Race, and Age: 1991

[For civilian noninstitutional population 16 years old and over. Annual averages of monthly figures. Based on Current Population Survey; see text, section 1 and Appendix III]

AGE AND RACE	CIVILIAN LABOR FORCE				MALE (1,000)				FEMALE (1,000)				PERCENT OF LABOR FORCE			
	Total (1,000)	Percent by age		Total	Em- ployed	Un- em- ployed	Total	Em- ployed	Un- em- ployed	Employed		Unemployed				
		Male	Fe- male							Male	Fe- male	Male	Fe- male			
All workers ¹	125,303	100.0	100.0	68,411	63,593	4,817	56,893	53,284	3,609	93.0	93.7	7.0	6.3			
16 to 19 years . . .	6,918	5.2	5.9	3,588	2,879	709	3,330	2,749	581	80.2	82.6	19.8	17.4			
20 to 24 years . . .	13,710	10.6	11.3	7,270	6,421	849	6,440	5,812	628	88.3	90.2	11.7	9.8			
25 to 34 years . . .	35,330	28.6	27.7	19,548	18,188	1,360	15,782	14,726	1,057	93.0	93.3	7.0	6.7			
35 to 44 years . . .	32,975	26.1	26.6	17,854	16,883	971	15,121	14,402	718	94.6	95.3	5.4	4.7			
45 to 54 years . . .	21,118	16.8	17.0	11,461	10,909	552	9,657	9,255	402	95.2	95.8	4.8	4.2			
55 to 64 years . . .	11,752	9.8	8.9	6,699	6,389	310	5,052	4,879	173	95.4	96.6	4.6	3.4			
65 years and over . . .	3,500	2.9	2.7	1,990	1,923	66	1,511	1,461	50	96.7	96.7	3.3	3.3			
White	107,486	100.0	100.0	59,332	55,557	3,775	48,154	45,482	2,672	93.6	94.5	6.4	5.5			
16 to 19 years . . .	5,966	5.2	6.0	3,094	2,552	542	2,872	2,436	436	82.5	84.8	17.5	15.2			
20 to 24 years . . .	11,575	10.4	11.3	6,148	5,522	626	5,427	4,990	436	89.8	92.0	10.2	8.0			
25 to 34 years . . .	29,896	28.2	27.3	16,754	15,695	1,059	13,142	12,403	740	93.7	94.4	6.3	5.6			
35 to 44 years . . .	28,293	26.2	26.5	15,547	14,769	777	12,747	12,195	551	95.0	95.7	5.0	4.3			
45 to 54 years . . .	18,288	16.9	17.1	10,035	9,593	442	8,253	7,928	325	95.6	96.1	4.4	3.9			
55 to 64 years . . .	10,314	10.0	9.1	5,940	5,667	272	4,375	4,231	143	95.4	96.7	4.6	3.3			
65 years and over . . .	3,154	3.1	2.8	1,815	1,758	57	1,339	1,298	41	96.9	96.9	3.1	3.1			
Black	13,542	100.0	100.0	6,754	5,880	874	6,788	5,983	805	87.1	88.1	12.9	11.9			
16 to 19 years . . .	744	5.8	5.2	390	247	142	354	227	128	63.5	63.9	36.5	36.1			
20 to 24 years . . .	1,673	12.9	11.8	870	675	195	802	636	166	77.6	79.3	22.4	20.7			
25 to 34 years . . .	4,199	31.2	30.8	2,110	1,858	252	2,089	1,809	280	88.1	86.6	11.9	13.4			
35 to 44 years . . .	3,507	24.9	26.9	1,680	1,519	162	1,827	1,688	139	90.4	92.4	9.6	7.6			
45 to 54 years . . .	2,057	14.9	15.5	1,003	917	86	1,054	989	65	91.4	93.8	8.6	6.2			
55 to 64 years . . .	1,087	8.4	7.7	565	537	28	522	502	20	95.0	96.2	5.0	3.8			
65 years and over . . .	275	2.0	2.1	135	127	8	140	133	6	94.1	95.7	5.9	4.3			
Hispanic ²	9,762	100.0	100.0	5,873	5,278	595	3,890	3,521	368	89.9	90.5	10.1	9.5			
16 to 19 years . . .	653	6.5	7.0	379	290	90	273	213	60	76.3	78.0	23.7	22.0			
20 to 24 years . . .	1,476	16.0	13.8	939	830	109	537	474	63	88.4	88.3	11.6	11.7			
25 to 34 years . . .	3,204	33.9	31.2	1,991	1,807	185	1,213	1,102	111	90.7	90.8	9.3	9.2			
35 to 44 years . . .	2,363	23.5	25.3	1,337	1,261	118	984	909	75	91.4	92.4	8.6	7.6			
45 to 54 years . . .	1,307	12.5	14.7	736	678	58	571	525	46	92.1	91.9	7.9	8.1			
55 to 64 years . . .	653	6.5	6.9	383	352	31	270	259	11	91.9	95.9	8.1	4.1			
65 years and over . . .	107	1.1	1.1	65	60	5	42	39	3	92.3	92.9	7.7	7.1			

¹ Includes other races not shown separately. ² Persons of Hispanic origin may be of any race.

*Table 1. Job Placement Rates
in Dayton Treatment Groups.*

<i>Group</i>	<i>Sample Size Enrolled</i>	<i>Number Placed in Jobs</i>	<i>Percentage Placed in Jobs</i>
Tax Credit Voucher	247	32	13.0
Direct Rebate Voucher	299	38	12.7
Control	262	54	20.6
Total	808	124	15.3