An Income Determination Model With Implications for Occupational Mobility in a Rural Labor Force

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ABSTRACT

"Excessive" job-changing by workers is perceived as irrational behavior by employers in Oregon's wood products industry. A hypothesis of equi-marginal returns to firm-specific and general work experience is tested with a partitioned income determination model. The revealed incentive structure encourages frequent job-changing.

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The purpose of this paper is to present a relatively simple model for understanding cross-sectional income variation among workers and to show how this model yields fairly powerful insights into worker behavior. In particular, our estimates for Oregon's wood products workers suggest the economic rationality of what is perceived by many employers to be irrational behavior, that is, frequent job changing by workers.

I. Occupational Mobility in the Oregon Wood Products Industry:

Historically an outlet for surplus agricultural labor, the Oregon wood products industry is now facing substantial employment decline due to technological change and liquidation of old-growth timber. The research out of which this paper arises has attempted to assess both the current economic welfare of workers in the industry and the nature and magnitude of problems related to future labor-release. While the answers to these questions will be of more interest to local and state decision-makers than to academicians, we will describe here one aspect of the research which is of rather general interest. That aspect has to do with an employer-perceived "excess" degree of occupational mobility.

As an overview, average monthly employment in the industry in 1972 was about 75,000 workers. Our state-wide survey of these workers, however, revealed that over 110,000 different individuals had worked in the industry in that year, or about three workers for every two jobs. Further analysis (Stevens)

revealed that about 60 percent of these workers had remained in the industry throughout that entire year, and that this older, more experienced "core" labor force is relatively secure in terms of historical and current income and employment levels. The remaining 40 percent of the labor force had either entered or left the industry during the survey year; we have labeled this the "peripheral" labor force.[1/] Younger and less experienced than the industry veterans, their work histories are characterized by short job durations (one year, on the average) resulting from frequent intra-industry and inter-industry mobility.

While it is fairly obvious that 110,000 people cannot be fully employed within an industry which generates only 75,000 jobs, employers are still skeptical of people who change jobs frequently. The existence of statistical discrimination[2/] against workers due to frequent job changing has been documented elsewhere (Young and Stevens). There, it was estimated that intra-industry mobility would reduce a worker's chance of re-employment in wood products by about 10 to 12 percent per job change. In addition, there would be a 33 percent reduction in his chances of re-employment if he left wood products and then attempted to return. These penalties were attributed to social rather than economic factors; it was argued that "instability" is penalized because workers who do not exhibit normative patterns of behavior are regarded, by employers, as less deserving of economic rewards.[3/]

In view of the penalties associated with job-changing and the fact that the workers themselves are quite cognizant of these penalties (Young and Stevens), why do they change jobs so frequently? The explanation which we are most prepared to defend at this point is that the economic returns to being occupationally immobile are relatively low.[4/]

II. A Model for Explaining Cross-Sectional Income Variation:

One avenue for exploring the economic rationality of job-changing is to hypothesize that experience with the current employer and with past employers add equally to current income, where the contribution of each type of experience is evaluated at the margin. Gary Becker's distinction between "general" and "specific" training is thus translated into a distinction between general and firm-specific work experience. If the learning (and hence, productivity) generated by work experience with one firm can readily be transferred to other firms in the industry, then the marginal rewards for the two types of experience will tend toward equality. Neither firms nor workers will have a strong economic incentive for maintaining liaison in this case, and job-changing will occur frequently.

This null hypothesis is tested below with a cross-sectional income determination model. Most models of this type use a single equation and define the dependent variable as hourly, monthly, or yearly earnings (Rees, et al; Stoikov). While these approaches may be useful for predictive purposes, the following problems exist with respect to making structural inferences.

1. Labor earnings depend on both remuneration per unit of time and the number of time units that the worker is employed. Low earnings can arise from low wages, frequent unemployment, or both. Moreover, the productivity of various human capital attributes and/or the effects of institutions (e.g., the seniority system) may vary in the two cases.

2. Cross-sectional wage or unemployment regressions are generally reduced-form equations; attempts to draw structural inferences about the marginal productivities of various forms of human capital must proceed with caution.[5/]

Both problems are dealt with below, although the first is resolved more satisfactorily than the second.

A. Separation of Income Components:

In the empirical estimates which follow, weekly earnings (W) and the number of weeks worked in a year (Q) are hypothesized to be determined by those variables which embody human capital attributes of workers (X_i) or which otherwise affect the supply of or demand for labor (Z_i).[6/]

That is,

$$W = f_1(X_i, Z_i) \tag{1}$$

$$Q = f_2(X_i, Z_i) \tag{2}$$

Yearly income (I) is the product of weekly earnings (W) and weeks worked (Q). Thus,

$$I = W \cdot Q \tag{3}$$

$$I = [f_1(X_i, Z_i)] \cdot [f_2(X_i, Z_i)] \tag{4}$$

If equations (1) and (2) can be estimated, it is then possible to derive "marginal income coefficients", $\frac{\partial I}{\partial X_i}$, which would show the relationship between income and a particular human capital attribute. That is,

$$\partial I/\partial X_i = \frac{\partial f_1}{\partial X_i} \cdot Q + \frac{\partial f_2}{\partial X_i} \cdot W \ , \tag{5}$$

$$\partial I/\partial X_i = \frac{\partial W}{\partial X_i} \cdot Q + \frac{\partial Q}{\partial X_i} \cdot W \ , \tag{6}$$

where $\frac{\partial W}{\partial X_i}$ and $\frac{\partial Q}{\partial X_i}$ are partial regression coefficients from equations (1) and (2), and Q and W are selected values for appropriate groups of workers. The first term

of equation (6) reflects the expected income increment due to higher weekly earnings, holding constant the number of weeks worked. The second term is the increment due to an increase in number of weeks worked, holding constant the level of weekly earnings.

B. The Reduced-Form Problem:

While the model above explicitly separates the two components of income, the reduced-form problem can be lessened (but not eliminated) by approporiate specification of variables and by careful definition of data sets.

1. Variable Specification

In addition to standard human capital attributes, measures of different types of work experience were available from the life-time work histories of 189 workers in the state-wide survey. A priori expectations for equations (1) and (2) included:

(a) positive returns to the individual types of work experience,

(b) diminishing returns to age, education, and total wood products work experience, and

(c) substitutability between firm seniority (experience with current employer) and other wood products experience.

To lessen the reduced-form problem, a variable was included in the weekly earnings equation to reflect the predicted opportunity earnings outside the wood products industry.[7/] The appropriate interpretation of the coefficient itself will not be clear, since the variable could reflect both supply and demand considerations. That is, those with higher opportunity costs might

be less likely to work in wood products (supply); they might also be more productive workers in wood products (demand). In any event, the intent in specifying this variable is to allow supply considerations to surface and thus isolate the demand effects via the human capital variables.[8/]

2. Definition of Data Sets

The equations for weekly earnings were estimated from all wood products jobs in the lifetime work histories of the (core and peripheral) sample. This allows the full range of data to be utilized. The equations for explaining weeks worked, however, utilized only those (core) workers who attempted to work full-time for a single wood products employer in 1972. Those with voluntary unemployment periods were excluded, as were those who worked for another employer at any time. The interpretation of coefficients, then, must be that they reflect the expected outcomes for those who attempt to remain with a single employer. Had all observations been included, the estimates would have revealed the outcome of the incentive structure (i.e., much job changing) rather than testing a hypothesis about that structure.

III. Empirical Estimates:

The regression equations of Table 1 reveal a general robustness of the human capital approach, although unemployment is much more difficult to explain than weekly earnings. The earnings equations are highlighted by:

(1) significance of the opportunity cost variable in mill work but not in logging,

(2) separation of age (representing physical endurance, agility, and/or stamina) and experience in logging,

(3) variation among sectors in importance of the different work experience variables (e.g., experience with current and past employers are quite substitutable in logging, but not in mill work).

The equations for weeks worked reflect:

(1) a small but significant effect of seniority in determining lay-offs in mills,

(2) the apparent inclination of (less-unionized) logging firms to "protect" older workers even at the expense of more senior workers,

(3) the role of capital-intensity of mills in providing employment stability, at least for those workers not displaced by substitution of capital for labor.

IV. Conclusions:

Estimation of the regression coefficients permits computation of equations (5) and (6), or the "marginal income coefficients" for higher weekly earnings and for less frequent unemployment (Table 2).[9/] The sums of these coefficients can be interpreted as expected increments in income for workers who may be deciding whether to remain with their current employer or to become occupationally mobile.[10/] The null hypothesis, again, is that (wood products) experience with current and past employers is equally productive in terms of value to the current employer. To the extent that firm-specific human capital is embodied in workers, one would expect the marginal income coefficient for firm seniority to exceed that for other wood products experience.[11/]

Our estimates reveal, however, that firm-specific human capital exists

only among plywood workers. Even there, the difference in marginal income coefficients is quite small (and also non-significant); an additional year of firm seniority is worth only about $65 per year (3 cents per hour) more than an additional year of experience with other wood products firms. Moreover, the incremental value of experience outside the industry exceeds that of plywood firm seniority, also by about $65 per year.[12/]

In light of these estimates, then, the rationality of frequent job-changing becomes more understandable, and the rationality of immobility emerges as an interesting question.

Table 1. Regression Analyses[1/]

	Weekly Earnings			Weeks Worked in 1972	
	Logging (n=164)	Sawmills (n=130)	Plywood (n=153)	Logging (n=35)	Sawmills & plywood (n=57)
General:					
Age	10.61***	n.s.	n.s.	n.s.	n.s.
$(Age)^2$	- .119***	n.s.	n.s.	.01**	n.s.
Education	n.s.	20.97**	n.s.	n.s.	n.s.
$(Education)^2$	n.s.	- .72**	n.s.	n.s.	.008#
Vocational training[2/]	n.s.	- .99***	n.s.	n.s.	- .073#
Disability	n.s.	46.44**	n.s.	n.s.	n.s.
Work experience (years):					
Firm seniority	n.s.	n.s.	5.53***[4/]	- .87**	.054*
Other wood products	n.s.	3.73***	4.49***[4/]	- .72*	n.s.
(Firm sen.) (other wood prod.)	- .40**	n.s.	n.s.	n.s.	n.s.
$(All\ wood\ products)^2$	.086***	n.s.	- .193***	n.s.	n.s.
Non-wood products	- 2.99#	2.78**	4.52***[4/]	- .72#	n.s.
Opportunity cost:[3/]	n.s.	.32**	.157*		
Job-specific:					
Years since job ended	- 5.93***	- 2.15***	- 6.23***		
Frequency of training	28.41**	n.s.	n.s.		
Capital/labor ratio					.062**
Union membership				- 3.45*	n.s.
Plywood job					.69#
Constant	31.81	-14.68	151.59	49.51	49.57
R^2	.372	.478	.552	.194	.220

1/ *** = .01, ** = .05, * = .10, # = .20, n.s. = not significant. Coefficients shown are those computed after deletion of non-significant variables.

2/ Earnings equation: months in high school. Weeks worked equation: High school months plus other vocational and on-the-job training.

3/ Predict d non-wood products earnings at time of wood products job.

4/ Not significantly different from each other at $\alpha = .05$.

Table 2. Marginal Income Coefficients[1/]

	Increment due to higher weekly earnings[2/]			Increment due to less frequent unemployment[3/]			Sum		
	Logging	Sawmills	Plywood	Logging	Sawmills	Plywood	Logging	Sawmills	Plywood
General:									
Education	0	195.62	0	0	32.70	32.70	0	228.32	32.70
Vocational training	0	- 51.48	0	0	- 14.36	- 14.36	0	- 65.84	- 14.36
Work Experience:									
Firm seniority	93.69	0	159.70	- 16.78	10.62	10.62	76.82	10.62	170.32
Other wood products	158.60	193.96	105.62	24.89	0	0	183.49	193.96	105.62
Non-wood products	- 17.68	144.56	235.04	24.89	0	0	7.21	144.56	235.04

1/ Work experience coefficients in logging reflect the combined effects of age and experience ($\frac{\partial W}{\partial Age}$ = 137.80, $\frac{\partial W}{\partial FS}$ = - 44.20, $\frac{\partial Q}{\partial Age}$ = 224.91, $\frac{\partial Q}{\partial FS}$ = - 241.69).

2/ $\frac{\partial W}{\partial X_i} \cdot Q$, where $\frac{\partial W}{\partial X_i}$ are derived from Table 1 and evaluated at the means of X_i for the respective groups. Q is assumed to be 52 weeks, or full-time employment. Partial derivatives for firm seniority (FS) and other wood products (OWP) utilize the equality, $WP^2 = (FS + OWP)^2$, where WP = all wood products experience.

3/ $\frac{\partial Q}{\partial X_i} \cdot \overline{W}$, where $\frac{\partial Q}{\partial X_i}$ are derived from Table 1 and evaluated at the means of X_i for the respective groups. Average weekly earnings in 1972 (W): logging, $277.81; sawmills and plywood, $196.76.

FOOTNOTES

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1/ About one-third of this group are seasonally-employed college sutdents whose job changing is more easily understood by employers.

2/ "Statistical theories of discrimination assume that employers hire, place, and pay workers on the basis of imperfect information about their true productivity ---" (Cain, p. 1232) and thus shift the cost of uncertainty from employers to affected workers.

3/ Training requirements for entry-level jobs are extremely minimal, and the (fixed) administrative cost of hiring a new worker is probably less than $50.

4/ The conclusions of this paper have led us to investigate the monetary costs and returns to job changing; this analysis is still in progress. Also, many jobs are regarded by workers as tiring, boring, and even demeaning. Data on monetary versus non-monetary reasons for job changing are also being analyzed.

5/ While education, for example, may cause a worker to be more valuable to a wood products employer, it may also cause him to be less likely to supply his labor to that industry. Either a rightward demand shift or a leftward supply shift, or both, would be consistent with a positive relationship of education to wage rates within the industry. For insight into the reduced form problem, see Blaug.

6/ Weekly earnings depend upon both hourly wage rates and length of the work week. In theory, choices between income and leisure may affect the latter. The assemblyline nature of production militates against such choices in this case.

7/ Weekly earnings in non-wood jobs were regressed against age, education, vocational training, disability, total wood products experience, total non-wood experience, experience in two specific occupations and industries and four dummy variables for whether the job involved specific occupations or industries. Squared terms were also included for age, education, total non-wood experience, and total wood products experience. Twelve variables were significant at $\alpha \leq .05$, with $R^2 = .50$, $n = 264$.

8/ Although not shown here, inclusion of predicted opportunity costs in the equations for weekly earnings resulted in a modest reduction in absolute value of the other coefficients; very little change occurred in relative magnitudes.

9/ As a matter of judgment, it may be that workers may perceive the effects of age and experience to be largely inseparable. Thus, the ceofficients for logging in Table 2 reflect the combined effects of age and experience. The same conclusions would still be drawn, had this adjustment not been made.

10/ In reality, the distribution of gains needs to be known, as well as the expected or mean value. If only a few workers advance through the internal process of "bidding" for jobs, then the median gain from additional firm seniority may be zero.

11/ If these estimates reflected only demand considerations, one would not expect that firm-specific experience would be less valuable at the margin than general experience. The explanation for this occurrence in logging and sawmills appears to be that supply considerations have not been entirely removed. This is consistent with observations by personnel managers that more senior workers are often content with their current jobs and do not "bid" on internal job openings which involve more pay (and more responsibility).

12/ This difference represents an (expected) gain which could only be realized by leaving wood products, acquiring non-wood products experience, and then returning. As noted earlier, this strategy would involve substantial risk that a worker would not be re-hired by wood products firms.

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