

DERIVING LABOR TURNOVER RATES FROM ADMINISTRATIVE RECORDS

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U.S. nonagricultural establishments will hire workers new to their firms an estimated 64 million times during 1985. These hiring transactions probably will involve only 12-16 million workers who changed their primary jobs.

An econometric model was constructed using administrative records from Social Security files, and estimates of new hires were made by industry, state, age, race, and sex. When this study was done, Social Security records were available only through the mid-1970s. Wage records used in the administration of the unemployment insurance system were available in sixteen states to verify the accuracy of the econometric estimates. Because wage records were available only for sixteen states, and because of differences in state laws and data processing procedures, wage records could not be used for obtaining national estimates.

Organizationally, this paper is divided into two main sections. In the first, the methodology employed is described. The second presents examples of the various results, as well as some general comments about the usefulness of these administrative records.

METHODOLOGY

Social Security data from a one-percent sample of a continuous work history file for the period 1971-76 were used to construct labor turnover measures. Instructions for using the methodology were given to three government agencies, who then did the matching and provided tabulations for different years. These agencies were the New York Department of Labor, the Social Security Administration, and the Bureau of Economic Analysis. The provisions of the 1976 tax reform act require the Internal Revenue Service to screen the data for possible confidentiality disclosures prior to release. All analyses of Social Security records were from tabulations provided by the government agencies. No Social Security data were released on individual workers or firms.

Employee records were matched with employer records. If a worker's identification number appeared in a firm's file in a given quarter, but did not appear in the file in the previous quarter, the worker was classified as an accession to the firm [1]. If a worker classified as an accession did not work for the firm for the prior four quarters, that worker was classified as a new hire. The decision to use four quarters as a determining factor was somewhat arbitrary. That period of time was chosen because it was long enough to identify workers who return to a firm seasonally, although it would not exclude workers who may have worked for a firm sometime in the more distant past. The higher degree of accuracy that might be attained by matching records several years back, however, was not considered great enough to justify the substantial increase in cost of matching data for more than four quarters [2].

It is also possible to generate other turnover measures using the pattern of employment within the firm. For example, if a worker is present in a given quarter and absent in the next quarter, this is a separation. If a worker is a new hire who continues to work for a period of, say, an additional two quarters, this is a permanent new hire. If a worker is an accession (not employed in previous quarter) who did work for the firm sometime in the previous four quarters, this is a recall. If a worker is an accession and separation in the same quarter, this is a short-term accession. Various turnover measures were developed based on these definitions.

Data were constructed for new hires from quarterly Social Security records from the second quarter of 1972 to the second quarter of 1975. A special tabulation for 1975-76 was used for special analyses but not included in the quarterly analyses used to generate current estimates.

A model was developed to predict new hires. The model's derivation begins with a tautology:

$$(1) \quad \Delta E = NH + \text{Recalls} - \text{Quits} - \text{Layoffs} - OS$$

where ΔE is change in employment; NH is new hires; and OS is other separations.

From this we obtain:

$$(2) \quad NH = \Delta E - Z$$

where $Z = \text{Recalls} - \text{Quits} - \text{Layoffs} - OS$

To obtain rates, both series were divided by E. It was assumed that the unemployment rate would be a good proxy for Z. It was assumed that there was a negative correlation between Z and the unemployment rate.

When the equation was estimated, data from the Bureau of Labor Statistics (BLS) 790 series were used for employment, and data from the monthly Current Population Survey were used for unemployment rates and seasonal dummy variables. The final equation was:

$$(3) \quad NHR_t = \alpha_0 + \alpha_1 \% \Delta E_t + \alpha_2 UR_{t-1} + \alpha_3 S_1 + \alpha_4 S_2 + \alpha_5 S_3 + \alpha_6 D + E_1$$

where NHR is the new hire rate; $\% \Delta E$ is the percentage change in BLS 790 employment; UR is the unemployment rate; S_1, S_2 and S_3 are seasonal dummies for the first three quarters of the year; D is 1 in the first quarter of 1974; and E_1 is a random term.

The dummy variable was used because of a data error in the first quarter of 1974 in the data provided. The coefficient α_1 is expected to be positive, while α_2 is predicted to be negative. The equations were estimated for each state with a total of thirteen observations. The results of the model for fiscal 1975 were simulated to determine goodness of fit.

Figure 1 provides the $\% \Delta E$ and UR_{t-1} parameters, the proportion of variation explained by the model (R^2), actual new hire rate, and percent error in the forecast for all 50 states. All parameters significant at the .05 level are indicated by an asterisk.

One of the difficulties with this model is that data for the dependent variable cannot be obtained from Social Security data beyond 1977 on a quarterly basis. Only annual new hire rates can be computed. These can only be obtained by special arrangements with the Internal Revenue Service and the Social Security Administration. To verify the model in selected states, however, wage records were obtained using similar concepts for workers covered by unemployment insurance. These data can be generated quarterly on a current basis in wage records states. Over 40 states are wage records states. Special arrangements must be made, however, in each state to obtain these data. The arrangements require considerable data processing to match workers and firms over at least four quarters.

Our estimates were compared with the wage records data in sixteen states. The results of the comparisons are shown in Figure 2. The errors are generally relatively small except in Florida. Here, however, the Florida data provided were probably more prone to error than our estimates. The significantly lower reported new hires in Florida probably represents an undercount in the state's processing. The

state used a different processing methodology than the other states.

We simulated our model and obtained new hire estimates for 1975-85 [3].

RESULTS

Figure 3 shows the predicted number of new hires from 1975 through 1985 using our model. Figure 4 illustrates the five states with the largest number of new hires. These states accounted for 40% of all new hires in the United States. Converting the new hires into rates, Figure 5 shows the parts of the United States with the highest and lowest rates. The highest rates are west of the Mississippi. A prominent exception is Florida.

It is also possible to compare new hire rates by industry. Figures 6 and 7 show the industries with the highest and lowest rates, respectively.

In 1985 it is unlikely that social services would be among the high new hire rate industries. This reflects changes in government priorities over the decade. It is probable, however, that the other industries are high and low turnover industries in 1985.

Individuals versus Transactions

One of the difficulties in interpreting our measures is reconciling the incredibly high turnover (e.g., 80% in 1985) with our knowledge of how often workers change jobs. The number of turnover transactions include instances where one worker changed jobs more than once, so the total does not reflect the actual number of workers who changed jobs. Thus, when turnover is expressed as a percentage of employment, the result should not be interpreted as the percentage of workers who changed jobs. To gain some insight into reconciling this apparent dilemma, we developed some special tabulations from 1975-76 Social Security files. First we computed an annualized 84% new hire rate for 1976 by multiplying the rate obtained in the second quarter of 1976 by 4. This is certainly comparable to the rates we had been obtaining for other years. A different analysis was carried out where workers were assigned to their primary jobs, where they earned the most money during 1976. Only 18% of the workers were new hires in their primary jobs, based on the second quarter of 1976. Some of these workers could have accounted for several new hire transactions. Similarly, workers who were not new hires in their primary jobs could be new hires in secondary jobs. Thus, we estimated that of the 64 million new hires, about 14 million workers were new hires in their primary jobs. In another quarter we estimated a ratio which would suggest that slightly under 16 million workers were new hires in their primary jobs. An estimate of 12-16 million seemed appropriate due to the limited number of quarters on which we could base our ratio.

Another comparison we made with our special tabulation was the average number of employers for whom employees worked in different industries. We assigned workers to the employer from whom they received the majority of their earnings and tabulated the number of different employers. Four nonagricultural industries--heavy construction contractors, water transportation, eating and drinking places, and motion pictures--had an average of two or more employers per worker. Water transportation (longshore) averaged 2.5 employers per worker. The industries with an average of 1.25 or fewer employers (with at least 100,000 persons in the industry) included: primary metals, communications, and public utilities.

Areas for Further Research

The information obtained from Social Security records and state unemployment insurance records represent about the only currently comprehensive source of labor turnover data. Our model permits obtaining current estimates from these data. It would be useful to tabulate annual Social Security files to determine labor turnover from more recent Social Security files. It would also be useful to forecast the turnover rates by industry, age, and sex. The 1975-76 special tabulations by person and transaction provide detailed characteristics by state, SMSA, industry, age, wage class, sex, and race. Additional analyses of these data remain to be carried out, as well as additional analyses of separations and short-term new hires. Finally, more efficient forecast estimates can be made by combining cross-section and time-series turnover data.

NOTES AND REFERENCES

- [1] A worker's identification number appears in the file if the worker had wages greater than zero in a given quarter.
- [2] Using California wage records from the Unemployment Insurance system, the California Employment Development Division did a test of how many fewer new hires there would be if seven quarters were used as a cut-off instead of four, and found only about 2% fewer new hires. (Glen Siebert, Employment Service Potential: Indicators of Labor Market Activity, pp. 48-9. Sacramento, CA: Employment Development Department, 1977.)
- [3] For a more complete description of the simulation methodology, see Malcolm S. Cohen and Arthur R. Schwartz, "A New Hires Model for the Private Non-farm Economy," Economic Outlook for 1984, Department of Economics, University of Michigan, Ann Arbor, 1984.

Figure 1. New Hire Rates by State, Fiscal 1975.
 % Error, R², Selected Coefficients

State	1975 New Hire Rate	1975 % Error	R ²	%E	URLAG
Alabama	19.1	-.3	.943	51.94	-1.59*
Alaska	42.0	5.2	.941	165.85*	2.34
Arizona	24.9	.3	.978	148.44*	-1.65*
Arkansas	22.4	.5	.966	48.90	-2.24*
California	23.4	-.9	.930	87.91	-1.21
Colorado	28.3	1.6	.951	97.29*	-2.75*
Connecticut	15.0	.9	.984	97.25*	-1.03*
Delaware	15.9	-.6	.828	-64.85	-3.25*
D.C.	20.8	-3.5	.822	89.90	-1.49
Florida	26.3	-1.3	.973	178.70*	-2.29*
Georgia	20.2	-1.1	.982	118.40*	-2.24*
Hawaii	20.9	.9	.819	122.97	-.85
Idaho	26.3	.1	.898	68.38	-.52
Illinois	16.8	.1	.988	111.27*	-1.19*
Indiana	15.5	-.9	.992	83.49*	-1.56*
Iowa	18.7	3.0	.951	25.81	-1.61*
Kansas	23.1	3.1	.944	63.74	-1.33
Kentucky	17.7	-1.2	.980	107.40*	-1.07*
Louisiana	26.3	1.7	.890	-15.77	-1.37
Maine	18.2	-3.0	.943	105.95	-.88
Maryland	18.2	-.1	.982	162.01*	-.71
Massachusetts	16.5	-1.9	.976	126.06*	-.81*
Michigan	14.5	-4.1	.935	73.53*	-1.48*
Minnesota	17.3	-.1	.958	62.99	-1.30*
Mississippi	19.5	.2	.938	96.48*	-1.36
Missouri	18.2	.4	.989	99.74*	-1.13*
Montana	23.5	-1.3	.959	191.26*	-.20
Nebraska	20.6	1.7	.971	74.97	-.86
Nevada	33.2	-.5	.975	165.36*	-1.42*
New Hampshire	17.5	-2.0	.917	135.78*	-2.02*
New Jersey	17.1	-.1	.978	121.49*	-1.20*
New Mexico	28.3	-2.3	.916	103.08	-1.61*
New York	15.7	-1.7	.959	109.77*	-1.16*
N. Carolina	16.9	-1.5	.970	112.58*	-2.03*
N. Dakota	22.2	2.0	.902	229.05*	.72
Ohio	15.0	-.3	.996	91.35*	-1.33*
Oklahoma	24.8	-.1	.944	131.44	-1.08
Oregon	23.3	1.1	.925	103.60	-1.22
Pennsylvania	13.9	.2	.980	134.31*	-.96*
Rhode Island	17.8	-1.9	.960	72.75*	-1.84*
S. Carolina	17.6	-1.9	.918	69.73*	-1.77*
S. Dakota	19.9	-2.4	.968	133.96*	-.50
Tennessee	18.1	-.6	.978	93.82*	-1.38*
Texas	27.1	-.3	.977	34.35	-1.57*
Utah	23.9	.0	.967	109.57	-1.20
Vermont	18.0	.9	.821	161.11	-.18
Virginia	18.0	-.2	.970	107.94*	-1.66*
Washington	22.4	.7	.953	141.46*	-.07
W. Virginia	15.7	-2.3	.964	145.31*	-.27
Wisconsin	14.8	-.1	.988	72.78*	-1.39*
Wyoming	33.4	4.4	.899	21.54	-1.22

%E = percentage change in employment
 URLAG = unemployment rate in previous quarter
 * = coefficient significant at the .05 level
 N = 13 for each state

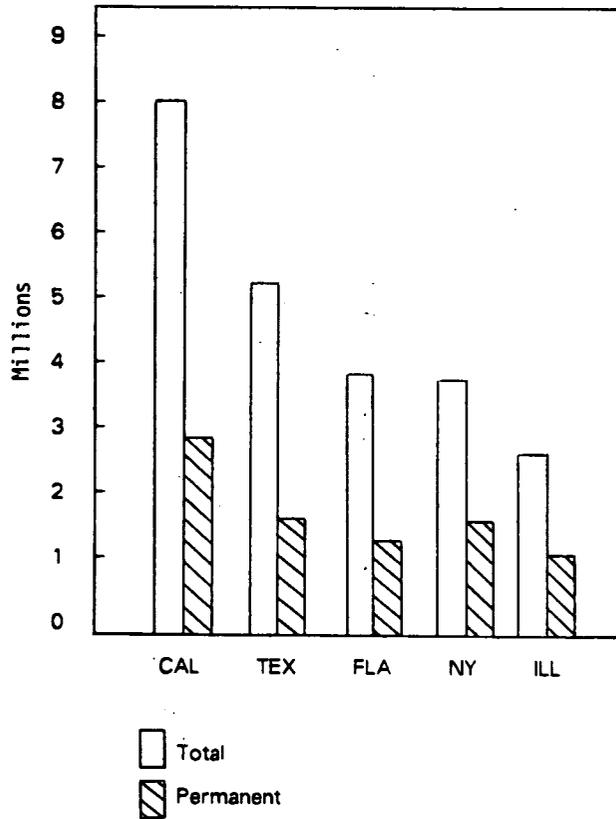
Figure 2. Comparison of New Hire Forecasts with Actual New Hire Data

State	Period	New Hires Reported by State Employment Agencies	Predicted New Hires	% Difference
Arkansas	Fiscal 1979	583,990	603,500	+3.34
Pennsylvania	Fiscal 1976	2,051,553	2,147,100	+4.66
South Dakota	Fiscal 1979	177,433	155,800	-12.19
	Fiscal 1980	142,795	137,500	-3.70
	Fiscal 1981	134,109	142,900	+6.57
Idaho	Fiscal 1976	238,989	241,000	+0.84
California	Fiscal 1976	6,142,625	5,796,000	-5.64
	Fiscal 1977	6,625,804	6,506,800	-1.80
	Fiscal 1978	7,523,644	7,640,400	+1.55
	Fiscal 1979	8,366,534	8,226,400	-1.67
North Dakota	Fiscal 1976	147,081	144,300	-1.88
North Carolina	1979 - 4th Q.	392,663	370,300	-5.71
Nevada	Fiscal 1976	309,100	298,300	-3.48
	Fiscal 1979	452,679	476,800	+5.32
	Fiscal 1980	464,348	466,600	+0.48
	Fiscal 1981	438,880	477,600	+8.95
South Carolina	1979 - 1st-3rd Q.	611,324	627,700	+2.68
	1981 2nd-4th Q.	550,619	522,900	-5.03
Maine	Fiscal 1978	263,175	268,900	+2.17
Illinois	1979 3rd-4th Q.	1,436,475	1,593,500	+10.93
New Mexico	Fiscal 1979	410,927	412,000	+0.26
	Fiscal 1980	378,288	386,200	+2.10
Missouri	1979 -3rd-4th Q.	718,946	670,400	-6.75
	Calendar 1981	1,073,311	1,204,900	+12.26
Iowa	Fiscal 1981	587,016	582,500	-0.77
Mississippi	1981 4th Q.	101,921	107,400	+5.40
Florida	Calendar 1980	2,673,019	3,790,500	+41.81
	Calendar 1981	2,918,487	3,729,700	+27.80

Figure 3. Number of New Hires in the Private Nonfarm Economy by State
(annual totals in thousands)

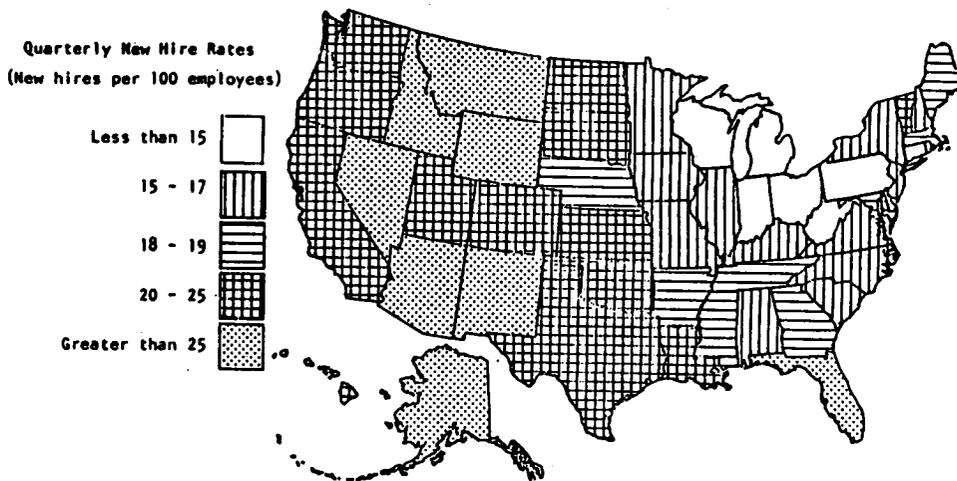
State	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Alabama	610.9	693.3	765.6	878.3	895.3	808.1	770.0	620.8	598.7	744.9	829.9
Alaska	178.8	112.3	92.8	102.6	109.2	111.7	126.8	136.2	171.3	162.5	172.3
Arizona	514.5	624.0	735.7	903.1	1005.0	891.5	889.8	730.0	789.2	921.3	1019.3
Arkansas	378.8	443.0	498.7	580.6	606.2	534.0	503.7	392.4	364.2	472.8	541.5
California	5219.2	6059.2	6811.6	7838.4	8294.0	7770.4	7760.8	6700.8	6743.6	8001.6	8532.8
Colorado	656.3	813.2	951.6	1148.8	1242.7	1140.8	1097.3	888.8	913.8	1190.4	1371.7
Connecticut	530.9	653.1	719.2	829.0	852.6	795.4	757.8	642.0	654.6	781.2	862.5
D.C.	183.9	164.2	174.4	196.3	205.8	187.0	180.8	147.8	151.3	174.2	186.5
Delaware	126.4	182.4	203.2	243.4	259.2	220.3	208.1	140.3	138.5	183.7	211.3
Florida	2006.5	2567.0	2968.8	3614.6	3884.4	3790.5	3729.7	3104.6	2983.2	3778.2	4162.8
Georgia	1031.3	1226.7	1388.1	1667.6	1720.3	1547.1	1437.8	1143.7	1223.9	1464.5	1634.2
Hawaii	179.6	205.6	219.9	263.0	268.2	254.5	238.6	213.0	221.4	265.2	278.5
Idaho	207.4	250.0	261.4	289.9	282.7	260.9	260.3	247.2	274.5	290.2	303.1
Illinois	2195.1	2718.2	2813.5	3178.2	3172.0	2826.4	2639.7	2074.3	2241.8	2632.6	2761.8
Indiana	876.1	1090.2	1192.6	1393.0	1351.4	1115.6	1078.8	799.8	844.7	1062.0	1153.4
Iowa	485.4	547.4	602.0	691.4	718.5	633.8	580.4	453.0	405.5	518.4	596.0
Kansas	507.6	564.0	612.7	694.4	726.4	655.0	646.4	532.3	521.9	623.2	680.3
Kentucky	563.8	647.9	733.1	826.1	785.0	689.9	659.4	541.6	633.7	687.9	739.6
Louisiana	868.4	1019.4	1092.7	1239.0	1308.0	1298.7	1295.5	1167.1	1084.5	1240.2	1369.5
Maine	201.8	241.0	247.6	278.0	277.4	261.7	247.4	222.8	237.4	267.8	272.5
Maryland	774.1	859.4	981.1	1111.2	1077.0	1008.1	976.8	872.3	927.6	1007.8	1053.0
Massachusetts	1181.1	1416.4	1535.9	1707.1	1768.3	1697.5	1652.0	1422.0	1525.1	1717.6	1812.5
Michigan	1377.7	1639.4	1862.6	2110.8	2036.3	1676.4	1574.2	1177.4	1292.1	1574.6	1728.0
Minnesota	713.2	823.4	905.2	1065.5	1123.6	993.8	950.0	766.8	766.2	958.9	1074.3
Mississippi	403.6	460.4	517.6	566.2	577.7	507.2	501.5	406.8	429.4	514.0	558.6
Missouri	947.7	1096.5	1201.8	1347.0	1366.0	1184.6	1204.9	1019.6	959.4	1158.4	1251.6
Montana	167.2	213.5	208.6	241.4	219.7	201.2	224.6	183.8	200.5	241.8	249.0
Nebraska	318.7	366.4	381.3	418.9	441.6	399.7	394.3	336.2	317.7	381.7	406.1
Nevada	255.1	319.4	380.8	473.4	488.6	459.4	470.8	400.0	442.6	575.5	637.0
New Hampshire	153.5	208.2	236.8	277.1	292.2	255.4	253.0	183.3	202.5	256.6	278.6
New Jersey	1396.3	1648.9	1793.3	2038.4	2069.0	1917.8	1878.5	1572.4	1628.0	1887.0	2041.0
New Mexico	269.6	312.5	358.1	399.3	414.6	378.9	384.8	334.4	338.0	407.4	454.4
New York	3211.6	3568.6	3809.7	4285.6	4391.2	4072.8	4015.6	3356.4	3296.5	3719.8	4014.8
North Carolina	1035.5	1225.3	1377.6	1622.5	1707.0	1741.9	1378.6	1027.8	1072.5	1366.1	1512.6
North Dakota	134.8	140.5	138.7	160.2	161.8	141.1	159.9	145.9	171.8	185.3	190.0
Ohio	1702.0	2077.8	2324.2	2632.2	2622.1	2204.4	2152.4	1653.7	1595.4	2062.7	2247.7
Oklahoma	632.1	715.4	775.4	904.6	933.1	942.4	972.8	820.1	836.3	975.2	1072.2
Oregon	562.8	661.6	744.8	839.5	884.7	750.3	697.0	592.8	625.4	748.8	813.8
Pennsylvania	1864.6	2214.4	2330.8	2717.4	2651.9	2285.8	2289.0	1628.0	1840.2	2118.2	2271.6
Rhode Island	187.4	223.7	244.6	279.3	286.8	258.4	244.0	188.8	188.5	236.0	265.1
South Carolina	501.3	594.0	649.8	764.0	797.9	719.9	684.2	536.7	508.5	654.4	725.6
South Dakota	119.1	139.9	147.9	159.8	155.1	134.2	141.2	122.7	141.0	155.8	163.8
Tennessee	838.4	975.2	1091.6	1231.3	1223.3	1079.2	1072.2	869.2	850.8	1063.3	1135.4
Texas	3369.7	3886.5	4228.4	4909.2	5327.6	5266.0	5359.2	4772.0	4376.8	5132.4	5760.4
Utah	287.7	337.3	366.9	425.1	434.8	395.6	402.6	350.8	359.1	434.4	475.6
Vermont	96.3	113.2	123.7	136.9	133.7	125.3	126.0	123.0	143.8	149.4	152.7
Virginia	848.0	1014.2	1124.8	1308.3	1378.2	1234.8	1151.6	953.5	912.0	1172.3	1303.1
Washington	828.6	952.7	1034.8	1174.8	1212.2	1085.9	1072.0	1026.9	1156.8	1313.9	1364.2
West Virginia	267.3	288.8	307.0	337.4	353.1	324.6	299.3	259.6	237.7	272.8	294.8
Wisconsin	702.2	830.5	922.1	1075.1	1121.9	932.2	898.1	683.0	667.8	856.0	973.9
Wyoming	123.9	147.2	166.3	193.0	209.8	210.6	212.2	192.7	189.0	222.8	235.9
U.S. Total	42794.9	50296.0	55356.0	63768.0	65824.0	60108.0	58904.0	48876.0	49396.0	58984.0	64196.0

Figure 4. States with the Highest Number of New Hires, 1984



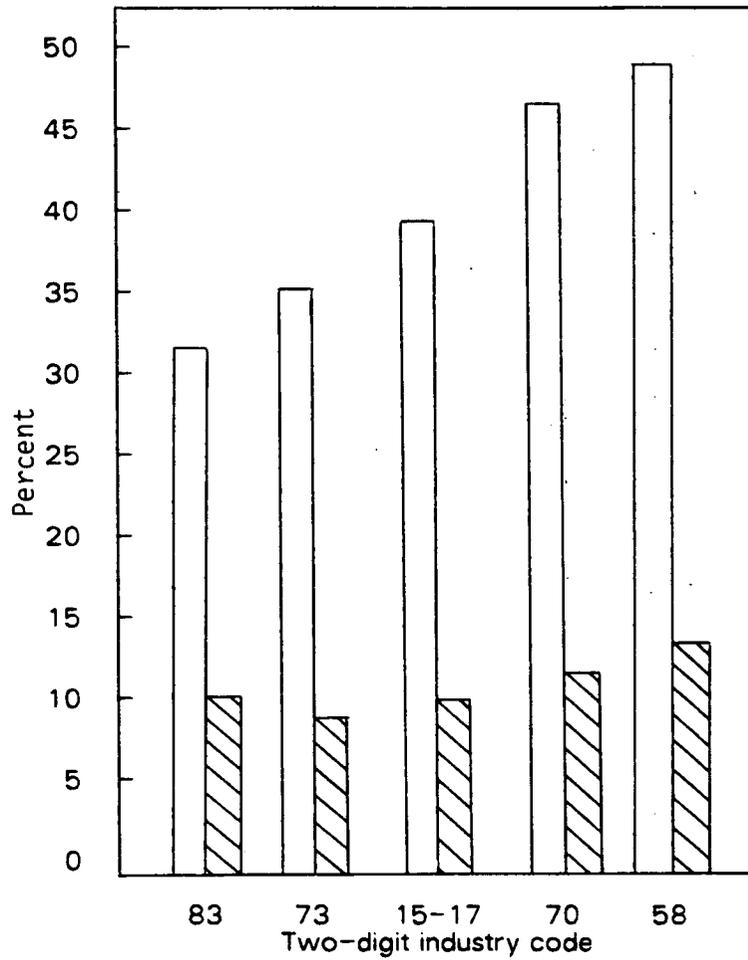
Source: Institute of Labor and Industrial Relations, University of Michigan, November 1983

Figure 5. Projected Quarterly New Hire Rates, 1984.



SOURCE: Institute of Labor and Industrial Relations, University of Michigan, November 1983.

Figure 6. Industries with Highest New Hire Rates, 1975 2nd Quarter

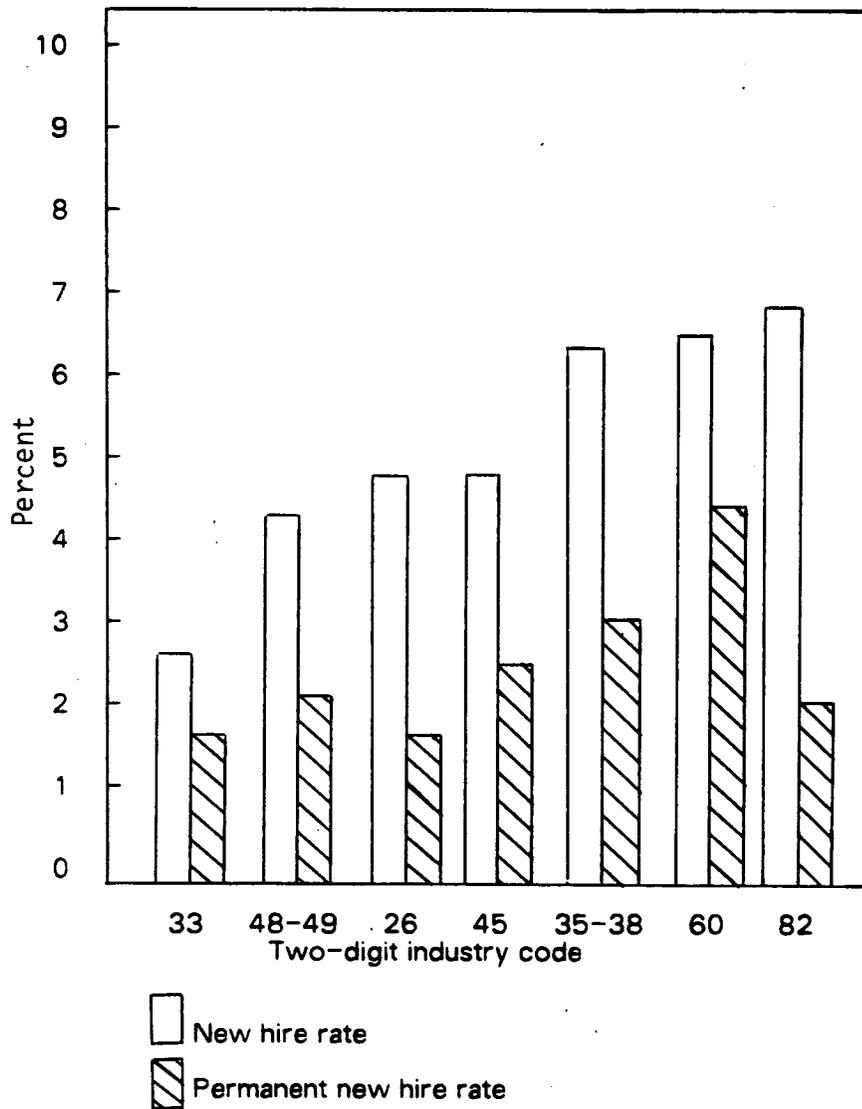


 New hire rate
 Permanent new hire rate

83 - Social services
 73 - Business services
 15-17 - Construction
 70 - Hotel and other lodging
 58 - Eating and drinking establishments

Source: Institute of Labor and Industrial Relations, University of Michigan

Figure 7. Industries with Lowest New Hire Rates, 1975 2nd Quarter



- 33 - Primary metal manufacturing
- 48-49 - Communications and public utilities
- 26 - Paper manufacturing
- 45 - Air transportation
- 35-38 - Machinery + transportation + instrument manufacturing
- 60 - Banking
- 82 - Educational services

Source: Institute of Labor and Industrial Relations, University of Michigan