WAGE FORMATION AND RECURRENT UNEMPLOYMENT

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ABSTRACT

Examination of cross-section data on non-contractual construction workers in Egypt reveals strong attachment to the sector despite extreme demand instability. Also present are statistically significant wage differentials between construction trades that cannot be attributed to differential costs of skill acquisition. These observations suggest that employers might be compensating their non-contractual workforce for recurrent unemployment so that they can rely on a steady supply of qualified workers. We rely on a static labor supply model and investigate the theoretical consequences of rationing, turnover, and randomness in employment and unemployment durations. Assuming that the risk-averse worker would demand an expected utility which is at least as high as the reservation utility provided in the unconstrained sector, we derive structural expressions that quantify the anticipated and unanticipated components of compensation for employment risk. To test the model we use data from two rounds of the labor force surveys conducted in 1988. The first data set allows us to construct trade-specific measures of risk based on information on individual spells of employment and unemployment. The second allows us to estimate a restricted version of our model based on quarterly information on aggregate unemployment experiences of the workers. We find strong evidence that workers are compensated for the anticipated component and weak evidence that they are compensated for the unanticipated component. The estimated magnitudes reveal that employers provide only partial compensation against recurrent unemployment.

Keywords: Compensating wage differentials, turnover, unemployment risk, duration of unemployment and employment, rationed labor supply, construction sector in Egypt.

JEL classification: J31, J41, J64.

1. INTRODUCTION

Most labor economists would agree that wages of apparently equal quality workers differ across sectors, employers, and even between workers in the same firm. However, when explanations for the source of the differentials are sought, stark differences in opinion emerge. One branch of literature, starting with Adam Smith's *Wealth of Nations*, views the differentials as a competitive phenomenon. Within this framework, each labor market transaction may conveniently be viewed as a tied sale in which the worker simultaneously sells the use of her/his labor, and buys the attributes of the job (Rosen, 1986). This suggests, for example, that wage differentials might capture the 'hazards' or 'joys' associated with different jobs. Another branch of the literature, going back to John Elliot Cairnes (1874) and John Stuart Mill (1909), attributes the differentials to the presence of noncompetitive elements. In the recent incarnations of this view, 'efficiency wage' or 'segmentation' arguments are used to explain the pattern of persistent differentials (Dickens and Katz, 1987; Krueger and Summers, 1988; Katz and Summers, 1989). A third approach of a more recent vintage attempts to determine if the differentials can be attributed to unobserved differences in ability (Murphy and Topel, 1987; Krueger and Summers, 1988; Gibbons and Katz, 1989).

When the whole economy is the subject of study, it is not entirely surprising that the data could be reconciled with apparently conflicting theoretical premises. After all, while competitive forces undoubtedly have a bearing on wage and earnings formation, imperfections of various sorts are also likely to be present at a given point in time, and may even withstand the passage of time. The role that can be attributed to elusive factors such as unobserved ability, propensity for shirking, and concern for worker morale may also change drastically as we move from one environment to another. This suggests that sharper conclusions concerning the root causes of wage differentials can be drawn by focusing on a particular sector or segment of an economy.

In this paper, we pursue this line of reasoning and study the wage formation process in the construction sector in Egypt. Our focus is of some historical significance, because it was in the context of the construction sector that Adam Smith motivated the idea of compensating wage differentials:

> "Employment is much more constant in some trades than in others. In the greater part of manufactures, a journeymen may be pretty sure of employment almost every day in the year that he is able to work. A mason or bricklayer, on the contrary, can work neither in hard frost nor in foul weather, and his employment at all other times depends on the occasional calls of his customers. He is liable, in consequence, to be frequently without any. What he earns, therefore, while he is employed, must not only maintain him while he is idle, but make him some compensation for those anxious and desponding moments which the thought of so precarious a situation must sometimes occasion." (Smith, 1976, p. 115.)

Smith substantiated his argument with data showing that wages of skilled construction workers were fifty to one hundred percent more than those of unskilled construction workers. He then pointed out that the requisite skills could be learned with ease, and reached the conclusion that "... high wages of those workmen, ... are not so much the recompense of their skill, as the compensation for the inconstancy of their employment" (p. 116).

In Tunali and Assaad (1992) we examined data on individual employment and unemployment spells obtained from the Construction Workers Survey, carried out in Egypt in March/April 1988, and found that unemployment was a frequently entered state. Our parametric predictions (reproduced below) indicated that the average worker was unemployed 20-74 percent of the time, depending on his trade. We also found substantial variation in spell durations. If workers anticipate this employment instability as a feature of their trade, wages are likely to adjust to ensure a steady supply of workers. The question that we pursue in this paper is whether observed differences in the wages of workers engaged in different construction trades are commensurate with the differences in their exposure to employment instability.

Wage differentials that could be attributed to differences in the unemployment experiences of workers have been investigated by Abowd and Ashenfelter (1981), Hutchens (1983), Topel (1984), Li (1987), Hamermesh and Wolfe (1990), Hatton and Williamson (1991), Anderson (1994), and Moore (1995). Like Abowd and Ashenfelter's, our theoretical framework generates two forms of compensation. The first has to do with the anticipated level of employment -- that is, the compensation that the workers will demand to work in the construction sector rather than in a sector where they can find continuous employment. Since there will be deviations from the anticipated length of time spent in the employed and unemployed states, risk-averse workers are likely to seek compensation for these variations as well. This presumption yields additional compensation terms.

We begin our empirical examination in section 2 with a short account of the key characteristics of the construction sector in Egypt based on our earlier work (Assaad and Tunali, 1997). Examination of cross-section data on non-contractual workers reveal strong attachment to the construction sector despite extreme demand instability. Also present are statistically significant wage differentials between construction trades which cannot be attributed to differential costs of skill acquisition. These observations suggest that employers might be compensating their non-contractual workforce for recurrent unemployment so that they can rely on a steady supply of qualified workers. In section 3 we establish the theoretical framework for our estimating equations and present the hypotheses to be tested. We take the unconstrained optimal labor supply choice of a wage-taking worker as our starting point. Subsequently we introduce rationing, and random employment and unemployment durations. Assuming that the risk-averse worker would demand an expected utility which is at least as high as the reservation utility provided in the unconstrained sector, we derive structural expressions that quantify the anticipated and unanticipated components of compensation for employment risk.

The methodological issues that arise in implementing the tests using a cross-section of workers constitute the subject of section 4. To test the model we use data from two surveys conducted in 1988. The first survey was specifically designed to study the construction sector in Egypt. It allows us to construct trade-specific measures of risk based on information on individual spells of employment and unemployment. The second permits us to estimate a restricted version of our model based on quarterly information on aggregate unemployment experiences of the workers. The empirical findings reported in section 5 establish the presence of systematic wage premia associated with employment instability. We find strong evidence that workers are compensated for the anticipated component and some evidence that they are compensated for the unanticipated component. The estimated magnitudes reveal that employers provide only partial compensation against recurrent unemployment. We offer a summary of the key findings and our concluding remarks in section 6.

2. THE CONSTRUCTION SECTOR LABOR MARKET IN EGYPT

Like its counterparts elsewhere, the construction industry in Egypt draws on skilled as well as unskilled labor, under a number of different employment arrangements. Bifurcation occurs along two principal dimensions. The first pertains to the nature of the employment relationship, and distinguishes workers covered by legally binding, written contracts from those who are not.[1] Workers in the first group are covered by stringent job security regulations and therefore rarely (if at all) experience any unemployment. We refer to these as *formal* workers. The second group -- whom we label *casual* workers – are dominated by workers who change jobs and employers frequently and are often unemployed between jobs.

The second dimension along which distinctions arise pertains to the tasks performed by the workers. Jobs requiring specialized skills are performed by craft workers, who are broken down further by trade (as masons, tile layers, form workers, joiners, plumbers, electricians, painters, plasterers) and by skill level (as apprentices, assistants, and craftsmen). Jobs involving menial tasks such as digging, mixing and carrying mortar, are performed by common laborers who lack specific skills. In what follows we capture this distinction by referring to craft workers as *skilled*, and to common laborers as *unskilled* workers.

Yet another common construction sector feature we encounter in Egypt is demand instability. As aggregate demand conditions vary, the regional mix of projects, and consequently the trade and skill composition of the demand for construction labor are altered. This subjects casual workers to substantial employment instability, with some trades facing considerably more variability than others. Evidently Adam Smith's observations still apply. Furthermore

[1] Egyptian labor regulations allow for two types of employment contracts: Permanent and temporary. Permanent contracts entitle workers to lifetime employment security after an initial probationary period of three months. Temporary contracts are fixed in duration and cannot exceed one year at a time. They are renewable only once and, if upon termination of the second term, the relationship with the employer is not terminated, the temporary contract is automatically converted into a permanent contract. Workers on temporary contracts can only be laid off at the close of the contract duration. Both types of contracts entitle workers to a number of employment benefits including social insurance, paid vacations, disability insurance, sick leave, etc. Workers on temporary contracts made up 17 percent of all contract workers in the CWS sample.

examination of average wage data for manual workers by industry in the Egyptian private sector reveals that construction workers are paid significantly more than other manual workers. The average daily wage for a casual construction worker in 1987 was 7.5 £E (Egyptian pounds) compared to 5.5 £E for the average manufacturing worker, and 4.8 £E for the average service sector worker (Assaad, 1991). Average daily wages for manual workers in construction enterprises of 10 or more workers were 6.5 £E, significantly higher than those of manufacturing and service workers in similar enterprises but lower than those of casual construction workers. Since there is no reason to believe that the average construction worker is significantly more skilled than the average manufacturing worker, these comparisons provide *prima facie* evidence that construction workers are being compensated for greater exposure to employment instability and unemployment.

By way of motivating our investigation, consider Figures 1 and 2, where we have plotted the mean (logarithmic) wage rate against the predicted unemployment rate (π_0) and incidence of unemployment (ϕ), using the averages for the eight worker categories we are able to distinguish in the 1988 Construction Workers Survey.[2] Here and below we focus on casual workers only.[3] Precise definitions of the two unemployment measures and the methodology used in estimating them are given in sections 4 and 5. For our present purposes it suffices to say that unemployment 'rate' captures the fraction of time spent in the jobless state, while unemployment 'incidence' measures how often a worker returns to that state.

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[2] The numbers plotted in Figures 1 and 2 may be found in Table 4.

[3] A broader examination of wage formation in the entire construction sector is the subject of Assaad and Tunali (1997).

The pattern in the aggregates is striking: Casual workers appear to be compensated for being subjected to employment instability. Higher wages support a higher expected probability of unemployment and higher incidence. In a hedonic framework, these represent the implicit prices that firms must pay for the ability to tap a reserve of ready labor. From the workers' point of view, wage premia emerge as an elementary form of insurance which compensate them for the risks of participation in the construction labor market.

Further examination of Figures 1 and 2 suggest that common laborers do not benefit from this elementary insurance scheme. Unlike craft workers whose trade-specific skills are not substitutable, unskilled workers can be easily replaced. Consequently employers might have little reason to offer incentives for keeping the latter in the construction sector. Conversely, common laborers have very little invested in skills specific to the construction sector. Unlike the craftsmen who spend their early years as low-paid apprentices and assistants, they can reap immediate benefits to their manual labor when the demand is there, and turn to other work (such as loading and unloading trucks, ships, etc. and day labor in agriculture) at other times.

The patterns in Figures 1 and 2 pertain to bivariate associations. It remains to be seen if we can uncover a compensatory link between employment instability and wages using micro data, after correcting for worker heterogeneity and selectivity into the tiers of the construction labor market. The basic question however, remains the same: Do workers receive wage premia commensurate with the employment instability they have to shoulder as members of a particular construction trade? In the next section we lay out a theoretical framework designed to isolate the components of the wage premia that construction workers receive to compensate them for the expected unemployment and the instability of employment in their trades.

3. A MODEL OF COMPENSATING DIFFERENTIALS

Models used in pursuit of compensating differentials vary in several respects. To begin with, different assumptions are made regarding the worker's utility function. Topel (1984) assumes a utility function with total consumption as a single argument, which is the sum of market and non-market consumption. Hamermersh and Wolfe (1990) express utility as a von Neumann-Morgenstern function of lifetime consumption. The most common specification treats utility as a function of current consumption and leisure (Abowd and Ashenfelter, 1981; Murphy and Topel, 1987; Gaston and Wright, 1991). Since construction workers appear to consume large chunks of leisure, we adopt the last specification.

A second feature that distinguishes various models presented in the literature is the relationship between income and consumption. Since consumption is usually unobservable, it is either assumed that workers do not save, so that consumption is equal to income in any given period (Abowd and Ashenfelter, 1981; Anderson, 1994), or that they have access to perfect capital markets, so that what matters is permanent income or lifetime consumption (Topel, 1984; Hamermesh and Wolfe, 1990).[4] Capital markets are not very well developed in Egypt, and casual construction workers rarely have access to them. Workers are generally quite poor and are thus unlikely to posses any assets that provide them with unearned income. This fact, coupled with the absence of an unemployment insurance system for construction workers, suggests that workers have to self-insure in order to smooth consumption. A static utility specification where consumption equals earnings turns out to be sufficient for formalizing the self-insurance motive.

[4] Murphy and Topel (1987) estimate a model in which consumption is some linear combination of what it would be under each of the two assumptions.

We initially assume that workers are homogeneous and that they possess a well-behaved utility function defined on annual consumption and leisure, $V(c,l)$.[5] We choose the consumption good as the numeraire and normalize total time to 1. Let h^* denote the optimal amount of labor a worker will supply during the reference period when faced with the wage rate w^*, the equilibrium wage rate in the absence of constraints on the amount of labor each worker can supply. We term w^* the opportunity wage, and h^* the unconstrained (optimal) labor supply. Under the assumption that consumption is equal to earnings,

(1) $$\max_{c,l}\{V(c,l);\quad c+w^*l\le w^*\}=V(w^*h^*,\quad 1-h^*)\equiv V^*.$$

The typical worker faces a different situation in the construction sector: Jobs are project-specific, and are often followed by an unemployment spell. A worker who anticipates to be involuntarily unemployed for a certain proportion of the time will require compensation for that fact if he is to stay attached to the construction sector. If a worker is constrained to supply a quantity of labor $\bar{h}<h^*$ during the reference period, the minimum wage rate he is willing to accept has to satisfy $w_1>w^*$ and is defined by the identity

(2) $$V(w_1\bar{h},\quad 1-\bar{h})=V^*.$$

To derive empirically tractable expressions for the equalizing difference we follow the literature on rationed demand (Deaton and Muelbauer, 1981; Neary and Roberts, 1980) and work with the dual of the worker's utility maximization problem. As shown in the appendix, we obtain the following second order approximation:

(3) $$\frac{w_1-w^*}{w^*}\cong\frac{1}{2\eta}\frac{(\bar{h}-h^*)^2}{\bar{h}h^*},$$

[5] We later introduce worker heterogeneity, but maintain the assumption of identical preferences.

where $\eta = \left(\frac{\partial h^*}{\partial w^*} \right) \frac{w^*}{h^*} > 0$ is the compensated labor supply elasticity. This term is the same as that derived in Abowd and Ashenfelter (1981), specialized for the case without unemployment insurance.

Since our measures of compensation will be based on information on the durations of the last employment and unemployment spells for each worker rather than the number of hours employed and unemployed in a given year, we specialize expression (3) further. Let y_e denote the random duration of a spell in state e (=0 if unemployed, =1 if employed) measured in days and define $\mu_e \equiv E(y_e)$ and $\sigma_e^2 \equiv \text{var}(y_e)$. During a fixed time interval of length D days, this worker will expect to go through $\varphi = D/(\mu_0 + \mu_1)$ job cycles and anticipate spending a total of $\varphi\mu_1$ days in the employed state, and $\varphi\mu_0$ days in the unemployed state. Consequently he will be unemployed for a proportion $\pi_0 = (h^* - \bar{h}) / h^* = \mu_0 / (\mu_0 + \mu_1)$ of the time. Thus the equation for the first compensation component may be expressed as

(4) $$\frac{w_1 - w^*}{w^*} \cong \gamma_1 \frac{\pi_0^2}{(1-\pi_0)},$$

where $\gamma_1 = 1/2\eta > 0$, and π_0 may be termed the unemployment rate.

In deriving (4) we ignored the intermittent nature of employment. If job dislocation and search are costly, workers will care about the frequency of turnover. Assuming that each job change involves a fixed cost of b, the consumption of a rationed worker is reduced by the amount $b\varphi$. The minimum acceptable wage w_2 that compensates the worker for turnover costs has to satisfy

(5) $$V(w_2\pi_1 - b\varphi, \quad \pi_0) = V(w_1\pi_1, \quad \pi_0),$$

where $\pi_1 = 1 - \pi_0$. Upon equating the consumption terms in (2), the compensation needed for restoring the worker to his former level of utility may be expressed as:

$$(6) \qquad \frac{w_2 - w_1}{w^*} = \gamma_2 (\frac{1}{\mu_1}) ,$$

where $\gamma_2 = b/w^*$ measures the cost of a job change as a fraction of the opportunity wage. Note that γ_2 and μ_1 have the same units: γ_2 measures turnover cost in days of work foregone.

Equations (4) and (6) capture the compensation needed for the anticipated component of job instability. Risk-averse workers are likely to seek additional compensation for the unanticipated risk, induced by the variations in the lengths of their employment and unemployment spells and the consequent variation in the frequency of turnover. Abowd and Ashenfelter (1981) take this risk into account by assuming that the proportion of the time spent in the employed state $\tilde{h}$ is a random draw from a distribution with expected value $\bar{h}$ and constant variance. In our case, we have two independent sources of randomness, y_0 and y_1. Assuming that workers have a von Neumann-Morgenstern utility function, the wage rate w_3 that restores the reservation level of utility satisfies

$$(7) \qquad EV(\frac{w_3 y_1 - b}{y_0 + y_1}, \quad \frac{y_0}{y_0 + y_1}) = V(w_2 \pi_1 - b\varphi, \quad \pi_0) ,$$

where E(.) denotes the mathematical expectation operator.[6]

[6] Option price theory points out that risk can be advantageous. For example, workers would opt for employment variability if they can work long hours when wages are high, and can take time off when wages are low (Gaston, 1991; Gaston and Wright, 1991). This line of reasoning yields $w_3 < w_2$. In our compensating differentials framework, whether risk is a 'good' or a 'bad' is a testable proposition.

In the appendix we derive the following expression for the wage premium that compensates workers for risk:

(8) $$\frac{w_3 - w_2}{w^*} \cong \gamma_3 \frac{1}{(\mu_1 - \alpha)} \sigma_0^2 + \gamma_4 \frac{(\mu_0 + \alpha)}{(\mu_1 - \alpha)^2} \sigma_1^2 .$$

Here $\gamma_4 > 0$, $\gamma_4 > \gamma_3$, and $\alpha = (w^*/w_3)\gamma_2$ is the cost of turnover expressed as a fraction of w_3.

The nature of the equilibrating premia can be illustrated with the help of Figure 3. The point of reference is the unconstrained worker, who chooses the bundle $\{w^*h^*, l^*\}$, $h^* = 1 - l^*$, when faced with the opportunity wage rate w^*, and enjoys the reservation utility $V(w^*h^*, l^*) = V^*$. When the employment constraint $\bar{h}$ is imposed, the worker is stuck with less than the optimal amount of consumption and more than the optimal amount of leisure ($\bar{l} > l^*$). For the worker to accept this constraint, the employer has to pay him a wage premium of $w_1 - w^*$, which restores the worker to his reservation utility V^*. As seen in the figure this wage premium does not compensate the worker fully for his income loss: $(w_1 - w^*)\,\bar{h} < w^*(h^* - \bar{h})$. This is because the rationed worker values leisure as well as consumption.

The wage rate w_2 compensates the worker for turnover costs. The dashed budget line that has slope $-w_2$ incorporates the costs of turnover, $b\varphi = (w_2 - w_1)\bar{h}$. Since it passes through the rationed equilibrium point $\{w_1\bar{h}, 1 - \bar{h}\}$, the worker is secured the reservation utility V^*. Finally, because employment and unemployment spells are random, a worker who accepts to work at the wage rate w_2 can end up anywhere along the solid budget line with slope $-w_2$. Not all points are equally likely, however. The distributions of employment and unemployment spells define a probability measure along this budget line. If the worker is risk-averse, he will demand compensation for the fluctuations in his utility level. For a worker who has a von Neuman-

Morgenstern type utility function, the compensation has to be such that the expected utility associated with the random bundle $\{w_3\tilde{h}, \tilde{l}\}$ restores the worker to his reservation utility V^*. This situation is illustrated with the outermost budget line which has slope $-w_3$. The worker who anticipates working a proportion $\bar{h} = 1 - \bar{l}$ of the time will be indifferent between facing the variation along the outermost budget line and giving up consumption equal to the amount $(w_3 - w_2)\bar{h}$ as long as employment and unemployment spells are non-random.

4. EMPIRICAL STRATEGY

Based on the theory of the previous section, construction sector wages are formed as:

$$(9) \qquad \ln w = \ln w^* + \gamma_1 \frac{\pi_0^2}{1-\pi_0} + \gamma_2 \frac{1}{\mu_1} + \gamma_3 \frac{1}{(\mu_1 - \alpha)} \sigma_0^2 + \gamma_4 \frac{(\mu_0 - \alpha)}{(\mu_1 - \alpha)^2} \sigma_1^2 + \xi$$

where w^* denotes the opportunity wage in the unconstrained sector, and ξ is the approximation error. We follow the literature and express (the natural logarithm of) the opportunity wage as a linear function of observed human capital characteristics. Providing that the unknown quantities $\pi_0, \mu_0, \mu_1, \sigma_0^2,$ and σ_1^2 can be estimated from the data and ξ has the requisite properties, α and the parameters in (9), γ_1, γ_2, γ_3, γ_4 may be estimated using iterative linear regression to test the above model of compensating wage differentials. In what may be termed the qualitative test of this model, evidence in favor of $\gamma_1 > 0$ and $\gamma_2 > 0$ would indicate that the workers are being compensated for the anticipated components of the recurrent unemployment imposed on them. Evidence supporting $\gamma_3 > 0$ and $\gamma_4 > 0$ would indicate that they are being compensated for the risk associated with the unanticipated component as well. Stronger tests of the model might entail hypotheses concerning the magnitudes of the labor supply elasticity η and the ordering of the coefficients on the unanticipated risk components.

As we discuss in some detail in section 5.2, the first stage in our empirical investigation entails estimation of parametric duration equations based on data on individual spells. In our detailed investigation the Weibull specification could not be rejected (see Tunali and Assaad, 1992). When this restriction is imposed in (9), the estimating equation simplifies to:

$$\ln w = \ln w^{*} + \gamma_1 \frac{\pi_0^2}{1-\pi_0} + \gamma_2 \frac{1}{\mu_1} + \gamma_3 \frac{\kappa_0 \mu_0^2}{(\mu_1 - \alpha)} + \gamma_4 \frac{(\mu_0 - \alpha)\ \kappa_1 \mu_1^2}{(\mu_1 - \alpha)^2} + \xi \,, \tag{10}$$

where κ_e denotes the square of the coefficient of variation (with e = 0 for unemployment, = 1 for employment durations) and is determined entirely by the Weibull shape parameter.

With $\ln w^{*} = \beta' x$, a linear function of the vector of human capital variables x, the estimated models are of the form

$$\ln w = \beta' x + \theta(\mu_0, \mu_1, \sigma_0^2, \sigma_1^2) + \xi \tag{11}$$

where $\theta(\mu_0, \mu_1, \sigma_0^2, \sigma_1^2)$ denotes the compensation component, and ξ denotes the disturbance term. Equation (11) is in the form used widely in the literature on compensating differentials. The compensating differential paid to a worker, relative to the workers opportunity wage is equal to ($\exp\{\theta\}-1$) where θ is the shorthand for $\theta(\mu_0, \mu_1, \sigma_0^2, \sigma_1^2)$. This measures the differential paid to workers who experience some unemployment relative to a reference worker who does not.

To form our estimates of the trade-specific compensation components, we relied on the duration estimates reported in Table 2 and the unemployment incidence probability estimates reported in Table 3. The latter were used to adjust for the presence of workers in our sample who had not experienced any unemployment in the past year. Letting p denote the predicted unemployment incidence probability, and m_e denote the mean unemployment (e = 0) and employment (e = 1) duration predicted from the estimates reported in Table 2, for each worker the mean duration of unemployment was estimated as

(12) $$\hat{\mu}_0 = p\, m_0,$$

and the mean duration of employment was estimated as

(13) $$\hat{\mu}_1 = p\, m_1 + (1 - p)\, 365,$$

where m_1 was truncated from above at 365 days. For each individual, we then obtained the estimated rate of unemployment as

(14) $$\hat{\pi}_0 = \frac{\hat{\mu}_0}{\hat{\mu}_0 + \hat{\mu}_1}.$$

We then formed trade-specific estimates of the anticipated risk components using within-trade averages of $\hat{\mu}_0, \hat{\mu}_1$ and $\hat{\pi}_0$ (estimate π_0 first, average later). As a check on the sensitivity of our results to the averaging method, we also used an alternate estimate of π_0 based on the trade-specific averages of the μ's (average μ's first, estimate π_0 later).

Estimation of the variance of unemployment and employment durations σ_0^2 and σ_1^2 is more challenging. Since all we have is single spell data, we formed our estimates using within-trade variations in the predicted durations. This ignores the fact that the predictions have been obtained from a Weibull model. When that information is utilized, we end up with (11). In this case estimates of κ_0 and κ_1 are readily available.[7] Consistency of μ_0, μ_1, π_0, κ_0, κ_1 follows from

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[7] Suppose y ~ Weibull, and let $h(y) = \delta\lambda^{\delta}y^{\delta-1}$ denote the hazard function, where λ and δ are the location and shape parameters respectively. Then

$$E(y) = \lambda^{-1}\,\Gamma(1+ 1/\delta),$$
$$V(y) = \lambda^{-2}\,[\Gamma(1+ 2/\delta) - \Gamma(1+ 1/\delta)],$$

the fact that maximum likelihood methods were used to obtain the estimates reported in Table 2 and 3.

Our empirical strategy for generating the measures of the compensation components is in keeping with the usual methodology followed in the literature on inter-industry wage differentials.[8] The premise is that workers will base their calculations on the average conditions that permeate their trade. CWS data set provides us with a snapshot of the employment experiences of the workers in the construction sector as represented by two random samples, one each from the distribution of unemployment and employment spells. Since structural aspects of the construction sector (such as trade membership, type of employer, and regional variables) capture the bulk of the variation in spell lengths, it makes sense to treat the within-trade distribution across individuals as the relevant distribution for each individual.

When the Weibull restriction is imposed, the squared coefficients of variation κ_0 and κ_1 are constant across trades because the same duration model is estimated for all workers. Our sample sizes do not permit examination of broader specifications. Thus in equation (11) cross-trade differences in the employment and unemployment durations constitute the only sources of variation in the magnitudes of the compensation components.

Our final methodological point has to do with an implication of using generated regressors. It is well-known that this results in downward biases in the standard errors produced by statistical packages (Newey, 1984; Pagan, 1984). Nevertheless we chose not to adjust the

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where Γ(.) denotes the Gamma function (Lancaster, 1990, p.37). It follows that for $e = 0,1$:

$$\kappa_e = \sigma_e^2/\mu_e^2 = [\Gamma(1+ 2/\delta_e)/\Gamma(1+ 1/\delta_e)] - 1.$$

[8] Exceptions include Abowd and Ashenfelter (1981) and Topel (1984) who exploit the panel aspect of the data sets to construct individual-specific measures.

standard errors. Since the generated regressors we rely on in this paper are averages, the biases are likely to be negligible.

5. EMPIRICAL RESULTS

5.1 The Data:

Our primary data source, the Construction Workers Survey (CWS), was carried out in March/April 1988. The survey and the data are described in detail in Tunali and Assaad (1992). The CWS provides information on employment and unemployment durations, as well as specific information on current or last job held, such as type of employer, type of construction project, and wage. Conventional human capital characteristics of the worker, such as education and labor market experience, and the skill classifications used in the construction sector are known. Our secondary data source is the October round of the 1988 Labor Force Sample Survey (LFSS88). LFSS88 provides information on most of the variables used in the primary analysis. The exceptions and caveats are given in section 5.5, where we discuss the estimation results based on LFSS88. Additional information on the Egyptian Labor Force Sample Surveys may be found in Assaad (1997).

In Table 1, we provide a detailed breakdown of our sample of 314 full-time casual construction workers, all of whom work for time wages. The sample excludes any craft workers who are still in training, such as apprentices and assistants, because their wage formation process is distinctly different from that of fully trained journeymen or common laborers. Since employment and unemployment durations are affected by the worker's trade and skill level, the nature of his employer, and the type of project he works on, we examine these variables next. Among casual workers 24 percent are attached to regular employers. Although their employers are under no contractual obligation to rehire them, or to employ them for a predetermined period of time, and the attached workers are under no obligation to turn down offers from other employers, they nevertheless work for the same employer most of the time. Our sense is that attached workers are preferred because information problems are mitigated through repeated encounters. The unattached workers frequently move among employers as they move among construction sites.

About half of the workers in the sample are employed by private contractors. The second largest employer group is other craftsmen (39 percent). A substantial minority (15 percent) are hired directly by the client who commissions the construction project. Nearly 90 percent of workers in the sample worked on residential construction as opposed to commercial or infrastructure projects. Finally, the data set includes information on the worker's community of residence, including an index of concentration of construction workers and an index of construction activity.[9]

5.2. Durations of employment and unemployment:

The duration information we rely on comes from the incomplete spell occupied by the worker at the time of the survey, and the completed spell that preceded it. Workers were considered unemployed only if they were not working due to lack of acceptable employment opportunities. Periods of rest and vacation were not considered as interruptions in the employment spell. The duration equations were estimated conditional on having occupied the state (employed or unemployed) for at least one day during the preceding year. In our sample of 314 casual workers, 17 had an unbroken employment record spanning the entire year. All were attached to a regular employer. Deletion of these observations brought the sample size in the unemployment duration equation down to 297. Of the 314 workers in our working sample, 208 (66 percent) had censored employment spells. Of the 297 workers for whom we were able to examine unemployment spell lengths, 130 (44 percent) had censored spells. Maximum Likelihood estimates of the duration equations obtained under the Weibull parametrization are reported in Table 2.[10] Based on likelihood ratio tests, the models fit well. What is immediately apparent is that productivity traits captured by conventional human capital variables are irrelevant in influencing who stays on the job longer, or how long each worker lingers in the unemployed state. To the degree that human capital matters, it is through trade membership and skill classification. Two types of variables stand out as primary determinants of employment duration. These are the input requirements of the construction projects (as captured by type of employer and type of project) and the regional demand conditions (as captured by the region dummies and the index of construction activity). Regional variations in unemployment durations are also discernible. There is mild evidence that likelihood of exit from the unemployed state decreases over time, perhaps because employers are able to sort out potential employees by questioning them about their employment record.

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[9] The derivations of the indices are explained in Tunali and Assaad (1992).

[10] These correspond to the reduced form specifications reported in Tables 3 and 4 in Tunali and Assaad (1992), except apprentices and assistants whose wage formation process differs from craftsmen, have been excluded from the working sample. We found considerable heaping of reported durations longer than one month around integer multiples of 30 days. To minimize the impact of noisy information about exit times recorded in the upper tail of the spell distributions, we artificially censored all long spells at 60 days. The Weibull parameterization held up well in the diagnostic tests we conducted in that paper. Further, estimates were found to be robust to changes in the artificial censoring date.

There are statistically significant differences across trades. With form workers as the reference category, we find that joiners have much longer employment durations while electricians and plumbers have much longer unemployment durations. Attachment to a regular employment nearly doubles the length of the employment spell. However, it does not influence length of the unemployment spell in a statistically significant manner.

Maximum Likelihood probit estimates of the incidence of unemployment are reported in Table 3. The explanatory variables are the same as those used in the employment duration equation. The sample size is 292, because all 22 masons in our sample experienced unemployment. The model fits well according to conventional goodness of fit criteria. Since the qualitative patterns are similar to those encountered in Table 2, we refrain from further discussion of the probit results.

5.3. Quantifying employment instability:

In section 2 demand instability and heavy reliance on craft skills were identified as key features of the construction sector in Egypt. Since skills are not substitutable across trades, casual workers are subjected to substantial employment instability. The magnitude of this instability, and the sizeable differences between the trades are documented in Table 4. We find that the average employment duration for the joiners in our sample is 181 days. The average for the electricians and plumbers is 156 days. For members of other trades, the average employment duration varies between 24 and 74 days. Unskilled workers on average spend 42 days on the job before returning to the unemployed state. There is considerable within-trade variation in the predicted employment durations. This has to do with the dependence of the length of the employment spell on the type of project.

What distinguishes joiners, electricians and plumbers from other craftsmen is their ability to smooth demand. The typical joiner divides his time between building various items to fill special orders, mounting finished items on the construction site, and stockpiling inventories of widely used items (such as standardized door and window frames). The typical electrician or plumber can extend employment spells by engaging in maintenance activity. Members of other trades do not have the option of riding lean times productively. They work on a particular construction site when they have a job; otherwise they do not work.

The group that faces longest unemployment spells consists of electricians and plumbers, who on average spend 73 days between job spells. This figure seems very high. Recall that electricians and plumbers constituted the largest segment of the construction labor force under contracts (51 percent of all craft workers). On the basis of casual impressions gained during visits to coffee shops, it appears that casual electricians and plumbers face stiff competition from their counterparts in the contract segment when short-duration maintenance and repair jobs come up. Since moonlighting contract workers can not hold a regular daytime construction job in the casual job market, casual electricians and plumbers specialize in long-duration projects that arise infrequently.

Other craftsmen on average spend between 18 and 39 days between job spells depending on their trade. Once again, there is considerable within-trade dispersion, perhaps because of regional differences in the arrival rate of job offers across trades. Common laborers experience the shortest average unemployment spell, at 10 days.

In subsequent columns of Table 4 the alternate estimates of the trade-specific unemployment rates, and the first compensation term are reported. Note that the values obtained by estimating first and averaging later [labeled (a)] are larger than the values obtained by averaging first and estimating later [labeled (b)]. Using the smaller estimates we see that joiners experience the lowest mean unemployment rate (13 percent), followed by plasterers and unskilled workers (20 percent). Craftsmen in other construction trades face unemployment rates in the 32 to 51 percent range.

5.4. Multivariate analysis of compensating wage differentials:

(This section is somewhat preliminary – in an effort to send the paper on time, we are able to report our results in a very cursory manner, without the careful checks.) Our regression results on the CWS sample are compiled in Table 5. In all the wage equations we corrected for two forms of selectivity that correspond to the two dimensions we identified in section 2, namely the formal/informal distinction, and the skilled/unskilled distinction. The issues surrounding selectivity are discussed in detail in Assaad and Tunali (1997). As it turns out, our conclusion regarding the nature of the compensating differentials is robust with respect to selectivity. That is, our qualitative and quantitative findings remain virtually the same whether we work with the uncorrected parameter estimates or the selectivity-corrected wage equation estimates reported in Table A.1 in the appendix (which have the advantage of being generalizable but the disadvantage of being open to the usual criticisms).

In the leftmost column of Table 5 we examine a baseline specification that corresponds to a simple Human Capital wage equation. In the next column we report a version with trade dummies. This specification is analogous to those estimated in the literature on inter-industry wage differentials. Judging by the change in R^2, there is strong evidence in favor of wage differentials between construction trades.

In subsequent columns of Table 5, we examine whether there are any wage differentials consistent with the theory of compensating differentials. We estimated four specifications using the models described in section 4. For the time being we rely on the estimates of the unemployment rate reported as version (a) in Table 4 and set $\alpha = 0$. We focus on four specifications. Models 1 and 2 exclude the unanticipated risk terms while models 3 and 4 include them. Model 3 is based on equation (9) while model 4 imposes the Weibull restrictions and corresponds to equation (10).

Several patterns emerge from Table 5. First, although models 1 through 3 lend support to our compensating differentials argument, only the first compensation component matters. Second, while the Weibull restrictions yield statistically significant coefficient estimates, the signs violate the restrictions on the γ's. Third, compared to the Human Capital model, models 1-4 improve the fit, but fail to explain as much of the variation in wages as the trade dummy model. When the alternative estimate of π_0 [version (b) in Table 4] is used, the findings are broadly similar. In model 1 the implied estimate of the uncompensated labor supply elasticity (η) is 0.167 (0.208 based on the alternative estimates of π_0). This magnitude is a bit larger than the range of estimates reported in Abowd and Ashenfelter (1981), although it is not outside the range of estimates reported by Pencavel (1986) for static labor supply models.

Next we use the estimates in Table 5 to calculate the size of wage premia in each trade, and report them in Table 6. These premia are equal to the proportionate increase in wage that a worker with no experience or education gets for being subjected to the average level of employment instability in his trade. The estimates for models 1 and 2 are quite similar. Models 3 and 4 yield wage premia which are inconsistent with our theory. Incidentally, when the alternate estimate of π_0 is used, only model 4 produces negative premia.

Based on model 1 estimates, masons and tile layers get the highest compensation, around 24-27 percent. Form workers and painters are paid around 14-18 percent over their opportunity wage. Consistent with our theory, joiners have the smallest premium, about 1 percent, while common laborers earn 5 percent.

(The empirical work on the second data source EFLS88 is partially complete. Results will be included in the next version.)

6. SUMMARY AND CONCLUSIONS

By way of highlighting the contribution of this paper, it is useful to begin by contrasting it with Tunali and Assaad (1992). In that paper the focus was on a search-theoretic explanation of employment dynamics. We examined data on individual spells of employment and unemployment and found strong evidence that employment durations varied by project type, and that this induced a trade-off between wages and spell lengths. Since workers could observe the project type in advance, they were able to form accurate predictions concerning their job duration, and were willing to settle for lower wages in return for prolonged employment. In the current paper, the focus shifts from transitory phenomena -- such as the trade-off between spell-specific wage and duration of employment -- to permanent phenomena, namely the anticipated rate of unemployment and the risk associated with employment and unemployment durations.

We adapt the theoretical framework developed in Abowd and Ashenfelter (1981) to our situation where the data come in the form of duration of employment and unemployment spells rather than total hours worked in a given time period. This involves extending the model to allow for two sources of randomness -- employment and unemployment durations -- instead of the single source of randomness in the original model. As a result we get two compensating differential terms associated with the risk of unanticipated unemployment instead of one.

To obtain empirical counterparts of theoretical variables in the model, we rely on reduced form duration equations to predict the mean duration of the employment and unemployment spells conditional on the observables. In line with the literature on inter-industry wage differentials, we assume that workers base their behavior on the prevalent conditions in their trade. We thus compute the compensation terms from trade-specific averages of the rate of unemployment, the incidence of unemployment, and the means and variances of employment and unemployment durations.

The empirical estimates we obtain from our specification provide conclusive evidence that workers are compensated for the expected rate of unemployment in their trade, but not for the variation around the mean. The magnitudes of the wage premia range between a low of 1 percent for joiners, the trade with the most stable employment, to a high of 27 percent for tile layers.

The usual criticism directed to work such as ours is that unobserved worker/firm heterogeneity might bias the results. Using longitudinal data, Murphy and Topel (1987) find evidence that observed wage differentials can be attributed to unmeasured worker characteristics. We do not expect ability differences in this rather homogeneous market for manual construction workers to be relevant. If differences were present, employers would compete for high-ability workers; this in turn would drive the wages of high ability workers up, and stabilize their employment experiences. The positive correlation we observe between wages and employment instability suggests that such an explanation is highly unlikely.

Rosen (1981) and Murphy and Topel (1987) point out another implication of unobserved heterogeneity. If workers who like employment variability can identify and work for employers who experience swings in their activities, while workers who dislike employment variability link up with those who can deliver longer employment spells, there could not be any premia to speak of. In fact about 30 percent of the casual workers in our sample are ‘attached’, in the sense that they had a regular employer for whom they worked on a repeated basis. Consequently, they and their employers may have found the type of match Rosen, Murphy and Topel have in mind. Note, however, that our compensation estimates are based on trade-specific averages. Although incidence of attachment does vary across trades, we were unable to detect a systematic relationship between incidence of attachment and average wages. This lends credence to the view that the hedonic relationship captured by our model and results is exogenous to the decision of an individual worker or employer.

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