XII. LABOR ECONOMICS/LABOR MARKETS AND HUMAN RESOURCES REFEREED PAPERS

The Instability of Unskilled Earnings

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Abstract

The year-to-year variability of unskilled workers' earnings increased over the period from the 1970s to the early 1990s. Moreover, much of the increase in earnings instability occurred in the 1980s, despite the long economic expansion that took place during the same period. The decline in average job tenure among less-skilled workers and wage instability (rather than hours instability) seem to have contributed to these results. The implication is that recent economic growth has failed to reduce earnings instability and, consequently, the design of income maintenance policies is better served by explicitly addressing access to capital markets and tenure instability (or job retention capacity) among the poor.

Introduction

This paper is concerned with earnings instability among less-skilled workers.[1] The study is based on data from the Panel Study of Income Dynamics (PSID), and examines the dynamics of unskilled workers' earnings over the 1970s, the 1980s, and the early 1990s by focusing on changes in the covariance structure of earnings. Annual earnings are decomposed into permanent

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and transitory components, and the implied covariances are evaluated over the period to see if the year-to-year variability of earnings has changed over time.

A study of earnings instability is important for several reasons. First, most explanations for the changing distribution of income associate the changes with increases in permanent differentials among individuals such as the increase in the returns to education. However, changes in the annual variance also come from increases in the instability of earnings, and the cause of this increase must be sought in other factors as well. Suggested explanations point to the importance of institutional factors such as de-unionization. Second, transitory shocks can be welfare reducing, particularly for individuals with limited access to capital markets. Zeldes (1989) examined consumption and liquidity constraints facing a sample of families selected from the PSID and found evidence that is generally supportive of the notion that individuals are unable to smooth consumption over the life cycle. Finally, a study of instability informs the design of income maintenance policies that could be strengthened by programs to ease access to capital markets as well.

The rest of the paper is divided in the following order. The next section describes the data. The third section outlines the methods used to construct the covariance matrix and to estimate the parameters of the model. Results from the descriptive and parametric analyses of the earnings data are presented in the fourth section. The roles of job, hours, and wage instability are also examined in this section, and the conclusions are given in the last section.

Longitudinal Data

In this paper, twenty-four years of survey data from PSID that span the period from 1970 to 1993 are used to examine the changes in the covariance structure of unskilled earnings. The study is restricted to a sample of annual earnings for male household heads, who have reported nonzero earnings, are between the ages of eighteen and sixty, and whose level of education is not more than twelve years. The focus on positive and male earnings minimizes the confounding effects of entry and exit in the labor market on the transitory variance of earnings. Although the PSID provides complete longitudinal history of earnings, it contains relatively little information on individuals who are not heads of households, limiting the scope of the sample to only heads of households. The choice of the entry age to the sample seems to be appropriate for this group of workers because, presumably for individuals who are no longer going to school, entry to the labor market takes place at an earlier age than for others.

These restrictions produced a balanced panel of 479 individuals and a total of 11,496 person-year observations that are used in the construction of the empirical covariance matrix.[2] In line with previous work, all of the analysis is conducted using residuals from a first-stage regression of the log of annual earnings on a quartic in age. All usable data are appropriately deflated to 1992 dollars.[3]

Econometric Specifications

The aim in this section is to present a parsimonious model for the autocovariance structure of earnings. The methods employed to construct and estimate the covariance matrix are those suggested by Abowd and Card (1989). In the first stage, the parameters β and the residuals y_{it} of the log of earnings $\langle Y^*_{it} \rangle$, for the i^{th} individual observed at time t are estimated with OLS, where,

(1) $LogY^*_{it} = f(X_{it}, \beta) + y_{it}$, and $f(\cdot)$ is a polynomial in age or experience.

The basis for the decomposition of earnings is the traditional error components model. The earnings residuals, y_{it}, are decomposed into an individual component, α_i, and a white noise transitory error term, ν_{it}, where

(2) $y_{it} = \alpha_i + \nu_{it}$.

Under the assumption of uncorrelated error components and serially uncorrelated transitory components,

(3) $\mathrm{Var}(y_{it}) = \sigma^2_\alpha + \sigma^2_\nu$, and

(4) $\mathrm{Cov}(y_{it}, y_{is}) = \sigma^2_\alpha$.

Baker and Solon (1998), among others, have stressed that the simple error components model above has to be general enough to allow for some patterns in the earnings data. These patterns include, for example, serially correlated transitory components that fade within one or two years, a non-mean-reverting permanent component, a heterogeneous growth factor, and time-varying loading factors that capture the secular trend in the earnings components.

These extensions are well justified in the context of investigating trends in overall inequality and particularly in analyzing the role of individual heterogeneity in shaping lifetime inequality among individuals in all skill and gender groups. The present study, however, focuses on a less heterogeneous and smaller group of the population than used in previous analyses and it emphasizes the evolution of the transitory variance component of the earnings of unskilled workers. Furthermore, the restrictions on the sample and the balanced nature of the panel resulted in a limited number of usable data points for the construction of the empirical covariance matrix. Instead, a stripped-down version of the models of covariance structures that is capable of accounting for the time variation and serial correlation in the variance components is developed below and used in the rest of the analysis.

Consider, for example, a model of transitory earnings that follows a low-order ARMA process and a random individual effect for the permanent component, i.e.,

(5) $y_{it} = p_t \alpha_i + f_t \nu_{it}$

(6) $\nu_{it} = \rho \nu_{it-1} + \varepsilon_{it}$

where p_t and f_t represent, respectively, the scale factors on the permanent and the transitory components, and the transitory component follows an AR(1) process with coefficient ρ and innovations that are uncorrelated across time. The scale factors allow the transitory and permanent components of earnings to vary over time. Assume also,

(7) $E(\alpha_i) = E(\nu_{it}) = E(\varepsilon_{it}) = 0$, and

(8) $E(\alpha_i \nu_{it})$.

Equations (5) and (6) imply a covariance matrix $\Phi(b)$ with typical diagonal element given by

(9) $\text{var}(y_{it}) = p_t^2 \sigma_\alpha^2 + f_t^2 (\sigma_\varepsilon^2 / (1 - \rho^2))$, and typical off-diagonal element given by

(10) $\text{cov}(y_{it}, y_{i,\, t-k}) = p_t p_{t-k} \sigma_\alpha^2 + f_t f_{t-k} (\rho^k \sigma_\varepsilon^2 / (1 - \rho^2))$, $t \quad k$, and b is a vector of the parameters to be estimated. The basic unit of data analysis is a vector of the individual residuals, denoted $\tilde{y}_i$ where $\tilde{y}_i = [\tilde{y}_{i1}, \tilde{y}_{i2}, \ldots, \tilde{y}_{iT}]'$ which has dimension equal to the length of each panel, T, $\tilde{y}_{it} = LogY^*_{it} - f(X_{it}, \hat{\beta})$, and $\hat{\beta}$ is the least squares estimator of β. The empirical covariance matrix $\hat{C}$ is constructed as the outer product of these individual vectors,

(11) $\hat{C} = (1/N) \sum_i (\tilde{y}_i \tilde{y}_i)$,

where N is the total number of units in the data. There are a total of 300 distinct moments in $\hat{C}$ from the current sample. Following the recommendations of Altonji and Segal (1996) and the practices of similar studies in this area, the model parameters are estimated by using the equally weighted minimum distance (EWMD) estimator.

The Covariance Structure of the Earnings Panel

Descriptive Analysis of Earnings Data

The model in (2) implies that the variances and covariances in the data can be used to approximate the permanent and transitory variances of earnings. For example, the difference between the variance and the covariance estimators for each time period, i.e., the difference between the estimates for (3) and

(4), can be used to estimate the transitory variance. In this case, changes in the stability of earnings can be approximated by changes in the difference between the estimated variances and covariances.

These covariances are summarized for different lag orders in Figure 1. Generally, the variances and covariances tend to rise over time. There is a clear indication of a growing gap between the variances and the corresponding covariances especially during the later years of the sample. Because this gap can be viewed as an approximate measure of the transitory variance there is graphical evidence that earnings instability has increased during the more recent years of the sample. Moreover, earnings became more unstable throughout the 1980s despite the long economic expansion during the decade, exhibiting a marked departure from the general cyclical trend in those variances.

The covariances from the error components model in (2) can also be cast in a simple regression framework. The distinct second moment estimates in $\hat{C}$ are stacked in a vector m and can be viewed as related to a lower dimensional vector of population moments in $f(b)$ through the model $m = f(b) + \varepsilon$, where ε is a vector of sampling errors and we wish to estimate the parameter vector b. Assuming for the moment that $f(b)$ is linear in b, the model becomes $m = \mathrm{X}b + \varepsilon$, where the "explanatory" variables in X consist of an intercept term and a diagonal dummy variable, D. The diagonal dummy equals 1 if the corresponding element in m is a variance (i.e., if it falls on the main diagonal of C) and 0 if not, thus capturing the difference between the variances and covariances. The intercept term is therefore an estimate of the permanent variance, and the coefficient on D is an estimate of the transitory variance.

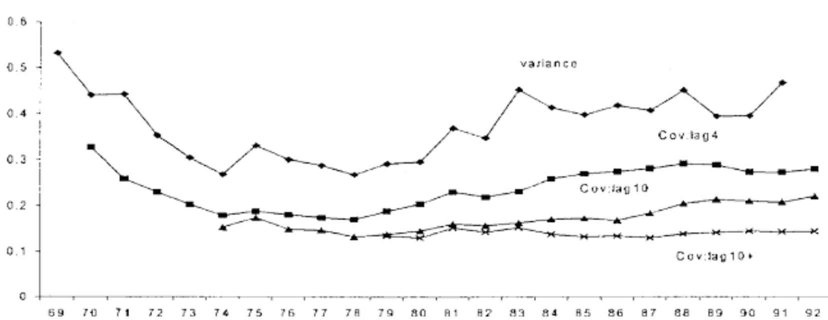

Figure 1. Sample Covariances at Selected Lag Lengths. From top line, respectively, are variances, and covariances at lags 4, 10, and more than 10. The covariances at lag i are calculated by averaging the first i covariances. The vertical difference between variances and covariances is an approximation of the transitory variances.

The results of this approximation are in the four columns of Table 1. The second column shows how the intercept term and the slope coefficients have trended over time by including a time trend and an interaction between the time trend and the diagonal dummy. The numbers indicate that the transitory variance trended at 0.0047 per year throughout the sample period.

The last two columns of Table 1 show that the transitory variance declined over the first sample period and exhibits a large growth in the second period, indicating once again a marked increase in earnings instability during the expansionary years of the 1980s.

The "Embellished" Error Components Model

As alluded to above, the simple decompositions above have many limitations. The sample variances and covariances in Table 2, for instance, indicate the presence of a long declining tail that tends to asymptote, mimicking an autoregressive process. In this section, time-specific factor loadings are also included on the permanent and the transitory components of earnings.

The estimation results from equations (5) and (6) are shown in Table 3. For comparison purposes, Column 2 presents estimates from fitting the earnings dynamics model with no calendar time effects but one with an individual effect and an AR(1) transitory term. All estimates are significant and there is evidence of a strong permanent individual component of earnings as well as a serially correlated transitory component that exhibits a degree of persistence.

Column 3 indicates that the transitory component still exhibits similar variance but one with a stronger indication of serial correlation. The year-specific factor loadings are reported in the second and fifth blocks of twenty-three rows, where, for identification purposes the estimates on p_{69} and f_{69} are set to equal one.

During the pre-1980 period, the factor loadings on the transitory component appear to be countercyclical, which is not the case for the post-1980 period. During the pre-1980 expansionary years of 1970 to 1973 and 1975 to

TABLE 1

Descriptive Covariance Regressions: D= Diagonal Dummy, T = Time Trend

Coefficient	1969–92(I)	1969–92(II)	1969–79	1980–92
Intercept	0.18(0.003)	0.27(0.005)	0.28(0.02)	0.33(0.008)
D	0.20(0.012)	0.08(0.02)	0.20(0.03)	–0.004(0.019)
T		–0.0005(0.00003)	–0.0029(0.0006)	–0.002(0.0001)
DT		0.0047(0.001)	–0.019(0.003)	0.015(0.0021)
R^2 Adj.	0.049	0.47	0.85	0.85

Note: Standard errors are in parentheses.

TABLE 2
Pooled Covariances and Correlations of Log Annual (Residual) Earnings: 1969–92 (by lag order)

Lag	Covariance	Correlation
0	0.38	1.00
1	0.27	0.72
2	0.24	0.64
3	0.22	0.59
4	0.21	0.56
5	0.19	0.52
6	0.18	0.49
7	0.17	0.46
8	0.16	0.44
9	0.16	0.43
10	0.15	0.41
11	0.15	0.39
12	0.14	0.38
13	0.14	0.38
14	0.14	0.36
15	0.14	0.35
16	0.13	0.34
17	0.13	0.32
18	0.13	0.31
19	0.13	0.30
20	0.13	0.28
21	0.12	0.26
22	0.12	0.23
23	0.12	0.23

1980, for example, the estimates on the transitory factor loadings appear to have consistently declined and become statistically insignificant during most of the 1975 to 1980 period. The parameter estimates exceed the zero statistical thresholds only in four out of the eleven years considered. By contrast, the 1982 to 1990 expansion produced a series of statistically significant and rising estimates on the factor loadings. In other words, estimates of the factor loadings trended upward despite the long expansion that took place during the post-1980 period, suggesting once again a rising instability of low-skilled workers' earnings during the period that spans the decade of high economic growth.

Although the focus here is on the transitory variance, it is instructive to note the parameter estimates for the permanent factor. The estimates show that permanent differentials started to increase in the early 1970s. The increase in the permanent variance is an indication of increases in within-group ine-

TABLE 3

Error Components Models for Log Annual Earnings, Annual Hours, and Hourly Earnings

Parameter	Annual Earnings: Random Effect + AR(1)	Annual Earnings: p_t(Random Effect) + f_tAR(1)	Annual Hours: p_t(Random Effect) + f_tAR(1)	Hourly Earnings: p_t(Random Effect) + f_tAR(1)
σ_a^2	0.18(0.0059)*	0.14(0.0048)*	0.02(0.007)*	0.109(0.005)*
$p_{69} = 1$				
p_{70}		0.92(0.0051)*	1.002(0.0068)*	0.93(0.005)*
p_{71}		1.03(0.0050)*	1.15(0.00611)*	1.01(0.004)*
p_{72}		0.95(0.0053)*	1.06(0.0067)*	0.99(0.005)*
p_{73}		0.94(0.0055)*	0.89(0.0082)*	0.97(0.005)*
p_{74}		0.86(0.0059)*	0.92(0.0083)*	0.98(0.0056)*
p_{75}		0.94(0.0055)*	1.22(0.0064)*	1.02(0.0054)*
p_{76}		1.05(0.0056)*	1.17(0.0068)*	1.08(0.0052)*
p_{77}		1.07(0.0058)*	1.02(0.0082)*	1.11(0.0053)*
p_{78}		1.04(0.0061)*	1.22(0.0071)*	1.07(0.0057)*
p_{79}		1.12(0.0061)*	1.21(0.0075)*	1.11(0.0058)*
p_{80}		1.22(0.0061)*	1.15(0.0082)*	1.13(0.0059)*
p_{81}		1.30(0.0062)*	1.37(0.0072)*	1.15(0.006)*
p_{82}		1.37(0.0064)*	1.43(0.0073)*	1.17(0.0062)*
p_{83}		1.55(0.0063)*	1.23(0.0088)*	1.18(0.0065)*
p_{84}		1.60(0.0066)*	1.19(0.0097)*	1.23(0.0067)*
p_{85}		1.56(0.0071)*	1.37(0.0090)*	1.25(0.0070)*
p_{86}		1.54(0.0077)*	1.36(0.0098)*	1.23(0.0076)*
p_{87}		1.57(0.0084)*	1.37(0.0107)*	1.21(0.0085)*
p_{88}		1.62(0.0092)*	1.52(0.0108)*	1.19(0.0096)*
p_{89}		1.46(0.011)*	1.44(0.0131)*	1.17(0.011)*
p_{90}		1.50(0.013)*	1.21(0.019)*	1.22(0.013)*
p_{91}		1.67(0.017)*	1.39(0.0233)*	1.17(0.019)*
ρ	0.53(0.108)*	0.61(0.016)*	0.49(0.03)*	0.63(0.012)*
σ_ε^2	0.12(0.0501)*	0.10(0.007)*	0.05(0.005)*	0.077(0.0054)*
$p_{69} = 1$				
f_{70}		0.81(0.072)*	0.99(.09)*	0.60(0.129)*
f_{71}		0.77(0.074)*	0.97(0.10)*	0.92(0.089)*
f_{72}		0.50(0.105)*	0.68(0.12)*	0.26(0.29)
f_{73}		0.21(0.241)	0.45(0.16)*	0.22(0.34)
f_{74}		–0.02(2.84)	0.67(0.12)*	–0.02(3.77)
f_{75}		0.40(0.127)*	0.77(0.11)*	0.25(0.30)
f_{76}		0.05(1.07)	0.51(0.15)*	0.39(0.20)
f_{77}		0.08(0.60)	–0.12(0.59)	–0.01(6.43)
f_{78}		0.02(2.12)	0.82(0.11)*	0.63(0.123)*
f_{79}		0.004(12.2)	0.72(0.12)*	0.56(0.14)*
f_{80}		–0.02(2.12)	0.0003(26.09)	0.002(40.8)
f_{81}		0.32(0.16)*	0.38(0.19)*	0.44(0.17)*
f_{82}		–0.10(0.48)	0.81(0.11)*	0.61(0.13)*

TABLE 3 CONT.

Error Components Models for Log Annual Earnings, Annual Hours, and Hourly Earnings

	Annual Earnings		Annual Hours	Hourly Earnings
Parameter	Random Effect + AR(1)	p_t(Random Effect) + f_tAR(1)	p_t(Random Effect) + f_tAR(1)	p_t(Random Effect) + f_tAR(1)
σ_a^2	0.18(0.0059)*	0.14(0.0048)*	0.02(0.007)*	0.109(0.005)*
f_{83}		0.56(0.09)*	0.94(0.10)*	0.45(0.17)*
f_{84}		0.34(0.15)*	0.65(0.13)*	0.85(0.09)*
f_{85}		0.25(0.20)	0.48(0.16)*	0.04(1.88)
f_{86}		0.41(0.13)*	0.56(0.14)*	0.11(0.72)
f_{87}		0.31(0.16)*	–0.0001(74.73)	0.02(4.39)
f_{88}		0.51(0.10)*	0.66(0.13)*	0.61(0.13)*
f_{89}		0.33(0.16)*	0.14(0.53)	0.21(0.38)
f_{90}		0.30(0.19)	0.30(0.26)	0.55(0.16)*
f_{91}		0.55(0.12)*	0.38(0.23)	1.07(0.09)*

Notes: Estimated models are

(1) Random Effect + AR(1): $\left\{ \begin{array}{l} y_{it} = \alpha + v_{it} \\ v_{it} = \rho v_{it-1} + \varepsilon_{it} \end{array} \right\}$ and

(2) p_t (Random Effect) + f_tAR(1): $\left\{ \begin{array}{l} y_{it} = p_t\alpha_i + f_t v_{it} \\ v_{it} = \rho v_{it-1} + \varepsilon_{it} \end{array} \right\}$.

The dependent variables for each column are the covariances of Annual Earnings, Annual Hours, and Hourly Earnings, respectively.

Asymptotic Standard errors are in parentheses.

* Indicates estimates that are statistically significant at the 5 percent level.

quality that precedes overall inequality by several years. From a separate data set, Katz and Murphy (1992) find that the rise in U.S. within-group inequality began in 1973, several years before most measures of between-group inequality began to rise. The results from PSID in this paper are therefore consistent with Katz and Murphy's observations from other samples.

Variations in Annual Hours of Work

To examine relative changes in hours and hourly earnings, annual earnings are decomposed into annual hours and average hourly earnings, and the covariance structures from the previous sections are imposed separately on hours and earnings. The dependent variables in these models are now average annual hours of work and hourly earnings.

The results from fitting the simple descriptive regressions on annual hours and wages are given in Table 4. All estimates are statistically significant, and

TABLE 4

Descriptive Regressions for the Sample Covariances of Log Annual Hours and Hourly Earnings

Coefficient	Annual Hours	Hourly Earnings
Intercept	0.03(0.001)	0.14(0.002)
D	0.10(0.004)	0.15(0.009)
adj. R^2	0.66	0.50

Note: Standard errors are in parentheses. *D* = diagonal dummy.

the estimate on the diagonal dummy indicates that hourly earnings appear to be more unstable than annual hours. The estimates from fitting the covariance structures implied by equations (5) and (6) are reported in the last two columns of Table 3. The estimates on the transitory variance components in Table 3 are displayed graphically in Figures 2 and 3 for hourly earnings and annual hours, respectively. The figures indicate that the transitory variance component of annual hours tends to remain high throughout the sample period. This is especially true when one considers the recessionary years of the early and mid-

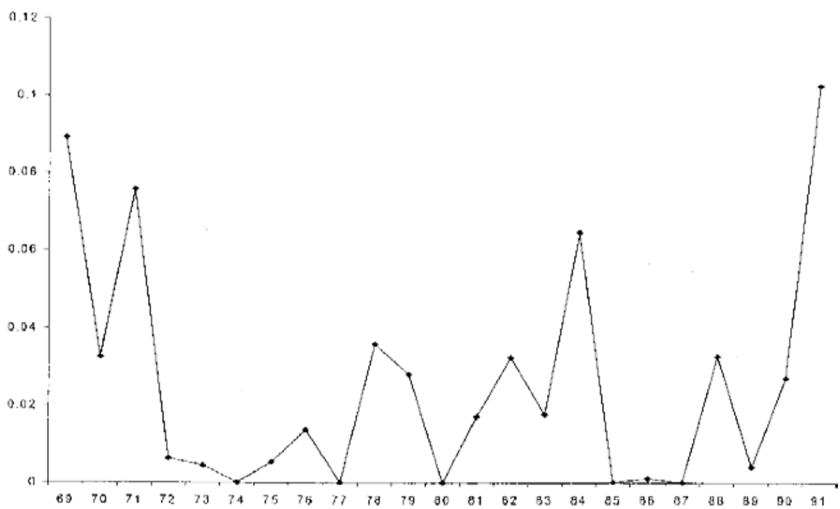

Figure 2. Transitory Variances of Hourly Earnings. Variances are calculated using the regression estimates for the scale parameters, the correlation coefficient, and the variance estimate for the transitory innovations and are based on equation 9 in the text, i.e.,

$$Var(v_{it}) = \hat{f}_t^2 \frac{\hat{\sigma}_\varepsilon^2}{1 - \hat{\rho}^2}$$

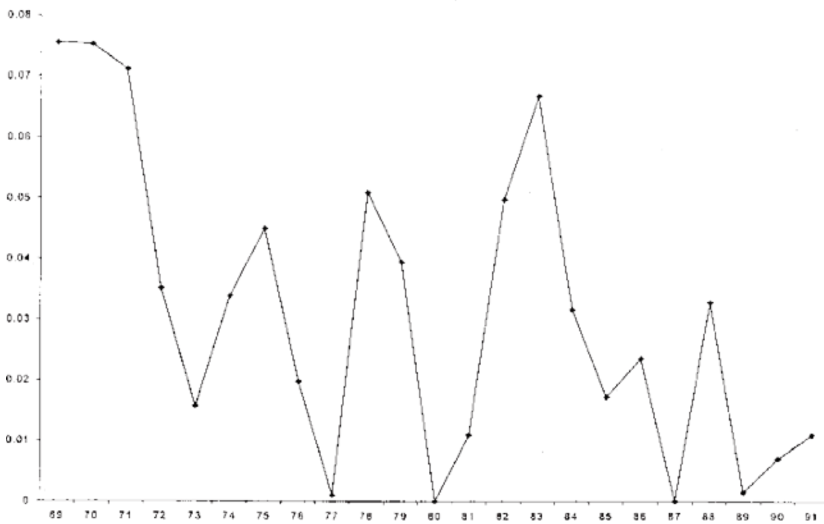

Figure 3. Transitory Variances of Annual Hours. See Figure 2 for explanations.

1970s and the early 1980s. A different picture emerges when we consider the time profile of transitory variances of hourly earnings. Higher variances become more frequent, particularly after the late 1970s, suggesting that wage variability, as opposed to hours variability, may have been the primary force behind the post-1980 earnings instability reported in the previous section.

Job Turnover

Another potential explanation for secular changes in transitory variances is the trend in job turnover rates. Documenting changes in job turnover rates, however, has become a controversial exercise. Studies based on the PSID and the Current Population Survey generally yield conflicting evidence on the trends in job stability. However, there is at least consistent evidence in most data of increased job turnover among the unskilled during the post-1980 period.

To assess the role of job instability, this section compares variance parameter estimates for "job stayers," defined as individuals who stayed with the present employer for more than the average tenure in the sample, and "job changers," those who stayed with their present employer for less than the same average. The estimates in Table 5 are obtained from running a regression of the type in Table 1 separately for the two groups.

TABLE 5

Regression Estimates of Transitory and Permanent Variances for the Earnings of "Job Stayers" (Tenure > Average Tenure) and "Job Changers" (Tenure < Average Tenure)

Variable	Coefficient
Job Stayers	
Intercept	0.030(0.0005)
D	0.024(0.002)
adj. R^2	0.34
Job Changers	
Intercept	0.032(0.0007)
D	0.037(0.002)
adj. R^2	0.43

Note: Samples are constructed from the PSID on the basis of the individual's reported tenure with the present employer.

The numbers indicate that while the estimates for the permanent variance components are virtually identical, the estimate for the transitory variance for job changers is substantially larger than the same for job stayers. In other words, while tenure differences, as to be expected, are not important in explaining permanent differences among workers, the increased tenure instability of the 1980s and the early 1990s has accounted for part of the corresponding earnings instability of less-skilled workers.

Conclusions

The findings above suggest that earnings became increasingly unstable in the second half of the sample period. Indeed, instability appears to have diminished during the early 1970s, suggesting that declining stability of earnings is presumably caused by changes that may have occurred during the 1980s. Moreover, periods of economic expansion that occurred during the 1970s tend to reduce the instability of earnings, consistent with what is expected. By contrast, earnings instability trended upward during the 1980s despite one of the longest peacetime expansions on record.

Studies have suggested that the high growth years of the 1980s failed to offset the incidence of high poverty unlike similar expansions during the previous decades. The present study is yet another indication of fundamental changes of the low-wage labor market of the 1980s and 1990s that may have transformed the dynamics of poverty as well as pay instability.

The results in this paper also suggest that tenure instability and limited access to credit and capital markets are issues that need to be taken into account in the design of effective income maintenance policies. While the above findings point to the need for further research to assess the determinants of instability, they are also suggestive of an important area that seems to have been overlooked in the design of policies as well as academic research.

Notes

1. Throughout the paper less-skilled workers are defined as individuals with no more than a high school education.

2. An obvious shortcoming of using a fully balanced panel as in the present paper is the inability to separate age effects from time effects. The results in this paper should be interpreted with this caution in mind. However, if age effects are primarily reflected in annual hours of work rather than hourly earnings, then separating the variance of annual earnings into the variances of annual hours and hourly earnings could provide an indirect but imprecise means to evaluate age and time effects. As the analysis in the next sections shows, the instability of hourly earnings mimics that of annual earnings, suggesting that perhaps age effects were not crucial in explaining the observed patterns in annual earnings instability.

3. Attrition in the PSID has been significant—reaching about 50 percent by 1988. Moffitt and Gottschalk (1995), among others, noted that the attrition has been mainly related to observables, and the sample weights have been adjusted to reflect this, considerably minimizing the bias in the selection.

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