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Skill Levels and the Cyclical Variability of Employment, Hours, and Wages

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This paper uses microeconomic panel data to examine differences in the cyclical variability of employment, hours, and real wages for skilled and unskilled workers. Contrary to conventional wisdom, it finds that, at the aggregate level, skilled and unskilled workers are subject to the same degree of cyclical variation in wages. However, the quality of labor input is found to rise in recessions, inducing a countercyclical bias in aggregate measures of the real wage. The paper also finds substantial differences across industries in the cyclical variation of employment, hours, and wage differentials, indicating important interindustry differences in labor contracting. [JEL E32, J31, J41]

WHILE IT HAS long been recognized that skilled workers face substantially lower cyclical variation in employment than unskilled workers, little evidence is available on the relative variation of their real wages over the cycle. Based largely on the work of Reder (1955, 1962), it has come to be widely accepted that wage differentials across skill levels are countercyclical. More precisely, the relative wage differentials between skilled and unskilled workers are believed to widen in recessions and narrow in booms. For instance, Azariadis (1976) brings this stylized

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fact to bear on his discussion of implicit contracts in the labor market, and Kydland (1984) discusses it in the context of his heterogeneous-agent business cycle model.

Most previous studies of wage differentials have used data that are aggregated based on some specific criterion of skill. For example, Reder (1955) divides the work force into skilled, semiskilled, and unskilled categories using job classifications and proceeds to look at average wage measures for each category. The use of such aggregate data may obscure the effect of substantial compositional changes in the work force over the cycle. In particular, systematic cyclical changes in the quality of the employed work force within specific job classifications may bias Reder's aggregate measurement of the cyclicality of wage differentials between skilled and unskilled workers.

Raisian (1983) was among the first to study the cyclicality of wage differentials using micro panel data to control for compositional changes in observed characteristics of workers and some unobserved measures of ability. He finds that workers with more work experience and longer tenure on their current job exhibit significantly greater procyclical variability in wages and weekly hours worked but less variability in annual weeks worked. Contrary to Reder's findings, Raisian concludes that relative wage differentials between skilled and unskilled workers are procyclical.

In this paper, we present new evidence on the cyclicality of wage differentials using micro panel data from the National Longitudinal Survey of Young Men, a panel containing 12 surveys over a period of 16 years. The long panel enables us to obtain efficient estimates of the interaction between skill levels and the cyclical behavior of real wages. Our estimates control for aggregation bias on the basis of observed worker characteristics and also for unobserved individual fixed effects. Another potentially important source of bias, referred to as selection bias, arises from the fact that in any period wages are observed only for workers who are employed in that period. By choosing only those person-year observations for which a wage is observed, estimated coefficients may pick up the effect of some unobserved component of ability that has a systematic effect on employment probabilities as well as on wages. We implement a maximum-likelihood version of Heckman's (1974) selection model to correct for such selection bias. This source of bias has not been dealt with in earlier studies of wage differentials.[1]

By controlling for observed worker characteristics and unobserved

[1] The magnitude of this bias in measuring the cyclicality of the average real wage may be substantial as shown in Keane, Moffitt, and Runkle (1988).

fixed effects and by correcting for selection bias, we are able to provide consistent estimates of the cyclical properties of offer-wage differentials. The offer wage for workers of a particular skill level is defined as the wage offered to a "representative" worker of that skill level, after controlling for heterogeneity within that skill category. Our results demonstrate that the two quantities discussed above, mean offer wages and average observed wages, have considerably different cyclical properties. This implies that changes in the average wage of employed workers are biased measures of changes in the mean of the offer-wage distribution, both at the aggregate level and within specific skill categories.

In our empirical work, we do not attempt to develop a single measure of skill level but, instead, examine a variety of plausible proxies for human capital. In particular, we focus on education levels, total labor market experience, and tenure on the current job. These variables arguably act as a proxy for different facets of human capital. Since Becker's (1962) seminal paper, it has been recognized that a careful distinction needs to be made between general human capital and firm-specific or industry-specific human capital. This distinction has implications for the effects of skills on employment, hours, and wage variability. Indeed, we find that our proxies for skills differ considerably in their effects on cyclical fluctuations in employment, hours, and wages.

We also provide results broken down by industry, in order to closely examine interindustry differences in the cyclical behavior of the wage premium for skills. In addition, we separately measure the cyclicality of employment and weekly hours worked. This enables us to estimate the relative magnitude of the variation in employment and weekly hours in accounting for cyclical labor input variation in different industries.[2]

A key finding of the paper is that, at the aggregate level, skilled and unskilled workers face almost the same degree of relative cyclical variation in wages. In other words, offer-wage differentials between skilled and unskilled workers are essentially acyclical. However, after controlling for other characteristics, older workers are estimated to have more procyclical wages.

Although their patterns of wage variation are similar, workers with a college degree have little cyclical variation in employment probabilities or weekly hours, while workers without a degree have employment probabilities and hours that are procyclical. The greater procyclical variation in employment and hours for nondegreed workers implies that the

[2] The standard measure of labor input is aggregate hours worked, which is the product of the number of persons employed and the average weekly hours worked (or the appropriate frequency).

average quality of labor input per manhour rises in a recession. It follows that a substantial countercyclical bias may exist in those measures of the real wage that simply divide aggregate compensation by total manhours. Our finding that the quality of the labor force rises in a recession is similar to that reported by Kydland and Prescott (1988), who use data from the Michigan Panel Study of Income Dynamics.

At the industry level, we find that the wage premium for skills is strongly procyclical in durable and nondurable manufacturing and is countercyclical in retail trade and services. In durable manufacturing, workers with a college degree have much more procyclical variation in wages than other workers. Educated workers in durable manufacturing have relatively less procyclical variation in employment probabilities and are actually found to have countercyclical variation in weekly hours.

Variation in average weekly hours accounts for only about 30 percent of the variation in total hours worked in the economy. However, in certain industries, such as nondurable manufacturing, variation in average weekly hours accounts for a substantial portion of the variation in total hours. These and other industry results indicate substantial intersectoral differences in labor contracting.

It is useful to discuss the relation between skill levels and employment, hours, and wage variability in the context of labor market contracting models. The next section of the paper surveys some theoretical models of labor market contracting and compares their implications. This provides a framework for analyzing and interpreting our empirical results. We follow with a section describing the econometric techniques used in the paper and another section describing the data set used in the estimation. Next, we detail our main results, concluding with a summary of the paper's findings and implications.

I. Conceptual Framework

The concept of a "skilled worker" is rather nebulous since the term "skill level" is often used as a portmanteau to refer to various aspects of human capital. The literature on human capital theory makes an important analytical distinction between general and firm-specific (or industry-specific) human capital (see Becker (1962)).[3] General human capital

[3] Notice that firm-specific and industry-specific capital are not necessarily identical. However, when issues of labor reallocation and wage dispersion are examined in the context of business cycles, the typical unit of analysis is the industry (for example, see Lilien (1982)). This is partly driven by the fact that industry-level data contain less measurement error. Also, the concept of a "firm"

increases the productivity of a worker in any firm. Such capital is assumed not to depreciate when a worker switches from one firm (or industry) to another. Firm-specific capital is, by definition, not transferable across firms. There is an element of risk to investment in such capital since a separation of the worker from the firm leads to the loss (or significant depreciation) of such capital. The real resource costs of investment in specific capital include training costs and forgone output from time spent training rather than directly producing output.[4] Workers may bear a portion of these costs by accepting a wage below their marginal product when they join the firm. This joint investment provides an incentive for both the firm and the worker to avoid a separation.

Specific human capital is key to many of the models of labor market contracting that have direct implications for the cyclical behavior of employment, hours, and wages for workers of different skill levels. These models may be classified into two broad categories. The implicit contract models of Azariadis (1975, 1976), Baily (1974), and Gordon (1974) imply the existence of wage-smoothing arrangements provided by firms for their workers. The implicit contract models of Hashimoto (1981) and Raisian (1983), on the other hand, imply the existence of labor contracts with more procyclical compensation for workers with higher skill levels. The main differences between these two sets of models arise from their assumptions regarding the rules that determine how the costs of investment in specific capital and the returns from it are shared by firms and workers.

The Azariadis-Baily-Gordon class of models postulates that risk-neutral firms may implicitly offer insurance to risk-averse workers by guaranteeing them relatively stable employment and wages when faced with uncertain demand for the firm's product. In its basic form, this theory suggests that all workers receive some form of employment or wage insurance, reflected in the weak response of employment and wage measures to demand shocks or other real shocks.

By incorporating firm-specific human capital, this theory can be extended to the case of risk-averse firms and heterogeneous workers. Risk-averse firms would, in general, not be willing to take on the risks posed by fluctuations in demand or productivity. However, if firms bear the cost of investment in specific human capital, they might be reluctant

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is much less well defined than that of an industry. Given these facts and the constraints on our data set, we refer to industry-specific and firm-specific capital interchangeably. Alternatively, we could use the notion of a representative firm in each industry as the unit of analysis.

4 Oi (1962) uses a similar notion of fixed hiring costs to model skilled labor as a quasi-fixed factor input.

to lose the specific capital embodied in their workers. When faced with adverse demand or productivity shocks that they perceive to be transitory, firms then have an incentive to retain workers with high specific skill levels. Thus, skilled workers may be offered contracts that, at business cycle frequencies, provide them with smoother wages and more stable employment patterns than unskilled workers.[5] Unskilled workers would simply be paid their marginal product in every period, and their employment would depend solely on current-period demand conditions. Hence, their employment and wages would tend to be strongly procyclical.

The Hashimoto-Raisian class of models has markedly different implications. The key underlying notion in these models is that specific capital involves a joint investment by the firm and the worker. Further, the returns from this form of human capital are assumed to be shared by the two parties. This gives both parties, the worker and the firm, an incentive to avoid a separation that would cause specific capital to be lost. Thus, workers with more firm-specific human capital would face a trade-off between employment and wage variability. Since such workers typically have higher incomes than unskilled workers, they are likely to have better access to asset markets where they could insure against income fluctuations. Consequently, skilled workers would be willing to accept more procyclical variation in wages than unskilled workers, in return for a greater degree of employment stability.

It follows from the above argument that the larger their share in the returns from specific capital, the more employment stability the skilled workers would value (or the more variability in wages they would accept in return for not being laid off).[6] However, it is likely that skilled workers face a greater degree of adjustment at the intensive margin (that is, weekly hours worked). In other words, firms may respond to downturns by laying off unskilled workers and reducing the hours worked by skilled workers. This implication follows from the assumption that specific human capital is unaffected by hours variation but depreciates if a firm and a worker are separated for one or more periods.

[5] Further, if a firm received the entire return from a worker's specific capital, it would be even more willing to assure him or her a relatively smooth wage in order to prevent a separation and the consequent loss of such specific capital. The precise extent of wage and employment smoothing would depend on the degree of the firm's risk aversion, the cost of specific capital investment, and the persistence of the shock, among other things.

[6] This argument implicitly assumes that temporary and permanent separations between a firm and a worker are equivalent in that they cause specific capital to depreciate fully. This is the limiting case of a more general argument that would hold if there was a sufficiently large depreciation in specific capital resulting from a temporary separation.

However, the Hashimoto-Raisian model could also be consistent with countercyclical hours variation for skilled workers. Since highly skilled workers in many industries typically earn salaries rather than hourly wages, working longer hours in a downturn may be a means of taking a temporary cut in hourly wages.

Thus, the Azariadis-Baily-Gordon and Hashimoto-Raisian models have similar predictions about employment variability: skilled workers should face less cyclical variation in employment. Neither set of models has a definitive implication regarding relative cyclical variability of hours for workers of different skill levels, although, in its simplest form, the Hashimoto-Raisian model implies that skilled workers face more procyclical variation at the intensive margin (hours worked).

The predictions regarding differences in wage variability across skilled and unskilled workers are diametrically opposed in these two sets of models. The Azariadis-Baily-Gordon class of models posits the existence of contracts that assure skilled workers of smoother wages and employment, thereby implying a countercyclical wage premium for skilled labor. This is consistent with the findings of Reder (1955, 1962), who uses aggregate data to show that skilled-unskilled wage differentials narrow in booms and widen in recessions. The Hashimoto-Raisian model, on the other hand, implies that workers with more specific capital face more variable wages. That is, skilled workers may have more stable employment but are subject to greater wage variability than unskilled workers. This implies procyclical wage differentials between skilled and unskilled workers. Raisian (1983) provides evidence in support of this view.

We attempt to provide an empirical resolution of this issue using a detailed set of micro survey data to correct for various potential sources of bias. In our empirical work, we use different proxies for skills in order to disentangle the various effects of human capital on wage and employment variability. The primary determinant of general human capital is education. The costs of such human capital investment are usually considered to be borne entirely by the worker, as are the returns accruing from it. It is also likely that measures of general human capital, such as education, are highly positively correlated with levels of specific human capital. For instance, workers with a college degree presumably have attributes that make them more efficient at acquiring specific capital. Thus, education levels are a good measure of general as well as specific human capital.

A more direct proxy for specific human capital is tenure on the current job (see Altonji and Shakotko (1987)). On-the-job training and learning-by-doing are likely to enhance skills that are of particular value to a specific firm or industry. Further, longer tenure arguably indicates the existence of specific capital that the firm and the worker are reluctant to lose.[7] Another useful proxy for human capital is total labor market experience, although it is not obvious what aspect of human capital this best measures. We use all three variables as proxies for skills and estimate a series of models that independently analyze their effects on wage and employment variability.

II. Econometric Framework

The basic regression model is as follows:

$$\ln W_{it} = \mathbf{X}_{it}\boldsymbol{\beta} + U_t\alpha + \boldsymbol{\mu}_i + \epsilon_{it} \qquad \forall i = 1,2,\ldots,N; \quad t = 1,2,\ldots,T. \tag{1}$$

The real hourly wage rate of individual i at time t is represented by W_{it}. $\mathbf{X}_{it}$ is a vector of observed individual-specific variables that affect this wage rate, with associated coefficient vector $\boldsymbol{\beta}$. In our application, we use the aggregate unemployment rate in the economy, U_t, as an indicator of the cycle.[8] α indicates the relation between the real wage and the business cycle. For instance, a negative estimate of α would imply that the average real wage declines when the aggregate unemployment rate rises (or that the average real wage is procyclical). $\boldsymbol{\mu}_i$ stands for a vector of unobserved individual-specific characteristics that are fixed over time. The elements of $\boldsymbol{\mu}_i$ may be correlated with $\mathbf{X}_{it}$. The regression error ϵ_{it} is assumed to be independently and identically distributed (i.i.d.).

We are interested in estimating the effects of observed measures of skills on the cyclicality of a worker's real wage. This is accomplished by including an appropriate interaction term as follows:

$$\ln W_{it} = \mathbf{X}_{it}\boldsymbol{\beta} + U_t\alpha + U_i E_{it}\gamma + \boldsymbol{\mu}_i + \epsilon_{it} \qquad \forall i = 1,2,\ldots,N; \quad t = 1,2,\ldots,T. \tag{2}$$

The variable E_{it} is a measure of skill level (it should also be included in $\mathbf{X}_{it}$). The coefficient γ on the interaction term $U_t E_{it}$ captures differences in the cyclicality of wages for workers with different skill levels. A positive estimate of γ would indicate a countercyclical wage premium for skills—

[7] Length of tenure is also a good measure of the quality of the match between a worker and a firm. Given the uncertainty inherent in job matching, workers and firms would both be reluctant to terminate a good match when faced with a temporary decline in demand or productivity. For our purposes, the quality of a job match may be considered part of a worker's specific capital.

[8] Our results were not significantly affected by the choice of the business cycle indicator. See the discussion in the next section.

that is, the skill premium increases when the unemployment rate rises. Conversely, a negative γ would indicate a procyclical skill premium.

Estimating equation (2) by ordinary least squares (OLS), with $\boldsymbol{\mu}_i + \epsilon_{it}$ being the composite error term, would yield biased estimates of $\boldsymbol{\beta}$ and γ unless the variables in $\boldsymbol{\mu}_i$ were uncorrelated with the regressors. In general, this is not likely to be true. Workers with a high (unobserved) value of $\boldsymbol{\mu}_i$ are high-ability workers. If high-ability workers were less likely to be laid off in a recession than were low-ability workers, the mean level of $\boldsymbol{\mu}_i$ among employed workers would covary positively with the aggregate unemployment rate. The correlation between such unobserved individual fixed effects and the unemployment rate would induce an upward (countercyclical) bias in the estimated coefficient on the unemployment rate. Similarly, if an unobserved component of ability were positively correlated with, say, the observed level of education, the estimated coefficient on the education variable would be biased upward.

The interaction coefficient γ is subject to similar bias. For instance, if an increase in the aggregate unemployment rate caused the average unobserved ability of workers in lower skill categories (those with lower values of E_{it}) to rise relative to the average unobserved ability of workers in higher skill categories, γ would be biased downward. This procyclical bias in the estimated cyclical variation of the skill premium would spuriously indicate a narrowing (or understate the increase) of the skill premium in a recession.

To deal with such unobserved individual fixed effects, we employ a fixed effects estimator by using OLS to estimate the following transformed equation:

$$\ln \tilde{W}_{it} = \tilde{\mathbf{X}}_{it}\boldsymbol{\beta} + \tilde{U}_t\alpha + \tilde{U_t E_{it}}\gamma + \tilde{\epsilon}_{it},$$

where

$$\ln \tilde{W}_{it} = \ln W_{it} - \frac{1}{T}\sum_{t=1}^{T} \ln W_{it},$$

$$\tilde{\mathbf{X}}_{it} = \mathbf{X}_{it} - \frac{1}{T}\sum_{t=1}^{T} \mathbf{X}_{it},$$

$$\tilde{U}_t = U_t - \frac{1}{T}\sum_{t=1}^{T} U_t,$$

$$\tilde{U_t E_{it}} = U_t E_{it} - \frac{1}{T}\sum_{t=1}^{T} U_t E_{it},$$

$$\tilde{\epsilon}_{it} = (\epsilon_{it} + \boldsymbol{\mu}_i) - \frac{1}{T}\sum_{t=1}^{T} (\epsilon_{it} + \boldsymbol{\mu}_i)$$

$$= \epsilon_{it} - \frac{1}{T}\sum_{t=1}^{T} \epsilon_{it}. \qquad (3)$$

This transformation subtracts out individual means over time for each variable, causing the individual fixed effects to drop out. The error term $\tilde{\epsilon}_{it}$ is i.i.d. and is uncorrelated with the regressors. Note that to implement the fixed effects model we need to leave out control variables that are constant over time or collinear with the time trend.

To estimate the cyclical behavior of wages and skill premia at the industry level, we could include interactions of U_t and $U_t E_{it}$ with industry dummies. Specifically, the following counterpart to the OLS model in equation (2) may be employed:

$$\ln W_{it} = \mathbf{X}_{it}\boldsymbol{\beta} + \sum_{j=1}^{J} I_{ijt} U_t \alpha_j + \sum_{j=1}^{J} I_{ijt} U_t E_{it} \gamma_j + \boldsymbol{\mu}_i + \epsilon_{it}. \tag{4}$$

I_{ijt} is a binary indicator variable that takes the value one if worker i locates in industry j at time t. Otherwise, I_{ijt} equals zero. The coefficients α and γ are now indexed by industry. For instance, γ_j is an estimate of the cyclical variation in the skill premium in industry j. With appropriate transformations of the variables as described in equation (3), a similar pooled regression could be used to estimate the fixed effects model at the industry level:

$$\ln \tilde{W}_{it} = \tilde{\mathbf{X}}_{it}\boldsymbol{\beta} + \sum_{j=1}^{J} I_{ijt} \tilde{U}_t \alpha_j + \sum_{j=1}^{J} I_{ijt} \tilde{U}_t E_{it} \gamma_j + \tilde{\epsilon}_{it}. \tag{5}$$

A potential problem with specification (5) is that it restricts individual fixed effects to be the same across all industries. This would bias the coefficients of industry-level estimates if there were industry-specific unobserved fixed effects that were correlated with any of the regressors.[9] Further, both equations (4) and (5) restrict the coefficient vector $\boldsymbol{\beta}$ to be the same across industries. This implies the strong assumption that the returns to observed worker characteristics are the same in all industries.

Apart from unobserved individual fixed effects and industry-specific effects, there remains another potential source of bias. All of the above discussion assumes that the mean of $\tilde{\epsilon}_{it}$ conditional on individual i being employed in period t is zero. But notice that wages are observed only for those individuals who are employed in a given period. If an unobserved component of ability that affected the wage rate for an individual was correlated with the unobserved component that affected that individual's probability of employment, we would be faced with a typical selection

[9] Industry-specific fixed effects are a potential problem only in the case of workers switching industries over the sample period. Workers who stay in one industry over the entire sample period would have their industry-specific fixed effects eliminated by the transformation described in equation set (3).

bias problem.[10] For instance, changes in U_t may cause workers with systematically high or low values of the time-varying unobserved productivity component (reflected in high or low values of $\tilde{\epsilon}_{it}$) to enter or leave employment in an industry. The effect of changes in average labor force quality resulting from the inflow or outflow of high or low productivity workers would then bias the unemployment rate coefficient. If, in addition, the magnitude of this effect differed by skill level, a fixed effects estimate of γ_j would be a biased estimate of the change in the mean offer-wage differential in industry j.

To eliminate the effect of cyclical changes in the composition of the work force induced by such systematic selection, we estimate the variability of mean industry offer wages for different classes of workers using a maximum-likelihood version of Heckman's (1974) self-selection model. This model estimates a wage equation for each industry jointly with a probit choice equation that determines whether a worker locates in that industry. The model is written as follows:

$$\ln W_{ijt} = \mathbf{X}_{it}\boldsymbol{\beta}_j + U_t\alpha_j + U_tE_{it}\gamma_j + \boldsymbol{\mu}_{ij} + \epsilon_{ijt},$$

$$\textit{observed iff } I_{ijt} = 1,$$

where $$I^*_{ijt} = \mathbf{Z}_{it}\boldsymbol{\theta}_j + U_t\delta_j + U_tE_{it}\eta_j + \Psi_{ij} + \omega_{ijt},$$

$$I_{ijt} = \begin{cases} 1 \textit{ if } I^*_{ijt} \geq 0 \\ 0 \textit{ if } I^*_{ijt} < 0 \end{cases}. \qquad (6)$$

Here I^*_{ijt} is the latent index of a probit employment equation that determines whether worker i is employed in industry j at time t. $\mathbf{Z}_{it}$ is a vector of individual-specific regressors that affect the probability of employment in industry j at time t. The corresponding coefficient vector is denoted by $\boldsymbol{\theta}_j$. Typically, $\mathbf{Z}_{it}$ contains elements that enter into $\mathbf{X}_{it}$ as well as some additional variables that may affect labor supply propensity but not worker productivity. Since our data set does not contain any variables that fall clearly into this category, we include the same set of controls in the wage and employment choice equations. Further, our results were not sensitive to the overidentifying restrictions of omitting variables from $\mathbf{X}_{it}$. Individual fixed effects in the employment choice equation are represented by Ψ_{ij}.

[10] It might appear, from the specification in equation (2), that individual fixed effects could be eliminated by first differencing the data. However, such a procedure may exacerbate this selectivity bias if there are any missing data, except under a set of restrictive conditions. This is because differencing would require selecting only those pairwise adjacent periods for which an individual has an observed wage in both. See Keane, Moffitt, and Runkle (1988, pp. 1238–44) for a detailed discussion.

We estimate binomial selection models separately for each industry. This allows fixed effects to vary across industries and, thus, obviates the potential bias from restricting the fixed effects for any given individual to be the same across all industries. Further, it allows the coefficient vector $\boldsymbol{\beta}$ to vary across industries.[11]

The error terms ϵ_{ijt} and ω_{ijt} are assumed to have a bivariate normal distribution with correlation ρ_j and respective standard deviations σ_{ϵ_j} and 1. The latter variance is normalized to one for identification of the probit choice equation. The parameter ρ_j, estimated from the cross-equation correlation between wage equation residuals and employment equation residuals, is crucial for correcting the selection bias. The sign of this correlation coefficient is informative. A negative estimate of ρ_j, for instance, would indicate that workers with a high transitory wage component are more likely to be laid off in a downturn. This would, if a selection correction is not employed, bias the estimated effect of the cycle on the real wage and the skill premium.[12]

The source of selection bias can now be demonstrated fairly easily. For instance, consider the coefficient α_j in the above wage equation. Under the distributional assumptions made above (and ignoring fixed effects for the moment), we have

$$\frac{\partial E(\ln W_{ijt} \mid I_{ijt} = 1)}{\partial U_t} = \alpha_j - \rho_j \sigma_{\epsilon_j} m_{ijt} \delta_j,$$

where $m_{ijt} = \lambda_{ijt} (\lambda_{ijt} + \mathbf{Z}_{it} \boldsymbol{\theta}_j + U_t \delta_j)$ and λ_{ijt} is the Mill's ratio. It can be shown that $m_{ijt} > 0$. Hence, the estimate of α_j is biased downward if ρ_j and δ_j have the same sign and is biased upward if they have opposite signs. The other coefficients in the wage equation are also affected by selection bias.

[11] Estimating a single, multinomial model with selection corrections would require sector-specific regressors in order to identify cross-correlations among the error terms in the choice equations. We do not have such regressors in our

[12] In the fixed effects selection model, estimates of the choice equation fixed effects are inconsistent for small T. Monte-Carlo experiments by Heckman (1981) show that this inconsistency is small for $T > 8$. In our data set, T is on average 6 (with a maximum value of 12), indicating that inconsistency is a potential problem. However, the estimated ρ in the model with fixed effects in both the wage and employment equations always went to 1 or -1. Hence, the results we report are from a model with fixed effects in the wage equation alone. This obviates the problem of inconsistency of the estimated fixed effects in the choice equation. Besides, consistent estimation of the choice equation parameters is not important for our main results. Further, in our estimates reported below, we obtain values of ρ close to zero. Hence, any transfer of inconsistency from the choice equation to the wage equation would be negligible.