Turnover: The Implication of Establishment Size and Unionization

Peter A. Groothuis*
Westminster College

This paper considers four explanations of the influence of firm size and two explanations of the influence of unionization on aggregate turnover rates at firms. On the firm side, the focus is on the compensating wage differential model, the informational problem model, the internal labor market model, and the union avoidance model. On the union side, the focus is on the monopoly and the collective voice models. The implications of the above models are tested empirically using the equal opportunity pilot project (EOPP) database and the Tobit technique.

The results show that increases in firm size initially increase the turnover rates, but that eventually turnover rates decrease with firm size. Unionization is found to increase the layoff rates while exhibiting no direct influence on either the quit or dismissal rate. The interaction between firm size and unionization, however, is found to be an important determinant for both the quit and dismissal rates.

INTRODUCTION

Empirical evidence suggests that the employee relation differs between large and small firms and between union and nonunion firms. Perhaps the best documented difference shows large firms and union firms paying higher wages than do small firms and nonunion firms (Brown and Medoff, 1989; Hirsh and Addision, 1986). Many theories have been developed to explain these relationships, with most centering either completely on the firm side or completely on the union side. Few studies address the effect of firm size and unionization simultaneously (Brown and Medoff, 1989; Keeley, 1984; Masters, 1969). The present study empirically addresses the effect of firm size and unionization by looking at how each influences aggregate turnover at the firm level.

Previous empirical work shows that union workers demonstrate lower quit probabilities than do nonunion workers (Blau and Kahn, 1983; Freeman, 1980; Long and Link, 1983; and Mitchell, 1982); that employees at large firms exhibit lower quit probabilities than do employees at small firms (Brown and Medoff, 1989); and that union firms experience a higher layoff rate than do nonunion firms (Medoff, 1979).

Only Medoff (1979) examines turnover (specifically layoffs) at the firm level. All other studies investigate turnover at the employee level. The present study examines the influence of firm size and unionization on turnover at the firm level. A study at the firm level addresses the turnover decision as a function of both the environment at a firm and choices made by the employer and employee rather than simply as a function of employee choice.

* This article is a modified version of Chapter 3 of the author's dissertation where Dan Black and Mark Berger were advisors. Thanks to John Garen, Dan Fischmar, J. Richard Hill, Don Kazee, two anonymous referees, and an editor of this journal for comments and helpful suggestions. All mistakes, however, are the author's.

0747-5535/94/1300-0041 $01.00

The current approach is to analyze and test the implications of each of the competing theories of firm size and unionization on the employment relationship. I empirically test the predictions of the various models using the equal opportunity pilot project employer database (EOPP) and the Tobit technique. The Tobit coefficients are decomposed into two parts to gain additional information on turnover behavior. The first part measures the influence an independent variable has on the positive rate of turnover. The second part measures the influence an independent variable has on the size of the turnover rate, given that the rate is positive. The turnover rates measured include the quit, layoff, and dismissal rates.

TURNOVER: A REVIEW

Focusing on the differing predictions of turnover behavior is one way to distinguish competing theories of firm size and unionization. This study focuses on two explanations of the influence of unions on turnover: the monopoly model and the collective voice model of unionization. It considers four explanations of the effect of firm size on turnover: the efficiency wage-union avoidance model; the internal labor market model; the adverse selection/monitoring cost model; and the compensating wage differential model.

The union monopoly model characterizes a union as a cartel that collectively bargains and increases wages for its workers (Freeman and Medoff, 1984). These increased wages lead to a lower quit rate due to the monopoly rents that have been gained. These rents reduce the probability of a quit because the worker faces a lower probability of finding a better job. Monopoly power also lowers the likelihood of dismissal when monopoly power is exercised on the work standard.

The union monopoly model is extended by Kuhn and Roberts (1989) to include the prediction that unions will bargain for layoffs. Such temporary layoffs are optimal for union workers when unions price discriminate (that is, charge higher wages for more senior workers). The union monopoly model predicts a higher layoff rate at union firms.

Two additional implications can be deduced from this analysis of turnover. Let the permanent separation rate be defined as the quit rate plus the dismissal rate and the total separation rate be the sum of the quit, dismissal, and layoff rates. The permanent separation rate is predicted to be lower at union firms than at nonunion firms due to the lower quit rate and the lower dismissal rate. There are no expectations, however, about the total separation rate because the expected lower rates of dismissals and quits are offset by an increase in the layoff rate.

The collective voice theory of unions characterizes a union as a political institution providing a formal voice service for its members. The collective voice model suggests a lower quit rate at union firms as a result of the voice mechanism (Freeman, 1980; Freeman and Medoff, 1984). In the collective voice theory, exercising political voice replaces rents as the cause of lower quit rates. When a complaint arises, workers can choose to use a political institution to express dissatisfaction instead of quitting. Union voice should lower the use of the quit mechanism.

The collective voice theory also predicts a greater reliance on layoffs to meet swings in demand because it benefits the median, usually older, worker at the expense of the newer employee (Medoff, 1979). A decrease in the workforce instead of a reduction in the hours worked per employee occurs when a downturn in demand is experienced. Medoff

(1979) also shows that layoffs are temporary in nature, with the majority of workers recalled. Collective voice further predicts that unions may reduce the dismissal rate if voice reduces worker malfeasance (Kuhn, 1986). This reduces the rate of disciplinary dismissals.

If the above predictions are accepted, two additional effects can be derived. First, the permanent separation rate is expected to be lower at a union firm because both the quit rate and the dismissal rates are expected to be lower. The total separation rate is expected to be ambiguous because the lower quit and dismissal rates may be offset by a higher layoff rate.

To summarize, both the monopoly and the collective voice theory of unions yield equivalent predictions. Both models predict that unionization increases the layoff rate while decreasing both the quit and dismissal rates. To analyze unionization's effect on turnover further, there must be controls for firm size. The question is whether large union firms are experiencing turnover behavior that is different than that experienced at small union firms.

To answer this question, the direct influence of firm size on turnover must be considered. This research focuses on four models of firm size influence on turnover: the union avoidance model, the informational problem model, the internal labor market model, and the compensating differential model.

The union avoidance model is the only model that addresses the combined effect of firm size and unionization on the employee-employer relation. The union avoidance theory portrays a union as a monopoly seller of labor. Large firms, because of the fixed cost of organizing or because of the rents they receive, are targets for union organizing. Large firms, fearing union formation, pay higher wages to avoid unions (Master, 1969; Lazear, 1984). Unionized firms pay higher wages because of the monopoly power provided by unionization. Lower quit rates are predicted at both large and union firms in the union avoidance model because of increased rents. Increased rents lower the quit rate because a worker is less likely to find a better job. The union avoidance model contains no predictions of the dismissal or layoff rates.

The internal labor market model characterizes a large firm as developing an internal labor market through the promotion and transfer of its employees (Barron and Loewenstein, 1985). Quits and dismissals are hidden internally when a worker is a bad match in this model because the firm transfers the employee to a better matched position within the firm. Given this internal labor market, both quit and dismissal rates are expected to be lower at large firms because transfers are internal and are not measured in turnover. The model predicts no change in the layoff rate.

The informational problem model of firm size explains the large firm employee-employer relation in the absence of unionization. Large firms suffer from information problems of either moral hazard, adverse selection, or monitoring. The adverse selection problem can arise from the inability to detect the quality of workers in a heterogeneous workforce (Garen, 1986; Strand, 1987). The information problem also can be manifested in the monitoring problems at large firms (Oi, 1983; Barron, Black, and Loewenstein, 1986). In Oi's (1983) model, the higher monitoring costs come from the increased opportunity costs of an entrepreneur's time at large firms.

In many of the adverse selection/monitoring cost models, larger firms rely on greater firm-specific training, which creates quasi-rents received by workers (Oi, 1983; Barron *et al.*, 1986). In other models of this type, rents are created to solve the information problem by increasing the quality of the labor pool (Strand, 1987). In cases where rents or quasi-rents exist, lower quit rates are expected. Zax (1991) extends the turnover model in the presence of rents by showing that moves and quits are substitutes. Workers find it less costly when solving a commuting equilibrium to move than to quit the firm. The increased cost of quitting is caused by the rents or quasi-rents received at large firms.

There are no predictions about layoffs in adverse selection/monitoring cost models. Dismissal rates, however, are expected to be lower in a monitoring cost model with respect to increases in firm size. The fear of dismissals drives this result. Firms pay an efficiency wage to induce workers to provide effort by making unemployment a disciplinary device (Shapiro and Stiglitz, 1984). This result leads to greater effort at large firms and lower dismissal rates.

An alternative explanation of the influence of firm size on turnover is the compensating wage differential model. It centers on working conditions at the firm where large firms pay higher wages, in the absence of unionization, to compensate the worker for some unfavorable job aspect. The unpleasant aspects at large firms include work rigidity and average commute time (Brown and Medoff, 1989). This model of firms predicts no changes in the quit, layoff, or dismissal rates. This is because no rents or quasi-rents are received.

In summary, the union avoidance model predicts that an increase in firm size lowers the quit rate. The informational problem models predict lower quits and dismissal rates in the presence of firm-specific human capital or economic rents. The internal labor market predicts lower quit and dismissal rates at large firms because large firms can internalize transfers more easily than can small firms. The compensating wage differential model predicts no changes in any turnover rates with respect to changes in firm size.

In all the previous literature, firm size and unionization have been treated as separate influences. Focusing on turnover at the firm level addresses the possible interactions of unionization and firm size as well as their direct influences. The next section tests the various implications of turnover behavior at firms. The focus is the rate of quits, dismissals, and layoffs at the establishment.

DATA AND ESTIMATION

I use the first wave of the EOPP database to test the turnover predictions of firm size and unionization. The EOPP data set is a cross section of 5,918 firms collected from March 1980 through June 1980 to provide information on the success of government employment agencies and regulation.[1] The strengths of the data set are the wide array of control variables and turnover measures and the information at the firm level. I use the

[1] Barron, Black, and Loewenstein (1987) use the EOPP data set to study how firm size affects human capital decisions, wage profiles, and capital investment decisions. Barron and Loewenstein (1985) use this data set to study internal labor markets. Barron, Fuess, and Loewenstein (1987) use this data set to analyze the effect of unions on training.

database to provide a better understanding of the employer-employee relationship and how it is influenced by firm size and unionization.

The EOPP data set has an array of control variables and different measures of turnover that allow several empirical tests. The aggregate turnover variables used are the number of quits, dismissals, and layoffs a firm experiences during a three month period. To create turnover rates, the aggregate number of each turnover measure is divided by the total number of employees at the firm and multiplied by 100.

I define the quit rate as the number of workers who quit the establishment from October 1979 through December 1979 divided by the number of workers employed at the establishment on December 12, 1979 (multiplied by 100). I define the dismissal rate as the number of workers that were dismissed by the firm in the same three month period divided by firm size (multiplied by 100). Similarly, the layoff rate variable is the number of workers the firm suspended from pay status (initiated by the employer without prejudice to the worker for reasons such as lack of work materials, model changeover, or plant breakdown) divided by firm size (multiplied by 100).

I create two turnover measures of turnover rates (permanent separation rate and total separation rate) in addition to the quit rate, dismissal rate, and layoff rate. The distinction between the two measures centers on layoffs, with the permanent separation rate excluding the layoff rate and total separation including all three rates. The layoff rate is excluded in the permanent separation measures because Medoff (1979) shows that 70 percent of all suspended workers are recalled by their previous employers. Therefore, permanent separation attempts to measure the workers that will not return to the firm, while total separation measures all workers who leave the firm, regardless of whether they are recalled or not.

I use all measures of turnover rates as dependent variables to test the implications of the differing models of unionization and firm size. I report the means of the dependent variables and the percentage of firms that experienced the various turnover behaviors in Table 1.

Just over 50 percent of the firms in the survey experienced any type of turnover in the three month period of 1979. Column two reports the mean rates, given a positive amount of turnover occurred. The large number of zeros at each rate makes the Tobit technique necessary (Tobin 1958).[2] The Tobit equation can be thought of a selection problem that depends only on the value of the dependent variable. It can be explained in two steps. First, the selection rule: What is the probability of a observing a positive turnover rate in a set period? Second, given that the selection rule is met (a positive turnover rate exists), what is the level of the rate?

The independent variables include one digit standard industrial classification (SIC) dummy variables. I use these to control for possible industrial differences in turnover. The one digit dummies represent agriculture and mining; construction; manufacturing; trans-

[2] Heteroscedasticity is expected to be present in the aggregate turnover data because variance may be related to firm size (Greene, 1990). To address heteroscedasticity, I use turnover rates, not levels. If heteroscedasticity is present, it will bias the results because Tobit estimates are inconsistent in the presence of heteroscedasticity.

Table 1—Means of Turnover Rates[a] (Standard Deviation in Parentheses)

	Mean	Percent Above Zero[b]	Mean Above Zero
Quit Rate	8.58	42	20.34
	(44.5)		(66.9)
Dismissal Rate	2.77	21	13.06
	(20.9)		(44.2)
Layoff Rate	3.47	9	38.33
	(48.8)		(157.9)
Permanent Separation Rate	11.36	47	25.90
	(58.6)		(83.2)
Total Separation Rate	14.84	51	31.18
	(76.3)		(106.6)

Source: First Wave EOPP database
[a]Turnover rates are calculated by measuring the number of employees that left the establishment in each category from October 1979 to December 1979 divided by the total number of workers at the establishment on December 12, 1979 and multiplying by 100
[b]Percent above zero is the percentage of firms that reported a positive rate of turnover from October 1979 to December 1979. The interpretation is the average turnover rate of a firm experiencing turnover

Table 2—Means of the Independent Variable (Standard Deviations in Parentheses)

Variable	Mean
Percent Unionized[a]	9.895
	(27.61)
Firm Size[b]	55.374
	(195.10)
Agriculture and Mining[c]	.026
	(.159)
Construction	.076
	(.266)
Manufacturing	.111
	(.314)
Transportation and Public Utilities	.038
	(.192)
Wholesale Trade	.084
	(.277)
Retail Trade	.331
	(.471)
Finance, Insurance, and Real Estate	.064
	(.245)
Services	.260
	(.439)
Sample Size	5101

Source: EOPP employer date base

[a]Percent unionized is the proportion of the establishment's workers that are covered by a collective bargaining agreement

[b]Firm size is the number of employees at the establishment on December 12, 1979

[c]Industrial dummy variables are created using the one digit SIC

portation and public utilities; wholesale trade; retail trade; finance, insurance, and real estate; and services. The services category is excluded.

I also use firm size and firm size squared to examine the differences in turnover behavior at different size firms. The measure of firm size is the number of employees working for a firm on December 12, 1979. The firm size squared is included to measure possible convex or concave relations between firm size and turnover.

The implications of the different models of unionization are examined using a measure of unionization. The measure of unionization is defined as the percentage of nonsupervisory employees covered by a collective bargaining agreement. It ranges from 0 percent to 100 percent. I interact the firm size with the unionization dummy variable in all specifications. This interactive dummy variable is included to measure how the effect of unionization changes with firm size. The means of the independent variables are reported in Table 2.

Table 3 reports the results of the quit rate, dismissal rate, and layoff rate specifications. The first column reports the quit rate specification. Firm size is found to have a positive concave relation with quits. Increases in firm size initially increase the incidence of quits, but increases in firm size decrease the quit rate at large firms. The influence of firm size at an average firm is positive and equal to .07127.[3] The concave relation is consistent with all theories of firm size, except the compensating wage differential theory. The concave relation, however, points out that the predicted results do not occur until a firm is large.

Table 3, column two reports the result of the dismissal rate equation. Firm size has a positive but concave impact on the dismissal rate. There is a positive and significant coefficient on firm size and a negative and significant coefficient on firm size squared. The effect of firm size on a firm with medium attributes is positive and equal to .0714. The negative coefficient on firm size squared is consistent with the internal labor market model, where workers tend to be transferred at large firms. It also supports the adverse selection-monitoring cost model of firm size where workers fearing dismissal increase work effort.

Unionization has no significant direct effect on either the quit or dismissal rates. The coefficient on the interactive firm size-unionization term, however, is negative and significant. Thus, unionization lowers the expected rate of dismissals and quits at large firms.

Table 3, column three conveys the results of the layoff rate specification. Firm size has a positive concave relation to the occurrence of layoffs, with a positive coefficient on firm size and a negative coefficient on firm size squared. The effect of firm size on an

[3] To calculate the mean influence of firm size, the following derivative was used:

$dY/d\text{Firm Size} = B_1 + 2B_2 \times \text{Firm Size} + B_3 \times \text{Unionization}$,

where:

Y = Turnover;
B_1 = Coefficient on firm size;
B_2 = Coefficient on firm size squared; and
B_3 = Coefficient on the interaction of firm size and unionization.

The mean of firm size, 55, and unionization, .10, also are used in each calculation.

Table 3—*Determinants of Turnover Rates: The Quit Rate, Dismissal Rate, and Layoff Rate (Absolute Value of t-ratios in Parentheses)*

	Quit Rare	Dismissal Rate	Layoff Rate
Constant	-37.46	-53.75	-322.5
	(14.537)	(21.588)	(20.371)
Firm Size	.09187	.09007	.10215
	(8.680)	(11.212)	(2.945)
Firm Size Squared	-.00017	-.00016	-.00015
	(4.876)	(6.483)	(1.556)
Percent Unionized	1.22	-2.67	89.17
	(0.237)	(0.618)	(5.562)
Firm Size X Unionization	-.0186	-.0109	-.0159
	(1.582)	(1.105)	(0.353)
Agriculture and Mining	2.823	.389	71.853
	(.335)	(.004)	(2.081)
Construction	-8.720	-5.330	107.570
	(1.517)	(.880)	(8.053)
Manufacturing	1.171	.778	129.517
	(.240)	(.154)	(6.52)
Transportation and Public Utilities	-7.455	-19.579	76.954
	(1.001)	(2.325)	(2.640)
Wholesale Trade	-15.261	-4.872	-3.411
	(2.776)	(.857)	(.129)
Retail Trade	4.457	2.477	-6.822
	(1.283)	(.677)	(.396)
Finance, Insurance, and Real Estate	-10.892	-7.236	-2.174
	(1.800)	(1.13)	(.072)
σ	81.45	71.52	226.50
Log-Likelihood Ratio	-3883.0	-2110.8	-1721.9
Sample Size	5101	5101	5101

Tobit estimates EOPP employer database. The excluded category is services

average firm is .0979. Thus, large and small firms are less likely to rely on layoffs than are medium size firms.

The coefficient on unionization in the layoff rate specification is positive and significant. This supports both the monopoly and collective voice models of unionization, where small firms and large firms increase their layoffs with greater unionization. The interactive effect between firm size and unionization is insignificant.

Table 4 reports the results of the total separation and the permanent separation equations. Column one, the permanent separation specification, shows that firm size has a positive and concave relation. Unionization also is found to have no significant direct effect on permanent separation, but exhibits a negative relation when interacted with firm size. For a firm with mean characteristics, (missing word) has a positive influence equal to .0795. The negative coefficient on the interactive term supports both models of unionization.

The total separation specification, reported in column two, has a positive relation with firm size. I find a concave relation, with firm size squared having a negative and significant coefficient. The influence of firm size at a firm with mean attributes is .0846. Unionization has both a positive direct effect on turnover and a negative interactive effect with firm size. This suggests that the increased use of layoffs at all union firms is offset by the reduction in quits and dismissals at large union firms.

Table 4—Determinants of Turnover Rates: The Permanent and Total Separation Rates (Absolute Value of t-ratios in Parentheses)

	Permanent Separation Rate	Total Separation Rate
Constant	-37.43	-47.21
	(12.264)	(12.558)
Firm Size	.1037	.1076
	(8.044)	(8.757)
Firm Size Squared	-.00019	-.00018
	(4.503)	(3.466)
Percent Unionized	.1832	14.96
	(0.031)	(2.005)
Firm Size X Unionization	-.0221	-.0351
	(1.225)	(1.583)
Agriculture and Mining	4.650	18.672
	(.431)	(1.838)
Construction	-8.539	22.302
	(1.169)	(2.251)
Manufacturing	2.800	22.849
	(.448)	(2.627)
Transportation and Public Utilities	-12.495	2.161
	(1.309)	(.166)
Wholesale Trade	-14.287	-14.589
	(2.064)	(1.502)
Retail Trade	6.006	9.361
	(1.353)	(1.496)
Finance, Insurance, and Real Estate	-9.966	-5.345
	(1.300)	(.497)
σ	106.43	150.53
Log-Likelihood Ratio	-4646.1	-5386.3
Sample Size	5101	5101

Tobit estimates EOPP employer database. The excluded category is services

Table 5—Decomposition of Tobits, Tobit Estimates: EOPP Employer Database

Cumulative Distribution Function Evaluated at the Mean	F(z)	Fraction of Mean Total Response Given a Positive Rate is Observed $1-zf(z)/F(z)-f(z)^2/F(z)^2$
Quit Rate	.326	.277
Dismissal Rate	.228	.232
Layoff Rate	.077	.156
Permanent Separation Rate	.365	.295
Total Separation Rate	.377	.301
Sample Size	5101	

z is equal to xB/s, where x is a vector equal to the mean value of the independent variables, B is the vector of Tobit coefficient estimates, and s is the estimated standard deviation of the error term

Firm size has a positive concave relation to all turnover rate measures overall. Unionization has no significant direct effects on any turnover measures except layoffs, where it has a positive and significant effect. Unionization, however, has a significant effect when interacted with firm size. Unionization has a negative and significant effect in the quit, dismissal, permanent separation, and total separation rate equations. These

results show that unionization at large firms has a greater impact on turnover than at small firms, with only layoffs showing any effect of unionization directly.

THE TOBIT DECOMPOSITION

Table 5 reports the decomposition of the Tobit coefficients. The decomposition separates the total effect into two parts: the effect on the probability of an occurrence of a positive turnover rate and the effect on the rate of turnover, given the firm already is experiencing turnover.

Consider the following derivative of the expected value of the Tobit.

(1) $dE(y)/dx_i = F(z)(dE(y^*)/dx_i) + E(y^*)(dF(z)/dx_i)$.

where:

$E(y)$ = Expected value of the Tobit;

$E(y^*)$ = Expected value of the Tobit, given it is above zero;

$F(x)$ = Cumulative normal distribution; and

x_i = ith independent variable.

This derivative can be interpreted in the following way. The first component is the change in the turnover rate, y (given it is greater than zero, weighted by the probability of being above zero). The second part is the change in the probability of being above the zero, weighted by the expected value of y, given it is above zero (McDonald and Moffitt, 1980). Both are computable:

(2) $dF(z)/dx_i = f(z)B_i/\sigma$,

(3) $dE(y^*)/dx_i = B_i[1 - zf(z)/F(z) - f(z)^2/F(z)^2]$,

where:

$E(y)^*$ = Conditional expected value of the turnover rate given it is above zero;

x_i = The ith dependent variable;

B = Vector of estimated Tobit coefficients;

σ = Estimated standard deviation of the error term;

x = Vector of means of the independent variables;

z = xB/σ;

f(z) = Unit normal density; and

F(z) = Cumulative normal distribution.

The probability a firm exhibits a positive turnover rate, F(z), is calculated at the mean of all the variables. The z variable is calculated by summing the mean of all the independent variables, multiplying by the estimated Tobit coefficient, and dividing the estimated standard error of the regression. This normalizes the variable and is equal to z. The z is used to calculate the cumulative density F(z), which is interpreted as the probability of a firm with mean characteristics exhibiting a positive turnover rate.

Column one shows the cumulative distribution function evaluated at the mean of the dependent variables. Column 2 reports the fraction of the mean total response above the limit zero. The purpose of the decomposition is to provide further information on the effect of firm size and unionization on turnover at the firm.

The cumulative standard normal distribution evaluated at the mean of the dependent variables reflects the probability of turnover occurring at an average firm. The precise interpretation of F(z) is that a firm with the mean attributes of the independent variables will be expected to exhibit turnover with the reported probability. For example, a firm with the average attributes is expected to exhibit a positive amount of dismissal with a .15 probability in a three month period. Any type of turnover is expected only 36 percent of the time in a three month period. This shows that the likelihood of turnover occurring in a three month period is relatively small.

The calculated distribution at the mean of the dependent variables is less than the actual percentage of firms that experienced turnover in all cases. For example, the calculated cumulative distribution of quits is .302, while the actual proportion above the limit is .42. The reason for this difference is the nonlinearity of the cumulative distribution function.

Column two reports the decomposition of the Tobit attributed to the fraction of the mean total response due to the response above the limit. This fraction is interpreted as the proportion of the effect on turnover attributed to firms that already have incurred turnover. The fraction for all turnover measures is equal to or under .3. Total separation has the largest proportion of .301, and layoffs has the smallest with .156. Dismissals has a .232 proportion, while the quits proportion is .277.

The greater part of the total effect in all cases is on the probability of the occurrence of turnover. It only has a minor effect on the number of turnovers happening, given that a turnover already has occurred. Turnover is a relatively rare event in a three month period.

The decomposition of the Tobits shows that an increase in unionization or firm size affects the probability of turnover occurring at a firm more than it affects the level of turnovers at firms already experiencing turnover. Most firms in this sample do not experience turnover. Thus, when decomposing the total effect, the greater part is reflected through an increase in the likelihood of occurrence and not in the number of occurrences.

CONCLUSION

Turnover rates at firms are influenced by both firm size, unionization, and the interaction of firm size and unionization. Two major results are apparent when looking at turnover at the firm level. First, the preponderance of the influence of firm size and unionization is on changing the probability of occurrence rather than on the level of occurrence. Second, firm size and unionization should not be treated as separate phenomena.

The evidence on turnover behavior suggests that unionization lowers the likelihood of an individual quitting or being dismissed at large firms, while increasing the likelihood of a layoff at both large and small firms. Firm size also is found to have a positive, but concave, relation on the likelihood of an individual quitting, being dismissed, or being laid off. These findings suggest that unionization and firm size need to be considered simultaneously when modeling the employer-employee relation.

Furthermore, the quit and layoff behavior found with this data set is consistent with the literature that shows that unionization increases layoff rates and reduces quits (Freeman and Medoff, 1984; Medoff 1979). The negative relation found between dismissal and the interactive union firm size term as well as the concave relation between dismissals and firm size is not predicted explicitly by any model, but many allude to these relationships. Future models of unionization and firm size should be consistent with these phenomena.

REFERENCES

1. Barron, John, Dan A. Black, and Mark Loewenstein, "Employer Size: The Implication for Search, Training, Capital Investment, Starting Wages, and Wage Growth," *Journal of Labor Economics*, 5 (1987), pp. 76-89.

2. Barron John M., Scott M. Fuess, Jr., and Mark Loewenstein, "Further Analysis of the Effect of Unions on Training," *Journal of Political Economy*, 95 (1987), pp. 632-640.

3. Barron, John M., and Mark Loewenstein, "On Employer-Specific Information and Internal Labor Markets," *Southern Journal of Economics*, 52 (October 1985), pp. 431-445.

4. Blau, Francine D., and Lawrence M. Kahn, "Unionism, Seniority, and Turnover," *Industrial Relations*, 22 (Fall 1983), pp. 362-373.

5. Brown, Charles, and James Medoff, "The Employer Size Wage Effect," *Journal of Political Economy*, 97 (1989), pp. 1027-1058.

6. Freeman, Richard B., "The Exit-Voice Tradeoff in the Labor Market: Unionism, Job Tenure, Quits and Separations," *The Quarterly Journal of Economics* (June 1980), pp. 643-645.

7. Freeman, Richard B., and James L. Medoff, *What Do Unions Do?* (Basic Books: New York, NY 1984).

8. Garen, John, "Worker Heterogeneity, Job Screening, and Firm Size," *Journal of Political Economy*, 93 (1985), pp. 456-471.

9. Greene, William H., *Econometric Analysis* (Macmillan: New York, NY 1990).

10. Hirsh, Barry T., and John T. Addision, *The Economic Analysis of Unions* (Allen and Urwin: Boston, MA 1986).

11. Keely, Micheal C., "The Economics of Firm Size: Implications from Labor Market Studies," *Federal Reserve Bank of San Francisco Economic Review*, 1 (Winter 1984), pp. 5-21.

12. Kuhn, Peter, "Wages, Effort, and Incentive Compatibility in Life-Cycle Employment Contracts," *Journal of Labor Economics*, 4 (1986) pp. 28-49.

13. Kuhn, Peter, and Jacques Robert, "Seniority and Distribution in a Two-Worker Trade Union," *The Quarterly Journal of Economics* (August 1989), pp. 485-505.

14. Long, James, and Albert N. Link, "The Impact of Market Structure on Wages, Fringe Benefits, and Turnover," *Industrial and Labor Relation Review*, 36 (January 1983), pp. 239-250.

15. Masters, Stanley H., "An Inter-Industry Analysis of Wages and Plant Size," *Review of Economics and Statistics*, 51 (August 1969), pp. 341-345.

16. McDonald, J., and R. Moffitt, "The Use of Tobit Analysis," Review of Economics and Statistics, 62 (1980), pp. 318-321.

17. Mitchell, Olivia S., "Fringe Benefits and Labor Mobility," *The Journal of Human Resources*, 17 (1982), pp. 286-298.

18. Medoff, James L., "Layoffs and Alternatives Under Trade Unions in U.S. Manufacturing," *American Economic Review*, 69 (June 1979), pp. 380-395.

19. Oi, Walter Y., "Heterogeneous Firms and the Organization of Production," *Economic Inquiry*, 17 (1983), pp. 147-171.

20. Parsons, Donald O., "Specific Human Capital: An Application to Quit Rates and Layoff Rates," *Journal of Political Economy* (1972), pp. 1120-1143.

21. Rebitzer, James B., "Establishment Size and Job Tenure," *Industrial Relations*, 25 (Fall 1986), pp. 292-303.

22. Shah, A., "Are Wage Incentives and Unionism Important Determinants of Job Tenure?" *Oxford Economic Papers* (December 1985), pp. 643-658.

23. Shapiro, Carl, and Joseph E. Stiglitz, "Equilibrium Unemployment as a Worker Discipline Device," *American Economic Review*, 74 (June 1984), pp. 433-444.

24. Strand, John, "The Relationship Between Wages and Firm Size: An Information Theoretic Analysis," *International Economic Review*, 28 (February 1987), pp. 51-68.

25. Tobin, James, "Estimation of Relationships for Limited Dependent Variables," *Econometrica*, 26 (1958), pp. 24-36.

26. Weiss, Andrew, and Henry Landau, "Wages, Hiring Standards, and Firm Size," *Journal of Labor Economics*, 2 (August 1984), pp. 477-499.

27. Zax, Jeffery S, "The Substitution Between Moves and Quits," *The Economic Journal* (November 1991), pp. 1510-1521.