WAGE FORMATION AND RECURRENT UNEMPLOYMENT*

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Abstract

Cross-section data on non-contractual construction workers in Egypt reveal strong attachment to the sector despite demand instability. Also present are statistically significant wage differentials between construction trades. Preliminary examination suggests 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 structural model and investigate the consequences of rationing, turnover, and randomness in employment and unemployment durations. Estimates reveal that employers provide only partial compensation against recurrent unemployment. Although aggregate risk premia associated with trade membership estimated with precision, individual risk components are not.

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 the 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 casual (that is, non-contractual) segment of 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 [1776], p. 115.)

Smith substantiated his argument with data showing that wages of skilled construction workers were 50-100 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 Tunalí 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. 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 (1986), 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 Tunalí, 1997). Examination of cross-section data on non-contractual workers reveals strong attachment to the construction 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 indeed be compensating their non-contractual workforce for recurrent unemployment so that they can rely on a steady supply of qualified workers. In fact the observed patterns across construction trades in average wages, unemployment rates and frequencies of turnover lend credence to this view. The remainder of the paper is devoted to a formal investigation of the compensation conjecture.

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, excess turnover, 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. Although we follow the derivation methodology in Abowd and Ashenfelter (1981), our version has two distinguishing features. First, we introduce costs of turnover into the model. These are likely to be imperative in construction (as well as other lines of work) where workers are subjected to frequent job separations, and typically get employed by a different employer each time they start a new job spell. This observation also motivates the second feature of our model: We allow for random spells of employment as well as unemployment, because they make independent contributions to employment risk.

The methodological issues that arise in generating the compensation terms (that is, the empirical risk measures) and 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 the aggregate unemployment experiences of the workers. Our empirical findings (reported in Section 5) establish the presence of systematic wage premia associated with employment instability. The estimated magnitudes reveal that employers provide only partial compensation against recurrent unemployment. Although the aggregate risk premia associated with trade membership are estimated with precision, individual risk components are not. 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 covered.[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

[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 or tied to the completion of a specific task, such as a construction operation. If the relationship with the employer is not terminated upon termination of the term of the contract, 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 Construction Workers Survey sample.

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 encountered 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. 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 £E7.5 (Egyptian pounds) compared to £E5.5 for the average manufacturing worker, and £E4.8 for the average service sector worker (Assaad, 1991). Average daily wages for manual workers in construction enterprises of 10 or more workers were £E6.5, 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. There the mean (of the natural logarithm of the wage rate) has been plotted in turn against the predicted unemployment rate (π_0) and the frequency of turnover (φ),making use of the averages for the eight worker categories we are able to distinguish in the 1988 Construction Workers Survey (CWS)[2]. Here and below we focus on casual workers only[3]. Precise definitions of these two instability measures and the methodology used in estimating them are given in Section 4. For our present purposes it suffices to say that the unemployment rate captures the fraction of time spent in the jobless state, while the frequency of turnover measures how often a worker returns to that state during a fixed period of time.

The pattern in the aggregates is striking: casual workers appear to be compensated for being subjected to employment instability. Higher wages support higher unemployment rates and turnover frequencies. In a hedonic framework, the premia 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 that compensates them for the risks of recurrent unemployment.

Further examination of Figures 1 and 2 suggests that common laborers do not benefit from this elementary insurance scheme. Unlike skilled (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) when demand is low.

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.4 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

[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).

[4] In Assaad and Tunali (1997) we examined the wage differentials between workers in the formal (contractual) and informal (casual) segments of the labor market after adjusting for two forms of selectivity (skilled/unskilled, formal/casual). We found that wages of unskilled workers who did not have contracts was 17 percent higher. For skilled casual workers the differential was in the 13-54 percent range depending on the type of employer. These estimates reveal that workers who are exposed to recurrent unemployment earn more.

receive to compensate them for the expected unemployment and the instability of employment in their trades.

3. A Model of Compensating Differentials

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 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 the following applies,

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

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

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

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:

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

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

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

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

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

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

where $\pi_1 = 1 - \pi_0$. By construction the consumption terms on either side of (5) are the same[6]. Thus compensation needed for restoring the worker to his former level of utility may be expressed as:

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

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

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

where $E(.)$ denotes the mathematical expectation operator[7].

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

[6] In line with our earlier normalization, we set $D = 1$ in $\varphi = D/(\mu_0 + \mu_1)$.

[7] 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.

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

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:

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

where w^* denotes the opportunity wage in the unconstrained sector, and ξ is the approximation error. We follow the literature and introduce heterogeneity by expressing (the natural logarithm of) the opportunity wage as a linear function of observed human capital characteristics. Note that $\alpha = (w^*/w_3)\gamma_2$ may vary across trades, because w^*/w_3 may vary across trades. Neither the opportunity wage w^*, nor the fully compensated wage w_3 are known. Consequently α's are not known. Although (9) is nonlinear in the unknown α's, providing that the unknown quantities $\pi_0, \mu_0, \mu_1, \sigma_0^2, \text{and } \sigma_1^2$ can be estimated in a first stage and ξ has the requisite properties, α 's and the premium magnitudes (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 $\gamma_4 > \gamma_3 \text{ and } \gamma_4 > 0$ would indicate that they are being compensated for the risk associated with the unanticipated component as well. Stronger tests of the model would entail hypotheses concerning the magnitudes of the labor supply elasticity η and the ordering of the coefficients on the unanticipated risk components.

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

$$\ln w = \beta' x + \theta(\mu_0, \mu_1, \sigma_0^2, \sigma_1^2) + \xi \qquad (10)$$

where $\theta(\mu_0, \mu_1, \sigma_0^2, \sigma_1^2)$ denotes the compensation component, and ξ denotes the disturbance term. Equation (10) is in the form used widely in the literature on compensating differentials. The *compensating differential*, that is the premium over the worker's 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 magnitude is the differential paid to the marginal construction worker, for being exposed to the average conditions that permeate his trade. If preferences are heterogeneous, individual members of the trade can settle for less than the amount paid to the marginal worker.

The objective of the first stage of our empirical investigation then, is to form the trade-specific estimates of $\pi_0, \mu_0, \mu_1, \sigma_0^2, \text{and } \sigma_1^2$. As we discuss in some detail in Section 5.2, the first step of the first stage entails estimation of parametric duration equations based on data on individual spells (conditional on entering the unemployed state). The second step entails estimation of an unemployment probability equation. The latter are used to adjust for the presence of workers in our sample who had not experienced any unemployment during the preceding year.

Let m_e denote the mean unemployment ($e = 0$) and employment ($e = 1$) duration predicted from the estimates reported in Table 2. Let p denote the predicted unemployment incidence probability obtained from the estimates reported in Table 3. For each worker the mean duration of unemployment was estimated as

$$\hat{\mu}_0 = p\, m_0, \qquad (11)$$

and the mean duration of employment was estimated as

$$\hat{\mu}_1 = p\, m_1 + (1 - p)\, 365, \qquad (12)$$

where m_1 was truncated from above at 365 days. The individual predictions were averaged to arrive at the trade-specific averages $\bar{\mu}_0$ and $\bar{\mu}_1$. For each trade, the estimated rate of unemployment was calculated as

$$\bar{\pi}_0 = \frac{\bar{\mu}_0}{\bar{\mu}_0 + \bar{\mu}_1}. \qquad (13)$$

That is, we averaged the μ's first, and estimated π_0 using these averages. Magnitudes of the trade-specific frequency of turnover used in Figure 2 were calculated using

$$\bar{\varphi} = \frac{365}{\bar{\mu}_0 + \bar{\mu}_1}. \qquad (14)$$

Note that φ does not show up in any of the compensation terms derived above [see equations (4), (6) and (8)].

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. These were plugged into equation (9) alongside the trade-specific averages $\bar{\pi}_0$, $\bar{\mu}_0$ and $\bar{\mu}_1$ to arrive at our iterative estimating equation.

Our empirical strategy for generating the measures of the trade-specific 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. The CWS data set, described below, 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 features 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.

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

We provide the details of the second stage next. With the first stage estimates of $\pi_0, \mu_0, \mu_1, \sigma_0^2$, and σ_1^2 in hand, equation (9) is linear when $\alpha = 0$. At the initial iteration, we set $\alpha(0) = 0$ for all the trades and obtain the initial estimate of γ_2, say $\hat{\gamma}_2(0)$ and form an initial estimate of w^*/w_3 as $exp\{-\hat{\theta}(0)\}$. We then calculate trade specific estimates of the trade-specific α's from:

$$\hat{\alpha}(i+1) = \hat{\gamma}_2(i)\, exp\{-\hat{\theta}(i)\}, \qquad (15)$$

with $i = 0$. We iterate in this fashion until convergence is obtained[9].

In our detailed investigation of the individual spell data the Weibull specification could not be rejected (see Tunalí and Assaad, 1992). When this restriction is imposed,

$$\sigma_e^2 = \kappa_e\, \mu_e^2 \qquad (16)$$

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. In this case estimates of κ_0 and κ_1 are readily available[10]. The squared coefficients of variation κ_0 and κ_1 are constant across trades because the same duration model is estimated for all workers. Given our modest sample size, more flexible specifications cannot be justified. Consistency of μ_0, μ_1, π_0, κ_0, κ_1 follows from the fact that maximum likelihood methods were used to obtain the estimates reported in Tables 2 and 3.

[9] Note that α is a k-dimensional vector with $\alpha_k \in [0, \mu_{1k})$, and (15) is of the form $\hat{\alpha}(i+1) = g(\hat{\alpha}(i))$ where g: $R_+^k \rightarrow R_+^k$ is continuous. Thus the iterative procedure can be formalized using a fixed-point argument.

[10] 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

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

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

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

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

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). Since the generated regressors we rely on in this paper are averages, the biases are likely to be negligible. Given the differences in the sub-sample sizes across trades however, heteroscedasticity should be of concern. We chose not to adjust the standard errors but opted in favor of reporting robust (Huber-White) standard errors.

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 Tunalí 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[11].

5.2. Examination of Employment and Unemployment Spells:

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 parameterization are reported in Table 2[12]. Based on likelihood ratio tests,

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

[12] 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

the models fit well (p–value < .001). 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 the hazard of exit from the unemployed state decreases with duration, perhaps because employers are able to sort out potential employees by questioning them about their employment record.

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 (likelihood ratio test yields a p–value of .018). 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 (predicted) employment duration for the joiners in our sample is 185 days (see column labeled μ_1). The average for the electricians and plumbers is 170 days. For members of other trades, the average employment duration varies between 24 and 73 days. Unskilled workers on average spend 44 days on the job before returning to the unemployed state. There is considerable within-trade variation in the predicted employment duration. 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 the longest unemployment spells consists of electricians and plumbers, who on average spend 74 days between job spells (see column labeled μ_0). This figure seems very high. Electricians and plumbers constitute the largest segment of the construction labor force under contracts (51 percent of all craft workers on formal contracts), because many non-construction employers keep such workers on hand for maintenance activities. On the basis of casual impressions gained during visits to construction workers' 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 cannot 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 19 and 40 days between job spells depending on their trade. Once again, there is considerable within-trade dispersion, mainly because of regional differences in the arrival rate of job offers

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.

across trades. Common laborers experience the shortest average unemployment spell, at 10 days.

We see that joiners experience the lowest mean unemployment rate (π_0) at 13 percent. Craftsmen in the other construction trades face unemployment rates in the 20 to 51 percent range. Unskilled workers are unemployed 20 percent of the time. In Table 4 we also report estimates of the trade-specific turnover rates (φ) which were used in Figure 2. Masons have the highest turnover rate of 7.42 jobs per year, followed by form workers who experience just under six job changes. By contrast, joiners, electricians and plumbers return to the unemployed state less than two times on average. The middle group includes tile workers, plasterers and painters, who go through four or more job spells per year. Common laborers on average hold 6.75 different jobs per year.

Recall the bivariate relationships we uncovered with the help of Figures 1 and 2. There we plotted log-wage against the unemployment rate (π_0) and the frequency of turnover (φ), respectively. Note however, that the measures of anticipated risk we derived formally turned out to be different. It remains to be seen if unemployment and turnover matter in the manner predicted by our structural model.

In the final columns of Table 4 we report the trade-specific variance estimates, which are used to form our unanticipated risk measures. The first pair are the within-trade variances in the individual predicted durations (σ_0^2 and σ_1^2). The second pair of numbers (with additional subscript *w*) were obtained by invoking the Weibull assumption directly, whereby the individual variances can be expressed as a constant multiple of the squared means. With one or two exceptions, the within sample dispersion in the predicted durations is less than what may be termed the theoretical dispersion consistent with the Weibull parameterization.

5.4. Multivariate Analysis of Compensating Wage Differentials

Our regression results on the CWS sample are compiled in Table 5. In all the wage equations we corrected for selection into skilled and unskilled tiers of the casual construction workforce. 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)[13].

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 report results from four specifications based on equation (9). Model 1 is analogous to the Abowd-Ashenfelter model without unanticipated risk. Model 2 is our version, with turnover costs as the second anticipated risk component. Models 3 and 4 include the unanticipated risk terms as well. The latter incorporates the Weibull restriction. Variance estimates reported in Table 4 were divided by 1000 prior to their use in the estimating equation. Iterative least squares converged after five iterations in the case of Model 3 and 60 iterations in the case of Model 4. Iteration summaries are included in the appendix, as Tables A.2 and A.3.

Using R^2 as our goodness of fit measure, we see that the risk measures used in the compensating differentials models account for some of the residual variation in the human capital model, but fall short of the model with trade dummies. The signs of the estimated γ's, and the ordering of the estimated magnitudes of γ_3 and γ_4 are in agreement with the theoretical predictions in models 1-3. In model 4 two

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[13] The issues surrounding selectivity are discussed in detail in Assaad and Tunali (1997). There we examine the broader implications of selection along the two dimensions we identified in section 2, namely the formal/casual distinction, and the skilled/unskilled distinction. Since the present paper focuses on the casual construction workforce, only the skilled/unskilled distinction matters.

pieces of evidence mildly counter the theory: $\hat{\gamma}_1 < 0$ (p-value = 0.2), and $\hat{\gamma}_4 < \hat{\gamma}_3$ (p-value = 0.3)[14].

Model 1 yields strong support for the presence of premia associated with anticipated unemployment risk (p-value = 0.005). Judging by the R^2 values, the fit does not improve by much when additional risk terms are included. Controlling for anticipated unemployment risk, the null hypothesis that workers do not get additional compensation for turnover costs cannot be rejected (model 2 vs.1 p-value = 0.39). When we reverse the order in which these two regressors are included, their roles are interchanged (these results are not reported in the table). In this case we find evidence that workers are compensated for anticipated turnover risk (p-value = 0.003), but controlling for the turnover risk, no additional compensation is provided for anticipated unemployment risk (p-value = 0.61). It is evident that the two terms capture the same phenomenon (at least in the CWS sample). Put differently the anticipated unemployment and turnover risk jointly influence wages as we posited (p-value = 0.013), but their separate effects cannot be estimated with precision.

Returning to Table 5, once we control for both components of anticipated risk, we find little evidence that supports the view that additional compensation is paid for unanticipated risk (model 3 vs. 2 p-value = 0.26; model 4 vs. 2 p-value = 0.17). When we test the hypothesis that anticipated risk terms can be left out of the full model, we find strong evidence against the null in model 3 (p-value = 0.003) but not in model 4 (p-value = .28). Further examination reveals that when the anticipated risk terms are left out, the unanticipated risk terms are jointly statistically significant in model 4 (p-value = 0.024) but not in model 3 (p-value = 0.61). Under the Weibull restrictions, all risk measures are functions of the mean durations alone. We conclude that the nonlinearity inherent in the structural model is not sufficient for teasing out the separate influences of the anticipated and unanticipated components in the CWS sample.

In model 1 the implied estimate of the uncompensated labor supply elasticity (η) is 0.221 (0.213 when selectivity is controlled for). This magnitude is on the high side compared to the 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. The estimated value of the job change cost is about 4-5 days' wages in models 2 and 3. These magnitudes are substantial, but because the estimates are imprecise, we cannot view this as conclusive evidence. If turnover risk is included as the only compensation measure, the job change cost is estimated to be 6.7 days' wages.

Next, we use the estimates from models 1-4 in Table 5 to calculate the total wage premium and its four components for each trade. These are reported in Table 6. The total premium is 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 of the total compensation are positive in all the models and typically increase as we move from model 1 to model 4. The magnitudes obtained from models 2 and 3 are quite similar. Taken at face value, model 3 results indicate that workers like variation in employment durations. The premia obtained from model 4 are substantially larger and the cross-trade patterns are at odds with the patterns observed in the other models. Coupled with the fact that the sign of the component associated with anticipated unemployment risk is inconsistent with our theory, this suggests that our structural model is inconsistent with the Weibull duration model[15].

Based on model 1 estimates, masons and tile layers get the highest compensation, around 21-26 percent. Form workers and painters are paid around 10-12 percent over their opportunity wage. Consistent with our theory, joiners have the smallest premium, about 1 percent, while common laborers earn 2 percent. In model 2 the magnitudes are higher for all trades except tile layers and the composite category of electricians and plumbers. In model 3 the magnitudes are a bit higher still, except for painters.

We conclude then, that overall support for our compensating differentials formulation is strong in the CWS sample, subject to the following caveat: When multiple risk components are included we are able to estimate the total premia

[14] Here we test for sign, hence we report p–values from one-tailed tests. Elsewhere in the paper we report results from two-tailed tests, consistent with the practice in the tables.

[15] This statement should not be read as a rejection of the Weibull duration model. Given our modest sample size, we estimated the same duration model for all trades. It is this restricted version that is inconsistent with our structural model of compensating wage differentials.

well, but not the individual components. Given our small sample size, we have to be content with this result.

5.5 Sensitivity Analysis:

As a check on the sensitivity of our results to the averaging method, we also used an alternate strategy. We first estimated the unemployment rate at the individual level [by using $\hat{\mu}_0$ and $\hat{\mu}_1$ on the right hand side of (13)] and averaged these to obtain the trade-specific averages. In similar fashion we estimated the trade-specific values of the inverse of the employment duration by averaging the individual specific values ($1/\hat{\mu}_1$). The qualitative results were broadly the same. The alternate averaging method yielded larger magnitudes of the anticipated risk measures, which in turn resulted in smaller regression coefficients. We believe the original averaging method is superior, because information on the trade-specific averages of employment and unemployment durations should be the easiest for workers to acquire, and it appears more natural to construct measures of instability using these averages.

We turn to our findings from our secondary data source, the October round of the 1988 Labor Force Sample Survey (LFSS88) next. This survey was carried out six months after the CWS. Spell data were not collected. The workers were asked about the average number of days worked per week, as well as the number of weeks worked during a three-month reference period. We took the Egyptian norm of a six-day work-week for full-time workers and used the information in the LFSS88 to obtain individual-specific estimates of number of days worked in a quarter. We then formed the trade-specific averages of the unemployment rate as described in Section 4. These are reported in Table 8.

The unemployment rate of the average casual construction sector worker is substantially higher in the LFSS88 (41 percent) compared to the CWS (29 percent), while the cross-trade variation is lower. These differences are likely to do with the fact that the LFSS88 elicited information on days of actual work rather than the length of the employment spell. Consequently unlike the CWS, the LFSS88 does not allow us to distinguish between voluntary and involuntary unemployment.

There is a second shortcoming of the LFSS88. Since it was not designed specifically to study the construction sector, information on skill classification is not uniform. As a result the occupation designations we arrived at are not as precise. In particular we suspect that some craft workers may have been classified as unskilled workers. The average wage data reported in Table 8 suggest that this is likely to be the case: Unskilled workers no longer have the lowest average wage. Furthermore, the share of the unskilled work force is 34.5 percent in the LFSS88 sample, while it is only 30 percent in the CWS sample. Despite the shortcomings, we think the LFSS88 data are valuable because they offer a second snapshot of the construction sector based on a larger sample, obtained shortly after our specialized survey was conducted.

The wage equation estimates are reported in Table 7. Consistent with Table 5 we first estimate a simple human capital wage equation, followed by a model with trade dummies. As in Table 5 the trade dummies are jointly statistically significant (*p*-value = 0.032). The only compensating differential model we are able to estimate on the LFSS88 sample is model 1. We find evidence that workers are paid an unemployment premium (*p*-value = 0.102). Note that the estimated value for γ_1 is quite a bit larger: 1.102 vs. 0.442 in Table 5. However, there is weak evidence against the null hypothesis that the two independent estimates of γ_1 are equal (*p*–value = 0.22). We interpret this as validation of the compensation patterns in the CWS sample.

The premia obtained from the LFSS88 sample are reported in Table 8. The estimates are larger than those reported in Table 6, and range between 22-57 percent. As in the CWS sample, joiners earn the lowest premium. Tile layers, who earn the largest premium in the CWS sample, are a close second behind painters. According to our estimates, unskilled workers earn a spectacular wage premium of 38 percent. This lends further credence to our speculation that some skilled workers were mistakenly classified as being unskilled in the LFSS88 sample.

6. Conclusion

Analysis of employment dynamics in the casual (that is, non-contractual) construction labor market in Egypt reveals that there are substantial differences between the construction trades. The question we pursue in this paper is whether average wages adjust in a manner that compensates workers for anticipated employment instability, and the risk associated with exposure to random spells of employment and unemployment. Since construction relies on skilled labor and skill acquisition takes time, there is reason to believe that employers will pay attention to the plight of their workers.

We adapt the theoretical framework developed in Abowd and Ashenfelter (1981) to our situation in which the data is 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 uncertainty 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. We also adjust the anticipated risk component, to take the substantial turnover experienced by construction sector workers into account.

To obtain empirical counterparts of the risk measures used in our structural model, we rely on reduced form duration equations to predict the mean duration of the employment and unemployment spells conditional on the observables. We also estimate a reduced form model of the incidence of unemployment so that adjustments can be made for the presence of workers with unbroken employment spells in the reference year. In line with the literature on inter-industry wage differentials, we assume that workers base their behavior on the prevalent conditions in their trade. Our risk measures turn out be nonlinear functions of the expected rate 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 anticipated employment instability. Unanticipated instability (induced by variations around the spell means) does not elicit additional compensation. The magnitudes of the wage premia range between a low of 1-3 percent for joiners, the trade with the most stable employment, to a high of 26-31 percent for masons, who provoked Adam Smith's thinking on the subject. These wage premia can be viewed as trade-specific costs that the employers are willing to bear to ensure a steady supply of skilled workers in the construction sector.

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 supported by our empirical findings is exogenous to the decision of an individual worker or employer.

Appendix:Derivation of The Compensation Components

In this appendix we formally derive the compensation components. We consider the labor supply problem of a worker who maximizes a well-behaved twice differentiable utility function defined on annual consumption and leisure, $V(c,l)$.[†] We pick the composite consumption good as the numeraire, set total time equal to 1 and express the minimum (full) expenditure function for an unconstrained worker facing the wage rate w as:

(A1) $$e(w,V^*) = \min_{c,h}\left\{c + w(1-h);\, V(c,1-h) \geq V^*\right\}.$$

By construction, when $w = w^*$ the solution to this minimization problem yields the unconstrained equilibrium labor supply of $h = h^* < 1$, consumption level $c = w^*h^*$, and utility $V(c^*,1-h^*) = V^*$.

Next, consider the restricted expenditure function for a worker facing the labor supply constraint $h = \bar{h}$, whose reservation utility level remains at V^*:

(A2) $$\bar{e}((1-\bar{h}),w,V^*) = \min_{c}\left\{c + w(1-\bar{h});\, V(c,1-\bar{h}) \geq V^*\right\}.$$

Let $w_1 > w^*$ denote the wage rate which yields utility V^* for $h = \bar{h} < h^*$. The increase in the minimum full expenditure that restores the worker to the reservation utility level is the sum of the change in actual consumption, plus the change in the value of leisure:

(A3) $$\bar{e}((1-\bar{h}),w_1,V^*) - e(w^*,V^*) = w_1\bar{h} - w^*h^* + w_1(1-\bar{h}) - w^*(1-h^*) = w_1 - w^*.$$

A second equation that links the quantities of interest can be obtained by defining the virtual (real) wage $\omega(\bar{h},V^*)$ as the relative price at which the unconstrained worker would choose to supply $\bar{h}$ units of labor. Following the derivation in Neary and Roberts (1980: 30), or Deaton and Muelbauer (1981: 1527), we get:

(A4) $$\bar{e}((1-\bar{h}),w_1,V^*) = e(\omega(\bar{h},V^*),V^*) + (w_1 - \omega(\bar{h},V^*))(1-\bar{h}).$$

[†] See Neary and Roberts (1980: 27) for the conditions imposed on the preference ordering.

A Taylor series expansion of the right hand side of (A4) around the point $\bar{h} = h^*$ yields:

(A5) $$\bar{e}((1-\bar{h}),w_1,V^*) \cong e(w^*,V^*) + (w_1 - w^*)(1-\bar{h}) + \frac{1}{2\eta}\frac{w^*}{h^*}(\bar{h}-h^*)^2,$$

where $\eta \equiv \left.\frac{\partial h}{\partial w^*}\right|_{h=h^*}\frac{w^*}{h^*} > 0$ is the compensated labor supply elasticity for the unconstrained individual evaluated at the equilibrium number of hours.

To obtain (A5) we also relied on the following:

$w^* = \omega(h^*,V^*)$;

$\partial\omega(\bar{h},V^*)/\partial\bar{h}\big|_{\bar{h}=h^*} \cong 1/(\partial h^*/\partial w^*)$;

From Shephard's lemma, $\partial e(\omega(\bar{h},V^*),V^*)/\partial\omega = (1-\bar{h})$;

The ration $\bar{h}$ and the unconstrained labor supply h^* do not depend on w_1.

Combining (A3) and (A5), our second order approximation to the first compensation component for anticipated risk is obtained as:

(A6) $$\frac{w_1 - w^*}{w^*} \cong \frac{1}{2\eta}\frac{(\bar{h}-h^*)^2}{\bar{h}h^*}.$$

Given the two argument utility function $u(c,l)$, where c is subject to random shocks, Killingsworth (1983: 258) suggests that a measure of relative risk-aversion along the lines of Arrow and Pratt may be constructed as

(A7) $r = -c\, u_{cc}(c,l)/u_c(c,l)$.

We follow Killingsworth and focus on the variation in consumption, ignoring the induced variation in lesiure. In our case consumption is a function of two random variables, y_0 and y_1. We modify (A7) as

(A8) $\rho_e = -c\, u_{ee}(c(y_e),l)/u_e(c(y_e),l)$, e = 0,1.

That is, to characterize aversion towards unemployment and employment risk, we rely on two sets of derivatives with respect to consumption, viewed in turn as a function of the random y_0 and y_1. We evaluate the derivatives in question at the means of y_0 and y_1 to get:

(A9) $$\rho_0 = c\varphi\left(\frac{\overline{V}_{11}}{\overline{V}_1}c + 2\right),$$

(A10) $$\rho_1 = c\varphi\left(\frac{\overline{V}_{11}}{\overline{V}_1}(c - w_3) + 2\right) = \rho_0 - c\left(\frac{\overline{V}_{11}}{\overline{V}_1}w_3\right),$$

where $c = w_3(\pi_1 - \alpha\varphi)$, and $\overline{V}_1 > 0$, $\overline{V}_{11} < 0$ denote the first and second derivatives of $V(.)$ with respect to consumption, evaluated at the fully compensated rationed equilibrium $\{w_3\pi_1 - b\varphi, \pi_0\}$. It follows that $\rho_1 > 0$ and $\rho_1 > \rho_0$.

To derive the compensation components associated with unanticipated risk, we ignore the variation in leisure, rely on a Taylor series approximation to random utility $V(\frac{w_3 y_1 - b}{y_0 + y_1}, \frac{y_0}{y_0 + y_1})$ at the point $y_0 = \mu_0$ and $y_1 = \mu_1$, and take expectations to obtain:

(A11)

$$EV(\frac{w_3 y_1 - b}{y_0 + y_1}, \frac{y_0}{y_0 + y_1}) \cong V(w_3\pi_1 - b\varphi_1, \pi_0) +$$
$$\tfrac{1}{2}\varphi^2\overline{V}_1 c\left(\frac{\overline{V}_{11}}{\overline{V}_1}c + 2\right)\sigma_0^2 + \tfrac{1}{2}\varphi^2\overline{V}_1(c - w_3)\left(\frac{\overline{V}_{11}}{\overline{V}_1}(c - w_3) + 2\right)\sigma_1^2.$$

The equilibrium condition that relates w_3 and w_2 is:

(A12) $$EV(\frac{w_3 y_1 - b}{y_0 + y_1}, \frac{y_0}{y_0 + y_1}) = V(\frac{w_2\mu_1 - b}{\mu_0 + \mu_1}, \frac{\mu_0}{\mu_0 + \mu_1}) = V(w_2\pi_1 - b\varphi, \pi_0) \equiv \overline{V}.$$

Before exploiting the equality of (A11) and (A12), we express the first term on the right hand side of (A11) as:

(A13) $$V(w_3\pi_1 - b\varphi, \pi_0) = V(w_2\pi_1 - \alpha w_2\varphi + (w_3 - w_2)(\pi_1 - \alpha\varphi), \pi_0) \equiv \overline{V}^+,$$

where $\alpha = b/w_3$. We then note the fact that for small $(w_3 - w_2)(\pi_1 - \alpha\varphi)$,

(A14) $$(\overline{V}^+ - \overline{V})/[(w_3 - w_2)(\pi_1 - \alpha\varphi)] \cong \overline{V}_1.$$

With this simplification in hand, manipulation yields:

(A15) $$\frac{w_3 - w_2}{w^*} \cong \frac{1}{2}\frac{\rho_0}{w^*}\frac{1}{(\mu_1 - \alpha)}\sigma_0^2 + \frac{1}{2}\frac{\rho_1}{w^*}\frac{(\mu_0 + \alpha)}{(\mu_1 - \alpha)^2}\sigma_1^2.$$

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Figure 1: Log Wages vs. Predicted Unemployment by Trade

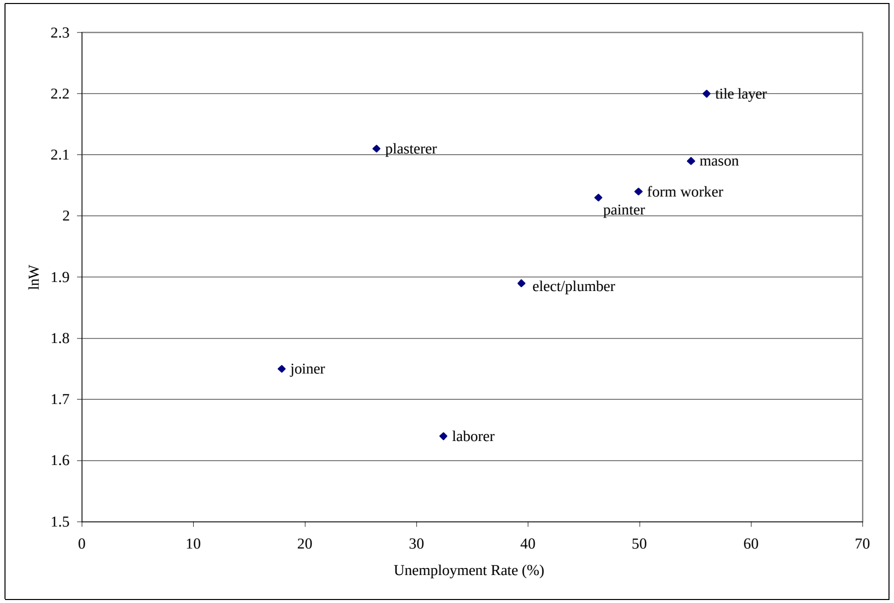

Figure 2: Log Wages vs Frequency of Job Turnover by Trade

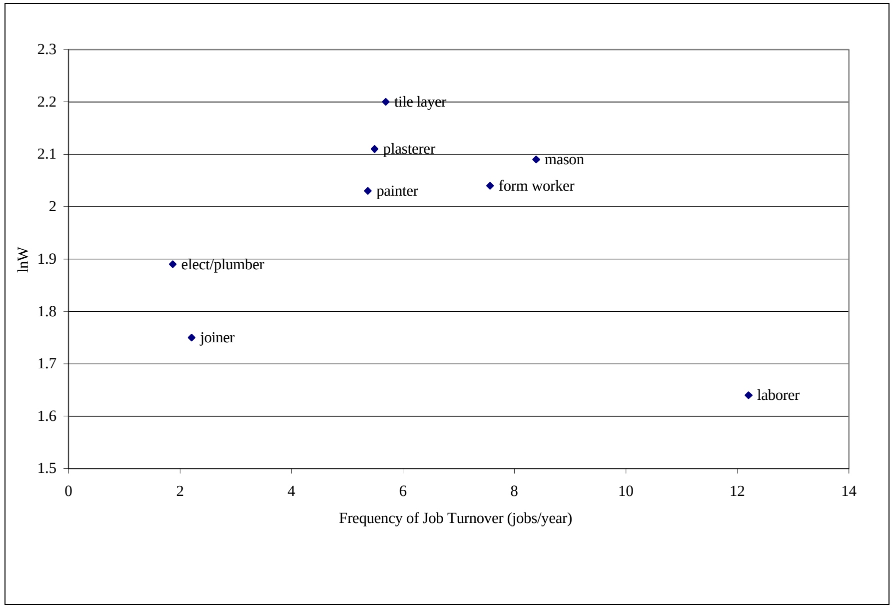

Figure 3: Equilibrating Wage Premia

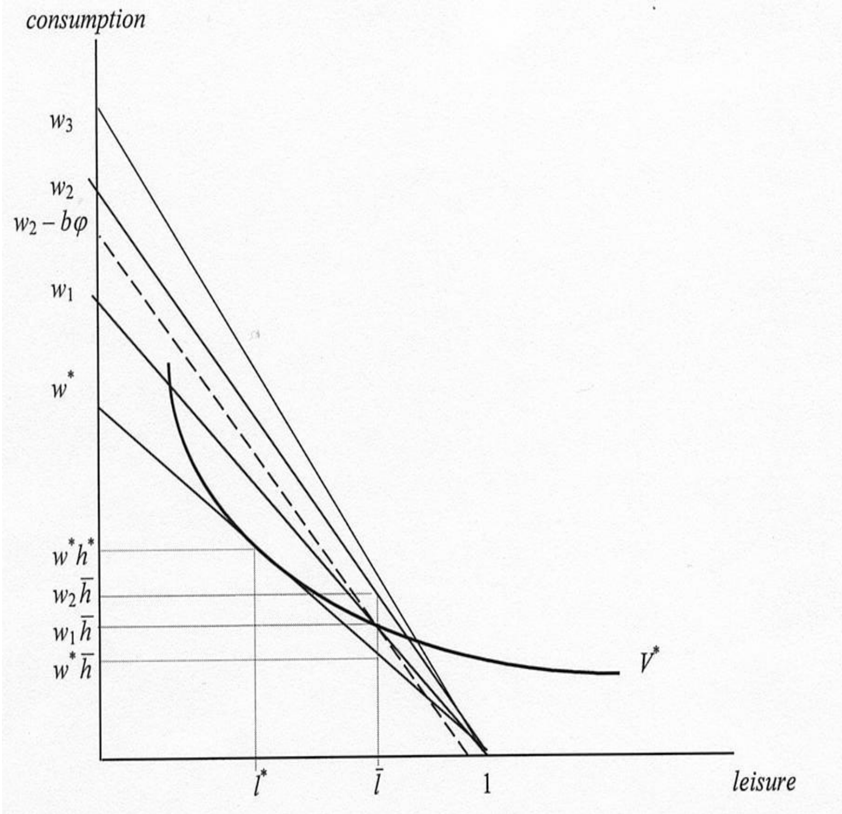

Table 1: Descriptive Statistics, Construction Workers Survey (CWS), Sample of Casual Construction Workers

Variable	**Craft Workers**		**Common Laborers**		**All**	
	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
Log-wage	2.026	0.313	1.636	0.306	1.728	0.523
Educational certificate°	0.266	0.443	0.042	0.201	0.198	0.399
Construction experience	16.7	10.3	18.4	13.1	17.2	11.2
Skill Level:						
Unskilled (common laborer)°					0.306	0.462
Trade Classification (for craft workers):						
Mason°	0.101	0.302	-	-	0.070	0.256
Tile layer°	0.064	0.246	-	-	0.045	0.207
Plasterer°	0.202	0.402	-	-	0.140	0.348
Painter°	0.161	0.368	-	-	0.112	0.315
Joiner°	0.124	0.330	-	-	0.112	0.316
Electrician, plumber, etc.°	0.051	0.219	-	-	0.035	0.184
Form worker (reference)	0.298	0.457	-	-	0.181	0.385
Contractual Arrnangement:						
Attached to a regular employer°	0.248	0.433	0.229	0.423	0.242	0.429
Type of Employer:						
Construction craftsman°	0.427	0.496	0.302	0.462	0.389	0.488
Building owner°	0.110	0.314	0.229	0.423	0.147	0.354
Private contractor (reference)	0.463	0.499	0.448	0.500	0.465	0.499
Region of Residence:						
Greater Cairo°	0.427	0.496	0.229	0.423	0.366	0.483
Alexandria & Suez Canal°	0.133	0.340	0.052	0.223	0.108	0.311
Lower Egypt°	0.312	0.464	0.188	0.392	0.274	0.447
Upper Egypt (reference)	0.129	0.335	0.531	0.502	0.252	0.434
Community of Residence:						

Table 1: contd.

Urban°	0.844	0.364	0.542	0.501	0.752	0.433
Index of concentration of construction workers	1.855	1.040	1.090	0.948	1.621	1.071
Index of construction activity	1.072	0.315	1.021	0.384	1.057	0.338
Type of Construction:						
Residential construction°	0.872	0.335	0.927	0.261	0.889	0.315
No. of observations	218		96		314	

Notes: ° Dummy variable; equals 1 if the definition applies to the individual, 0 otherwise.

Table 2: Duration of Last Employment and Unemployment Spell, Maximum Likelihood Estimates from the Weibull Parameterization, CWS Sample of Casual Construction Workers, Dependent Variable = log-duration (§)

Variable	Employment		Unemployment	
	Estimate	Std. er.	Estimate	Std. er.
Constant	5.530**	0.736	2.917**	0.561
Educational certificate°	0.081	0.306	0.140	0.242
Experience in construction	0.036	0.035	-0.037	0.033
Experience in construction sq./100	-0.079	0.075	0.090	0.070
Skill Classification:				
Unskilled°	0.026	0.331	-0.502	0.291
Trade Classification:				
Mason°	0.118	0.659	-0.065	0.335
Tile layer°	-0.782	0.574	0.695	0.569
Plasterer°	0.573	0.370	-0.067	0.313
Painter°	0.008	0.393	0.392	0.346
Joiner (carpenter)°	1.79**	0.649	0.415	0.397
Electrician, plumber, etc.°	0.920	0.761	1.421*	0.668
Contractual Arrangement:				
Attached to a regular employer°	0.939**	0.299	-0.159	0.229
Region:				
Greater Cairo°	0.719	0.430	0.325	0.344
Alexandria and Suez Canal°	0.443	0.512	0.089	0.396
Lower Egypt°	0.306	0.321	0.757**	0.287
Community:				
Urban°	0.256	0.315	-0.213	0.263
Index of concentration of construction workers	-0.148	0.177	0.238	0.142
Index of construction activity	-1.237**	0.325	0.416	0.313

Table 2: contd

Type of Employer:				
Craftsman°	-0.913**	0.258	--	--
Building owner°	-0.854*	0.375	--	--
Type of Project:				
Residential construction°	-1.023*	0.447	--	--
Scale	1.104**	0.115	1.158**	0.093
log-likelihood	-285.6		-400.7	
log-likelihood without	-319.0		-422.2	
no. of covariates	20.0		17.0	
completed spells	106.0		167.0	
censored spells	208.0		130.0	

Notes: Statistically significant coefficients at the 1% **, 5% * level based on a two-tailed test are marked. § Employment (unemployment) durations are censored for workers who were employed (unemployed) at the time of the interview. All spells are truncated at 60 days. ° Dummy variable; equals 1 if the definition applies to the individual, 0 otherwise. Reference categories are shown in Table 1.

Table 3: Incidence of Unemployment in Reference Year, Maximum Likelihood Binary Probit Estimates, CWS Sample of Casual Construction Workers, Dependent Variable = 1 if ever unemployed during the year, = 0 else

Variable	Coefficient (Std.er.)
Constant	4.456
	(1.058)**
Educational certificate°	0.798
	(0.552)
Experience in construction	0.034
	(0.047)
Experience in construction sq./100	-0.081
	(0.093)
Skill Classification:	
Unskilled°	-0.870
	(0.640)
Trade Classification: #	
Tile layer°	-1.225
	(0.843)
Plasterer°	-1.397
	(0.649)*
Painter°	-0.564
	(0.810)
Joiner (carpenter)°	-1.102
	(0.661)
Electrician, plumber, etc.°	-1.687
	(0.781)*
Contractual Arrangement:	
Attached to a regular employer°	-1.452
	(0.357)**
Region:	
Greater Cairo°	-1.072
	(0.671)
Alexandria and Suez Canal°	-0.811
	(0.758)
Lower Egypt°	-1.402
	(0.577)*

Table 3: contd

Community:	
Urban°	0.173
	(0.502)
Index of concentration of construction	-0.168
	(0.229)
Index of construction activity	-0.401
	(0.433)
Log-likelihood	-43.8
Log-likelihood without covariates	-58.8
No. of covariates	20.0
No. of observations	292.0#
Ever unemployed	175 (94.2%)
Never unemployed	17 (5.8%)

Notes: Statistically significant coefficients at the 1% (**), 5% (*) level based on a two- tailed test are marked. °Dummy variable; equals 1 if the definition applies to the individual, 0 otherwise. Reference categories are shown in Table 1. # The mason dummy predicts success perfectly; 22 observations were dropped.

Table 4: Means of Selected Variables by Trade, CWS Sample of Casual Construction Workers

Trade	Number in Sample	logw	μ_0	μ_1	φ	π_0	σ_0^2	σ_1^2	σ_{0w}^2	σ_{1w}^2
Form worker	65	2.04	24	37	5.95	0.397	211	584	848	3,432
Mason	22	2.09	25	24	7.42	0.508	795	552	1,036	1,157
Tile layer	14	2.20	39	44	4.37	0.473	250	2,296	2,332	4,431
Plasterer	44	2.11	18	73	4.00	0.202	249	1,106	519	10,695
Painter	35	2.03	31	53	4.35	0.369	1,400	3,312	1,390	6,251
Joiner	27	1.75	27	185	1.72	0.127	705	27,927	1,205	55,083
Electrician, plumber, etc.	11	1.89	74	170	1.50	0.304	645	5,328	8,187	49,741
Common laborer	96	1.64	10	44	6.74	0.193	159	700	187	6,178
Casual construction worker	314	1.91	23	63	5.26	0.289	433	3,588	1,027	11,552

Table 5: Wage Equations Based on Human Capital, Trade Dummy and Compensating Differentials Models; Least Squares Estimates; CWS Sample of Casual Construction Workers; Dependent Variable: log-wage

Variable	Human Capital Wage Model	Trade Dummy Model	Compensating Differentials Models			
			Model (1)	Model (2)	Model (3)†	Model (4)†
Constant	1.821 (0.075)**	1.831 (0.079)**	1.711 (0.101)**	1.683 (0.110)**	1.660 (0.113)**	1.498 (0.202)**
Educational certificate°	0.038 (0.047)	0.041 (0.046)	0.033 (0.048)	0.037 (0.049)	0.045 (0.050)	0.041 (0.049)
Construction Experience:						
Skilled	0.016 (0.008)*	0.018 (0.007)*	0.017 (0.008)*	0.017 (0.008)*	0.018 (0.008)*	0.018 (0.008)*
Unskilled	0.012 (0.008)	0.012 (0.007)	0.012 (0.007)	0.012 (0.007)	0.012 (0.007)	0.012 (0.007)
Construction Exp. Squared/100:						
Skilled	-0.018 (0.016)	-0.020 (0.016)	-0.020 (0.015)	-0.019 (0.015)	-0.020 (0.016)	-0.021 (0.016)
Unskilled	-0.020 (0.016)	-0.020 (0.015)	-0.020 (0.012)	-0.020 (0.012)	-0.020 (0.012)	-0.020 (0.012)
Skill Classification:						
Unskilled°	-0.298 (0.106)**	-0.308 (0.106)**	-0.208 (0.119)	-0.268 (0.129)*	-0.265 (0.149)	-0.341 (0.140)*
Trade Classification:						
Mason°	-	0.024 (0.073)	-	-	-	-
Tile layer°	-	0.186 (0.086)*	-	-	-	-
Plasterer°	-	0.027 (0.058)	-	-	-	-
Painter°	-	-0.033 (0.062)	-	-	-	-
Joiner°	-	-0.317 (0.067)**	-	-	-	-
Electrician, plumber, etc.°	-	-0.096 (0.096)	-	-	-	-

Table 5: contd.

Variable	Human Capital Wage Model	Trade Dummy Model	Compensating Differentials Models			
			Model (1)	Model (2)	Model (3)†	Model (4)†
Compensation Terms:						
γ_1	-	-	0.442	0.175	0.265	-1.059
			(0.155)**	(0.344)	(0.524)	(1.273)
γ_2	-	-	-	4.384	5.465	12.50
				(5.044)	(7.052)	(11.02)
γ_3 (×1000)	-	-	-	-	-3.539	4.382
					(2.920)	(5.654)
γ_4 (×1000)	-	-	-	-	0.425	1.016
					(2.630)	(1.182)
No. of observations	314.0	314.0	314.0	314.0	314.0	314.0
R-squared	0.292	0.371	0.316	0.318	0.324	0.324

Notes: Robust standard errors in parentheses. Statistically significant coefficients at the 1% (**), 5% (*) level based on a two-tailed test are marked;°Dummy variable; equals 1 if the definition applies to the individual, 0 otherwise. Reference categories are shown in Table 1.† Final iteration. See Appendix Tables 2 and 3 for detailed results.

Table 6: Sizes of the Compensation Terms and Total Wage Compensation by Trade;CWS Sample of Casual Construction Workers

Trade	Number in Sample	Model (1)		Model (2)		
		$\gamma_1 \frac{\pi_0^2}{1-\pi_0}$	$\frac{w-w^*}{w^*}$	$\gamma_1 \frac{\pi_0^2}{1-\pi_0}$	$\gamma_2 \frac{1}{\mu_1}$	$\frac{w-w^*}{w^*}$
Form worker	65	0.116	0.123	0.046	0.119	0.179
Mason	22	0.232	0.261	0.092	0.181	0.314
Tile layer	14	0.188	0.206	0.074	0.100	0.190
Plasterer	44	0.023	0.023	0.009	0.060	0.072
Painter	35	0.096	0.100	0.038	0.083	0.128
Joiner	27	0.008	0.008	0.003	0.024	0.027
Electrician, plumber, etc.	11	0.059	0.060	0.023	0.026	0.050
Common laborer	96	0.020	0.021	0.008	0.100	0.115
Casual construction worker	314	0.071	0.074	0.028	0.093	0.129

Table 6: contd.

Trade	Number in Sample	Model (3) $\gamma_1 \frac{\pi_0^2}{1-\pi_0}$	$\gamma_2 \frac{1}{\mu_1}$	$\gamma_3 \frac{1}{(\mu_1-\alpha)}$	$\gamma_4 \frac{(\mu_0+\alpha)}{(\mu_1-\alpha)^2}$	$\frac{w-}{w^*}$	Model (4) $\gamma_1 \frac{\pi_0^2}{1-\pi_0}$	$\gamma_2 \frac{1}{\mu_1}$	$\gamma_3 \frac{1}{(\mu_1-\alpha)} \sigma_0^2$	$\gamma_4 \frac{(\mu_0+\alpha)}{(\mu_1-\alpha)^2} \sigma_w^2$	$\frac{w-w^*}{w^*}$
Form worker	65	0.070	0.149	-0.023	0.007	0.224	-0.276	0.346	0.133	0.154	0.429
Mason	22	0.140	0.227	-0.140	0.017	0.276	-0.553	0.528	0.287	0.162	0.529
Tile layer	14	0.113	0.125	-0.022	0.026	0.274	-0.447	0.290	0.294	0.188	0.384
Plasterer	44	0.014	0.076	-0.013	0.002	0.082	-0.054	0.176	0.036	0.082	0.271
Painter	35	0.058	0.104	-0.102	0.021	0.084	-0.228	0.242	0.140	0.142	0.344
Joiner	27	0.005	0.030	-0.014	0.011	0.033	-0.019	0.069	0.030	0.073	0.165
Electrician, plumber, etc.	11	0.035	0.032	-0.014	0.006	0.062	-0.140	0.075	0.223	0.169	0.389
Common laborer	96	0.012	0.126	-0.014	0.003	0.135	-0.049	0.293	0.024	0.104	0.450
Casual construction worker	314	0.043	0.117	-0.035	0.008	0.145	-0.170	0.271	0.099	0.123	0.384

Table 7: Wage Equations Based on Human Capital, Trade Dummy and Compensating Differentials Models; Least Squares Estimates; Labor Force Sample Survey 1988 (LFSS-88) Sample of Casual Construction Workers Dependent Variable: log-wage

Variable	Human Capital Wage Model	Trade Dummy Model	Compensating Differentials Model (1)
Constant	1.204	1.153	0.869
	(0.101)**	(0.114)**	(0.246)**
Educational certificate°	0.015	0.015	0.010
	(0.066)	(0.069)	(0.066)
Construction Experience:			
Skilled	0.065	0.068	0.066
	(0.009)**	(0.009)**	(0.009)**
Unskilled	0.025	0.025	0.024
	(0.008)**	(0.009)**	(0.008)**
Construction Exp. Squared/100:			
Skilled	-0.119	-0.125	-0.119
	(0.021)**	(0.021)**	(0.020)**
Unskilled	-0.044	-0.044	-0.044
	(0.016)**	(0.016)**	(0.016)**
Skill Classification:			
Unskilled°	0.198	0.249	0.258
	(0.102)	(0.117)*	(0.113)*
Trade Classification:			
Mason°	-	0.166	-
		(0.139)	
Tile layer°	-	0.056	-
		(0.110)	
Plasterer°	-	0.068	-
		(0.074)	
Painter°	-	0.186	-
		(0.078)*	
Joiner°	-	-0.084	-
		(0.136)	
Electrician, plumber, etc. °	-	-0.183	-
		(0.118)	

Table 7: contd

Compensation Term:			
γ_1	-	-	1.102
			(0.673)
No. of observations	504.0	504.0	504.0
R-squared	0.196	0.222	0.203

Notes: Robust standard errors in parentheses. Statistically significant coefficients at the 1% (**), 5% (*) level based on a two-tailed test are marked. ° Dummy variable; equals 1 if the definition applies to the individual, 0 otherwise. Reference categories are shown in Table 1.

Table 8: Means of Selected Variables, Size of Compensation Terms, and Total Wage Compensation by Trade; LFSS-88 Sample of Casual Construction Workers

Trade	Number in Sample	$\log w$	π_0	Model (1) $\gamma_1 \frac{\pi_0^2}{1-\pi_0}$	Model (1) $\frac{w-w^*}{w^*}$
Form worker	53	1.92	0.425	0.401	0.494
Mason	21	1.97	0.398	0.336	0.399
Tile layer	6	1.96	0.442	0.447	0.564
Plasterer	51	1.91	0.426	0.404	0.497
Painter	25	1.88	0.444	0.453	0.573
Joiner	15	1.62	0.326	0.201	0.223
Electrician, plumber, etc.	12	1.81	0.412	0.369	0.446
Common laborer	106	1.65	0.392	0.323	0.381
Casual construction worker	289	1.80	0.407	0.357	0.429

Appendix Tables

Table A1: Wage Equations Based on Human Capital, Trade Dummy and Compensating Differentials; Models with Correction for Selectivity by Skill Level; Least Squares Estimates; CWS Sample of Casual Construction Workers; Dependent Variable: log-wage

Variable	Human Capital Wage Model	Trade Dummy Model	Compensating Differentials Models: Model (1)	odel (2)	Model (3)†	Model (4)†
Constant	1.90	1.89	1.783	1.755	1.745	1.588
	(0.080)**	(0.082)**	(0.102)**	(0.112)**	(0.119)**	(0.202)**
Educational	-0.005	0.004	-0.005	0.000	0.007	0.004
certificate°	(0.050)	(0.048)	(0.047)	(0.048)	(0.049)	(0.049)
Construction experience:						
Skilled	0.014	0.017	0.016	0.015	0.016	0.017
	(0.007)	(0.007)*	(0.008)*	(0.008)	(0.008)*	(0.008)*
Unskilled	0.009	0.010	0.009	0.009	0.009	0.009
	(0.008)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)
Construction experience sq./100:						
Skilled	-0.013	-0.017	-0.014	-0.014	-0.015	-0.016
	(0.016)	(0.016)	(0.016)	(0.016)	(0.017)	(0.016)
Unskilled	-0.017	-0.017	-0.017	-0.017	-0.017	-0.017
	(0.015)	(0.015)	(0.012)	(0.012)	(0.012)	(0.012)
Skill classification:						
Unskilled°	-0.256	-0.252	-0.137	-0.197	-0.183	-0.268
	(0.129)*	(0.127)*	(0.131)	(0.140)	(0.156)	(0.151)

Table A1: contd.

Trade classification:						
Mason°	-	0.032	-	-	-	-

		(0.072)				
Tile layer°	-	0.193	-	-	-	-
		(0.085)*				
Plasterer°	-	0.039	-	-	-	-
		(0.058)				
Painter°	-	-0.046	-	-	-	-
		(0.061)				
Joiner°	-	-0.299	-	-	-	-
		(0.066)**				
Electrician,	-	-0.092	-	-	-	-
plumber, etc. °		(0.095)				
Compensation terms:						
γ_1	-	-	0.425	0.159	0.333	-1.115
			(0.154)**	(0.343)	(0.530)	(1.270)
γ_2	-	-	-	4.365	4.461	13.043
				(5.016)	(7.176)	(10.932)
γ_3 (×1000)	-	-	-	-	-3.570	5.012
					(2.889)	(5.663)
γ_4 (×1000)	-	-	-	-	0.012	0.690
					(2.635)	(1.175)
Skilled-unskilled selection:						
Skilled	-0.196	-0.178	-0.211	-0.210	-0.219	-0.205
workers	(0.072)**	(0.070)*	(0.085)*	(0.084)*	(0.087)*	(0.085)*
Unskilled	0.115	0.116	0.117	0.117	0.118	0.118
workers	(0.071)	(0.068)	(0.081)	(0.081)	(0.082)	(0.081)
No. of observations	314.0	314.0	314.0	314.0	314.0	314.0
R-squared	0.31	0.39	0.34	0.34	0.34	0.34

Notes: Robust standard errors in parentheses. Statistically significant coefficients at the 1% (**), 5% (*) level based on a two-tailed test are marked; †Final iteration results. ° Dummy variable; equals 1 if the definition applies to the individual, 0 otherwise. Reference categories are shown in Table 1.

Table A2: Wage Equations Based on Compensating Differentials Model (3); Least Squares Estimates, Iterations (1)-(5); CWS Sample of Casual Construction Workers; Dependent Variable: log-wage

Variable	**Iteration**				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Constant	1.667	1.661	1.660	1.660	1.660
	(0.115)**	(0.113)**	(0.113)**	(0.113)**	(0.113)**
Educational certificate°	0.045	0.045	0.045	0.045	0.045
	(0.050)	(0.050)	(0.050)	(0.050)	(0.050)
Construction experience:					
Skilled	0.018	0.018	0.018	0.018	0.018
	(0.008)*	(0.008)*	(0.008)*	(0.008)*	(0.008)*
Unskilled	0.012	0.012	0.012	0.012	0.012
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Construction exp. squared/100:					
Skilled	-0.021	-0.020	-0.020	-0.020	-0.020
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Unskilled	-0.020	-0.020	-0.020	-0.020	-0.020
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Skill classification:					
Unskilled°	-0.261	-0.265	-0.265	-0.265	-0.265
	(0.149)	(0.149)	(0.149)	(0.149)	(0.149)
Compensation terms:					
γ_1	0.280	0.263	0.265	0.265	0.265
	(0.538)	(0.524)	(0.524)	(0.524)	(0.524)
γ_2	5.009	5.458	5.468	5.465	5.465
	(7.471)	(7.088)	(7.053)	(7.052)	(7.052)
γ_3 (×1000)	-3.618	-3.561	-3.541	-3.539	-3.539
	(3.131)	(2.939)	(2.920)	(2.920)	(2.920)
γ_4 (×1000)	0.349	0.439	0.427	0.425	0.425
	(3.446)	(2.705)	(2.632)	(2.630)	(2.630)
No. of observations	314.0	314.0	314.0	314.0	314.0
R-squared	0.32	0.32	0.32	0.32	0.32

Notes: Robust standard errors in parentheses. Statistically significant coefficients at the 1% (**), 5% (*) level based on a two-tailed test are marked. ° Dummy variable; equals 1 if the definition applies to the individual, 0 otherwise. Reference categories are shown in Table 1.

Table A3: Wage Equations Based on Compensating Differentials Model (4); Least Squares Estimates, Iterations (1)-(3) and (39)-(42); CWS Sample of Casual Construction Workers; Dependent Variable: log-wage

				Iteration			
	(1)	(2)	(3)	(40)	(41)	(61)	(62)
Constant	1.566	1.791	1.752	1.498	1.498	1.498	1.498
	(0.185)**	(0.120)**	(0.120)**	(0.202)**	(0.202)**	(0.202)**	(0.202)**
Educational certificate°	0.042	0.029	0.030	0.041	0.041	0.041	0.041
	(0.049)	(0.048)	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)
Construction experience:							
Skilled	0.020	0.014	0.015	0.018	0.018	0.018	0.018
	(0.008)*	(0.008)	(0.008)	(0.008)*	(0.008)*	(0.008)*	(0.008)*
Unskilled	0.012	0.012	0.012	0.012	0.012	0.012	0.012
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Construction exp. squared/100:							
Skilled	-0.025	-0.016	-0.016	-0.021	-0.021	-0.021	-0.021
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Unskilled	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Skill classification:							
Unskilled°	-0.412	-0.335	-0.298	-0.341	-0.341	-0.341	-0.341
	(0.140)**	(0.131)*	(0.130)*	(0.140)*	(0.140)*	(0.140)*	(0.140)*
Compensation terms:							
γ_1	-2.069	1.742	0.736	-1.059	-1.059	-1.059	-1.059
	(1.244)	(1.033)	(0.849)	(1.273)	(1.273)	(1.273)	(1.273)
γ_2	21.671	16.621	13.875	12.499	12.508	12.504	12.504
	(11.523)	(8.349)*	(8.221)	(11.016)	(11.018)	(11.017)	(11.017)
γ_3 (×1000)	17.127	-2.773	-0.892	4.379	4.383	4.382	4.382
	(9.432)	(3.122)	(3.050)	(5.653)	(5.655)	(5.654)	(5.654)
γ_4 (×1000)	-3.146	-1.842	-1.230	1.016	1.016	1.016	1.016
	(2.678)	(0.671)**	(0.536)*	(1.182)	(1.182)	(1.182)	(1.182)
No. of observations	314.0	314.0	314.0	314.0	314.0	314.0	314.0
R-squared	0.33	0.33	0.33	0.32	0.32	0.32	0.32

Notes: Robust standard errors in parentheses. Statistically significant coefficients at the 1% (**), 5% (*) level based on a two-tailed test are marked. ° Dummy variable; equals 1 if the definition applies to the individual, 0 otherwise. Reference categories are shown in Table 1.