

Appendix Table 1. Wage gap estimates by private sector industry

	1983-1988			1996-2001			$\Delta$ density	$\Delta$ wage gap
	density	wage gap	N	density	wage gap	N		
Agricultural services	1.8%	41.2%	1,852	2.2%	32.6%	4,115	0.4%	-8.6%
Other agriculture	2.5%	55.9%	12,451	1.8%	23.0%	4,828	-0.7%	-32.9%
Mining	18.3%	15.8%	9,311	12.8%	9.4%	4,142	-5.5%	-6.4%
Construction	22.7%	51.6%	44,026	18.8%	40.9%	31,878	-3.9%	-10.7%
Lumber	15.1%	15.7%	6,662	9.9%	14.0%	4,251	-5.2%	-1.7%
Furniture	16.8%	11.3%	5,449	7.8%	2.7%	3,288	-9.0%	-8.6%
Stone, clay & glass	30.6%	14.5%	5,143	21.6%	12.6%	3,149	-9.0%	-1.9%
Primary metals	48.1%	5.8%	7,021	36.0%	8.0%	3,852	-12.1%	2.2%
Fabricated metals	28.1%	12.5%	11,117	16.5%	13.7%	7,033	-11.6%	1.2%
Machinery excluding electrical	17.5%	3.9%	22,343	11.0%	8.2%	13,061	-6.5%	4.3%
Electrical equipment	19.6%	6.4%	19,162	10.6%	10.1%	10,387	-9.0%	3.7%
Autos	56.6%	10.0%	10,365	38.8%	21.7%	6,749	-17.8%	11.7%
Aircraft	34.6%	0.4%	4,929	27.8%	5.7%	2,347	-6.8%	5.3%
Other transport equipment	23.9%	4.8%	5,517	16.3%	9.2%	2,933	-7.6%	4.4%
Photographic	10.0%	-0.9%	6,104	5.1%	-3.1%	4,069	-4.9%	-2.2%
Toys	16.3%	2.2%	1,094	6.4%	1.5%	828	-9.9%	-0.7%
Miscellaneous manufacturing	13.8%	7.6%	3,344	8.4%	22.0%	2,416	-5.4%	14.4%
Food	31.1%	16.9%	16,396	22.5%	13.0%	9,627	-8.6%	-3.9%
Tobacco	33.0%	26.0%	553	22.4%	17.4%	248	-10.6%	-8.6%
Textiles	10.0%	4.0%	7,076	5.6%	-1.4%	2,681	-4.4%	-5.4%
Apparel	20.8%	5.1%	10,666	8.1%	2.7%	4,144	-12.7%	-2.4%
Paper	44.6%	7.6%	6,544	29.9%	9.7%	3,479	-14.7%	2.1%
Printing	13.4%	24.4%	14,983	8.2%	18.3%	9,331	-5.2%	-6.1%
Chemicals	17.2%	0.8%	10,953	11.0%	4.7%	6,908	-6.2%	3.9%
Petroleum	32.7%	2.3%	1,678	21.9%	-0.1%	940	-10.8%	-2.4%
Rubber & plastics	23.3%	11.4%	6,732	15.2%	9.2%	4,716	-8.1%	-2.2%
Leather & nes	20.7%	1.4%	1,953	17.5%	20.4%	633	-3.2%	19.0%
Transport	35.8%	44.2%	29,626	25.9%	36.2%	22,091	-9.9%	-8.0%
Communications	39.4%	6.0%	14,075	22.3%	10.2%	9,884	-17.1%	4.2%

Utilities & sanitary	35.1%	5.4%	9,731	29.6%	15.0%	6,085	-5.5%	9.6%
Wholesale trade	8.1%	15.7%	35,107	5.7%	9.3%	24,987	-2.4%	-6.4%
Retail trade	7.3%	34.2%	155,875	5.1%	13.9%	110,741	-2.2%	-20.3%
Banking	1.6%	1.4%	28,151	2.0%	-3.2%	20,459	0.4%	-4.6%
Insurance & real estate	3.6%	4.8%	28,075	2.9%	6.5%	20,034	-0.7%	1.7%
Private households	0.3%	29.2%	10,567	1.0%	0.2%	3,723	0.7%	-29.0%
Business services	5.1%	15.3%	31,916	3.0%	6.9%	30,867	-2.1%	-8.4%
Repair services	5.8%	36.6%	8,259	3.3%	37.0%	6,504	-2.5%	0.4%
Personal services excl households	8.4%	11.1%	22,431	6.8%	12.1%	15,731	-1.6%	1.0%
Entertainment	11.7%	46.8%	8,863	6.8%	29.3%	9,949	-4.9%	-17.5%
Hospitals	11.8%	7.4%	32,573	8.1%	10.2%	25,514	-3.7%	2.8%
Health excl hosp	5.1%	5.4%	28,681	4.6%	3.0%	31,345	-0.5%	-2.4%
Educational	9.7%	21.2%	16,421	12.8%	18.6%	15,522	3.1%	-2.6%
Social services	3.0%	24.0%	10,338	2.9%	16.6%	13,478	-0.1%	-7.4%
Other professional	3.5%	29.3%	28,175	2.4%	15.0%	27,600	-1.1%	-14.3%

Notes: see Tables 3 and 5. Union estimates are obtained from the ORG data files (weighted).

Appendix Table 2. Wage gaps and union density by state

State	1983 - 1988			1996 - 2001			Change in density	Change in wage gap
	Density (1983)	N	Wage gap	Density (2000)	N	Wage gap		
Alabama*	16.9%	8,908	27.3%	9.6%	7,463	13.1%	-7.3%	-14.2%
Alaska	24.9%	9,407	22.9%	21.9%	5,280	15.5%	-3.0%	-7.4%
Arizona*	11.4%	8,291	32.3%	6.4%	8,858	21.7%	-5.0%	-10.7%
Arkansas*	11.0%	9,037	31.3%	5.8%	7,317	16.1%	-5.2%	-15.2%
California	21.9%	59,161	23.5%	16.0%	44,410	22.1%	-5.9%	-1.4%
Colorado	13.6%	10,384	26.4%	9.0%	9,923	13.5%	-4.6%	-12.8%
Connecticut	22.7%	9,671	12.2%	16.3%	6,249	8.3%	-6.4%	-3.9%
Delaware	20.1%	8,451	22.9%	13.3%	5,759	14.1%	-6.8%	-8.8%
Dist of Columbia	19.5%	5,758	17.8%	14.7%	4,211	11.1%	-4.8%	-6.8%
Florida*	10.2%	30,682	26.9%	6.8%	24,244	16.8%	-3.4%	-10.1%
Georgia*	11.9%	11,547	21.9%	6.3%	8,904	20.7%	-5.6%	-1.2%
Hawaii	29.2%	7,634	18.8%	24.8%	5,202	20.8%	-4.4%	2.0%
Idaho*	12.5%	9,042	31.0%	7.6%	8,143	26.6%	-4.9%	-4.4%
Illinois	24.2%	30,071	18.5%	18.6%	23,510	14.0%	-5.6%	-4.5%
Indiana	24.9%	13,139	22.0%	15.6%	8,554	17.6%	-9.3%	-4.4%
Iowa*	17.2%	9,874	24.9%	13.6%	8,474	20.0%	-3.6%	-4.9%
Kansas*	13.7%	9,456	25.4%	9.0%	8,254	18.6%	-4.7%	-6.7%
Kentucky	17.9%	8,884	22.9%	12.0%	6,545	18.9%	-5.9%	-4.0%
Louisiana*	13.8%	7,867	24.9%	7.1%	5,922	20.9%	-6.7%	-3.9%
Maine	21.0%	8,730	7.0%	14.0%	6,662	16.1%	-7.0%	9.0%
Maryland	18.5%	11,169	22.6%	14.6%	6,322	10.8%	-3.9%	-11.8%
Massachusetts	23.7%	28,695	12.0%	14.3%	11,895	13.5%	-9.4%	1.6%
Michigan	30.4%	29,789	16.9%	20.8%	20,047	12.7%	-9.6%	-4.1%
Minnesota	23.2%	12,061	26.5%	18.2%	10,194	16.5%	-5.0%	-10.0%
Mississippi*	9.9%	8,941	25.0%	6.0%	5,909	14.3%	-3.9%	-10.6%
Missouri	20.8%	11,983	31.3%	13.2%	7,386	21.9%	-7.6%	-9.4%
Montana	18.3%	8,605	31.1%	13.9%	7,444	21.7%	-4.4%	-9.5%
Nebraska*	13.6%	9,523	37.3%	8.4%	9,067	22.3%	-5.2%	-15.0%

Nevada*	22.4%	8,446	25.9%	17.1%	8,555	18.5%	-5.3%	-7.3%
New Hampshire	11.5%	8,228	21.4%	10.4%	6,901	19.6%	-1.1%	-1.8%
New Jersey	26.9%	29,018	9.0%	20.8%	15,060	7.9%	-6.1%	-1.1%
New Mexico	11.8%	7,345	34.6%	8.1%	6,909	20.4%	-3.7%	-14.1%
New York	32.5%	44,351	11.7%	25.5%	27,394	11.2%	-7.0%	-0.6%
North Carolina*	7.6%	27,599	27.8%	3.6%	13,458	25.7%	-4.0%	-2.0%
North Dakota*	13.2%	8,915	35.0%	6.5%	7,817	28.0%	-6.7%	-7.0%
Ohio	25.1%	33,118	17.7%	17.3%	21,484	11.6%	-7.8%	-6.1%
Oklahoma*	11.5%	9,339	23.5%	6.8%	7,614	23.4%	-4.7%	-0.1%
Oregon	22.3%	8,243	20.3%	16.1%	7,371	17.5%	-6.2%	-2.9%
Pennsylvania	27.5%	32,228	15.6%	16.9%	23,276	10.8%	-10.6%	-4.8%
Rhode Island	21.5%	8,325	15.8%	18.2%	6,117	11.3%	-3.3%	-4.5%
South Carolina*	5.9%	9,960	23.9%	4.0%	6,195	13.3%	-1.9%	-10.5%
South Dakota*	11.5%	9,981	28.9%	5.5%	8,351	12.1%	-6.0%	-16.8%
Tennessee*	15.1%	9,922	25.9%	8.9%	6,883	14.2%	-6.2%	-11.6%
Texas*	9.7%	37,316	25.7%	5.8%	27,668	19.0%	-3.9%	-6.7%
Utah*	15.2%	9,308	29.3%	7.3%	8,741	18.6%	-7.9%	-10.7%
Vermont	12.6%	7,968	7.0%	10.3%	6,330	8.4%	-2.3%	1.4%
Virginia*	11.7%	12,777	28.5%	5.6%	8,587	24.0%	-6.1%	-4.5%
Washington	27.1%	8,685	22.6%	18.2%	7,947	14.3%	-8.9%	-8.3%
West Virginia	25.3%	7,257	27.1%	14.3%	6,633	21.3%	-11.0%	-5.8%
Wisconsin	23.8%	12,288	20.2%	17.6%	10,188	12.9%	-6.2%	-7.3%
Wyoming*	13.9%	6,259	32.0%	8.3%	7,336	33.1%	-5.6%	1.1%

Source: Outgoing Rotation Group files of the CPS. Union density obtained from Statistical Abstract of the United States 2001, Table 639. Notes: \* implies right-to-work state.

Appendix Table 3. Private sector union density and wage gaps by occupation, 1983-2001.

	1983-1989			1996-01			Δ density	ΔWage gap
	Union density	Wage gap	N	Union density	Wage gap	N		
Other Executive, Administrators & Managers	3.1%	6.3%	51,252	2.3%	5.7%	54,524	-0.8%	-0.6%
Management Related Occupations	3.1%	3.1%	21,736	2.3%	4.5%	19,742	-0.8%	1.4%
Engineers	5.9%	-3.7%	12,231	3.9%	-1.7%	9,637	-2.0%	2.0%
Mathematical & Computer Scientists	3.1%	-12.5%	4,154	1.8%	-7.6%	8,004	-1.3%	4.9%
Natural Scientists	4.1%	4.3%	2,076	2.7%	11.4%	2,077	-1.4%	7.1%
Health Diagnosing Occupations	3.3%	6.3%	1,731	3.9%	-8.3%	2,422	0.6%	-14.6%
Health Assessment & Treating Occupations	11.1%	3.8%	15,157	11.1%	10.4%	14,388	0.0%	6.6%
Teachers, College & University	8.8%	10.7%	2,013	8.3%	5.5%	2,155	-0.5%	-5.2%
Teachers, Except College and University	10.0%	38.5%	7,399	12.2%	35.7%	8,528	2.2%	-2.8%
Lawyers	1.7%	-1.9%	2,231	2.0%	-11.0%	2,293	0.3%	-9.1%
Other Professional Specialty Occupations	6.3%	28.1%	18,832	4.9%	27.8%	16,683	-1.4%	-0.3%
Health Technologists & Technicians	7.8%	4.6%	9,263	7.4%	3.8%	8,775	-0.4%	-0.8%
Engineering and Science Technicians	12.3%	7.9%	8,328	9.5%	15.6%	5,914	-2.8%	7.7%
Technicians, Except Health Engineering & Science	9.5%	16.2%	7,465	8.1%	25.1%	5,903	-1.4%	8.9%
Supervisors – Administrative Support	5.8%	21.9%	19,664	3.7%	8.0%	19,200	-2.1%	-13.9%
Sales Representatives, Finance & Business Service	3.2%	12.9%	12,624	2.7%	5.0%	9,948	-0.5%	-7.9%
Sales Representatives, Commodities Except Retail	2.0%	4.8%	11,450	1.8%	-9.5%	7,315	-0.2%	-14.3%
Sales Workers, Retail & Personal Services	7.5%	36.6%	51,351	4.6%	17.1%	34,567	-2.9%	-19.5%
Sales Related Occupations	4.6%	50.2%	385	3.5%	26.4%	417	-1.1%	-23.8%
Supervisors-Administrative Support	5.1%	-2.9%	4,550	4.3%	2.6%	2,873	-0.8%	5.5%
Computer Equipment Operators	8.6%	10.7%	5,986	6.4%	10.2%	1,586	-2.2%	-0.5%
Secretaries, Stenographers & Typists	3.9%	14.1%	34,703	3.3%	12.7%	14,449	-0.6%	-1.4%
Financial Records, Processing Occupations	4.7%	20.1%	19,406	3.4%	17.6%	10,300	-1.3%	-2.5%
Mail and Message Distributing	12.3%	40.9%	2,605	7.6%	33.1%	1,516	-4.7%	-7.8%
Other Administrative Support Occupations	11.8%	19.7%	57,618	7.1%	18.1%	48,916	-4.7%	-1.6%
Private Household Service Occupations	0.2%	9.3%	8,368	0.8%	1.8%	3,259	0.6%	-7.5%
Protective Service Occupations	12.9%	23.1%	5,672	7.7%	20.7%	3,856	-5.2%	-2.4%
Food Service Occupations	4.6%	21.0%	47,173	3.7%	16.5%	31,218	-0.9%	-4.5%

Health Service Occupations	9.7%	8.1%	14,636	9.0%	8.8%	11,894	-0.7%	0.7%
Cleaning & Building Service Occupations	15.9%	30.9%	20,720	11.3%	26.9%	13,646	-4.6%	-4.0%
Personal Service Occupations	8.7%	35.8%	10,623	7.9%	36.6%	9,117	-0.8%	0.8%
Mechanics & Repairers	28.9%	20.3%	33,537	20.5%	21.8%	21,893	-8.4%	1.5%
Construction Trades	30.6%	48.6%	31,417	24.6%	41.1%	21,594	-6.0%	-7.5%
Other Precision Production Occupations	24.9%	14.1%	34,107	18.0%	16.9%	20,229	-6.9%	2.8%
Machine Operators & Tenders, Except Precision	32.1%	26.4%	49,011	20.9%	25.5%	25,357	-11.2%	-0.9%
Fabricators, Assemblers & Inspectors & Samplers	35.8%	27.5%	24,007	21.3%	29.8%	14,662	-14.5%	2.3%
Motor Vehicle Operators	26.0%	45.4%	24,638	18.3%	41.6%	17,115	-7.7%	-3.8%
Other Transportation Occupations & Material Moving	47.3%	33.6%	10,539	33.3%	33.5%	6,293	-14.0%	-0.1%
Construction Laborer	24.0%	59.5%	5,103	18.1%	53.7%	3,571	-5.9%	-5.8%
Freight, Stock & Material Handlers	29.0%	37.2%	14,893	20.2%	24.2%	10,383	-8.8%	-13.0%
Other Handlers, Equipment Cleaners & Laborers	23.3%	47.8%	19,305	14.2%	36.6%	11,519	-9.1%	-11.2%
Farm Operators & Managers	1.8%	31.3%	649	0.9%	56.2%	444	-0.9%	24.9%
Farm Workers & Related Occupations	3.1%	53.0%	14,047	2.9%	39.4%	8,194	-0.2%	-13.6%
Forestry & Fishing Occupations	7.7%	20.3%	846	8.0%	-6.9%	349	0.3%	-27.2%

Notes: individuals with allocated earnings excluded. Private sector. Controls are age, age squared, male 15 schooling dummies, 4 race dummies, log of hours, 46 industry dummies, 50 state dummies and five year dummies. Union density estimates for the private sector weighted and averaged over the two six year periods.

Appendix Table 4. Industry definitions (1980 Industry classification)

	Number	SIC code
Agriculture Service	1	12-30
Other Agriculture	2	10-11
Mining	3	40-50
Construction	4	60
Lumber and wood products, except furniture	5	230-241
Furniture and fixtures	6	118 242
Stone clay, glass and concrete product	7	250-262
Primary metals	8	270-280
Fabricated metal and Metal nes	9 & 10	281-300, 169
Machinery, except electrical	11	310-332
Electrical Machinery, equipment, and supplies	12	340-350
Motor vehicles and equipment	13	219 351
Aircrafts and parts	14	227 352
Other transportation equipment	15	360-370
Professional and photographic equipment	16	371-382
Toys, amusements, and sporting goods	17	390
Miscellaneous and nes	18	391-392
Food and kindred products	19	100-122
Tobacco manufactures	20	130
Textile mill products	21	132-150
Apparel and other finished textile prod.	22	151-152
Paper and allied products	23	160-162
Printing, publishing and allied industries	24	171-172
Chemicals and allied products	25	180-192
Petroleum and coal products	26	200-201
Rubber and miscellaneous plastics products	27	210-212
Leather and leather products	28	220-222
Transportation	29	400-432
Communications	30	440-442
Utilities and Sanitary Services	31	450-472
Wholesale Trade	32	500-571
Retail Trade	33	580-691
Banking and Other Finance	34	700-710
Insurance and Real Estate	35	711-712
Private Household Services	36	769 761
Business Services	37	721-750
Repair Services	38	751-760
Personal Services, Except Private Household	39	762-791
Entertainment and Recreation Services	40	800-810
Hospitals	41	838 831
Health Services, Except Hospitals	42	812-830, 832
Educational Services	43	842-860
Social Services	44	861-871
Other professional Services	45	841, 872-893
Forestry and Fisheries	46	031-032

Appendix Table 5. Occupation definitions and average sample size per year

Table of 2-digit Occupation Codes (NBER assigned)		
Occupation Name	DOCC 1983- 1997	OCC80
		1983-1997
Administrators and Officials, Public Administration	1	1-3
Other Executive ,Administrators ,and Managers	2	7-22
Management Related Occupations	3	23-37
Engineers	4	44-59
Mathematical and Computer Scientists	5	64-68
Natural Scientists	6	69-83
Health Diagnosing Occupations	7	84-89
Health Assessment and Treating Occupations	8	95-106
Teachers, College and University	9	113-154
Teachers , Except College and University	10	155-159
Lawyers and Judges	11	178-179
Other Professional Speciality Occupations	12	43,63,163-177,183-199
Health Technologists and Technicians	13	203-208
Engineering and Science Technicians	14	213-225
Technicians, Except Health Engineering , and Science	15	226-235
Supervisors and Proprietors, Sales Occupations	16	243
Sales Representatives, Finance , and Business Service	17	253-257
Sales Representatives , Commodities , Except Retail	18	258-259
Sales Workers, Retail and Personal Services	19	263-278
Sales Related Occupations	20	283-285
Supervisors-Administrative Support	21	303-307
Computer Equipment Operators	22	308-309
Secretaries, Stenographers , and Typists	23	313-315
Financial Records, Processing Occupations	24	337-344
Mail and Message Distributing	25	354-357
Other Administrative Support Occupations, Including Clerical	26	316-336,345-353, 359-389
Private Household Service Occupations	27	403-407
Protective Service Occupations	28	413-427
Food Service Occupations	29	434-444
Health Service Occupations	30	445-447
Cleaning and Building Service Occupations	31	448-455
Personal Service Occupations	32	456-469
Mechanics and Repairers	33	503-549
Construction Trades	34	553-599
Other Precision Production Occupations	35	613-699
Machine Operators and Tenders, Except Precision	36	703-779
Fabricators. Assemblers and Inspectors, and Samplers	37	783-799



Motor Vehicle Operators	38	803-814
Other Transportation Occupations and Material Moving	39	823-859
Construction Laborer	40	869

Table of 2-digit Occupation Codes(continued) (NBER assigned)

Occupation Name	DOCC 1983- 1997	OCC80
		1983-1997
Freight , Stock and Material Handlers	41	875-883
Other Handlers , Equipment Cleaners and Laborers	42	863-868,873,874,885-889
Farm Operators and Managers	43	473-476
Farm Workers and Related Occupations	44	477-489
Forestry and Fishing Occupations	45	494-499
Armed Forces, Currently Civilian	46	905