HOURS–WAGE TRADEOFFS AND JOB MOBILITY

by

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Abstract

The paper examines how hours constraints affect the decision to change jobs and the patterns of hours-wage tradeoffs which result from job changes. We analyze job mobility in a labor market in which work hours on a given job are inflexible and it is costly for workers to locate and move to alternative jobs. Costs of mobility and imperfect information about job offers will prevent a worker from adjusting hours by costlessly moving to jobs which offer wage-hours combinations on the his or her labor supply schedule. Consequently, workers will trade off wage gains for hours adjustments in making job changes. Specifically, we show that the partial effect of a positive change in hours by job changers who were overemployed (underemployed) on their prior job is to increase (reduce) the size of the wage gain required to induce a quit. The partial effect of a positive change in hours by job changers who are overemployed (underemployed) on their new job is to increase (reduce) the size of the wage gain associated with the quit.

We test these propositions through an empirical study of the relationship between the wage change and interactions among the change in hours and indicators of overemployment and underemployment on the old job and the new job. Despite the limitation imposed by small sample sizes and lack of information on the magnitude of hours constraints, our results are supportive of the theory.
I. INTRODUCTION

Most of the existing literature on labor supply is based on the assumption that workers choose hours freely at a parametric wage. Given this assumption, labor supply theory has limited implications for mobility from one job to another or for the wage gains associated with such moves.\(^1\) Since hours can be freely varied within any job, job choice and hours choice are related primarily by the influence of the wage rate on desired hours.\(^2\)

There are theoretical reasons to believe that firms place significant constraints on work hours. Models of labor demand which include worker specific costs as well as nonlinearities in the relationship between hours per worker and output suggest that work hours may be a job characteristic about which firms have particularly strong preferences.\(^3\) Jobs are in fact characterized by many non-wage features which both firms and workers care about, such as location, safety, work environment, pace, training opportunities, and work hours. For technological reasons, it is expensive for an individual firm to unbundle these characteristics and permit a worker in a particular job to trade off among them in accordance with his preferences.

There is also some empirical evidence to support the view that the constraints placed by firms on hours choice are quantitatively significant. A number of studies indicate that unemployment is a constraint on choice of hours of work.\(^4\) Gustman and Steinhauer (1983, 1984) have shown that persons near retirement age often must change jobs to reduce work hours. In Altonji and Paxson (1985) we have shown that work hours for a given individual vary much more across jobs than within a job. One explanation of this finding is that fixed hours requirements of a job have a large influence on hours actually worked.

The possibility that workers are not free to choose (or change) their work
hours has a number of implications for both labor supply and job mobility. First, if hours are dictated by the firm, then job changes may be driven by changes in labor supply preferences or changes in the number of hours required by the firm. Second, if workers have imperfect information regarding job offers and/or face costs of changing jobs, workers will have to choose the best hours-wage package available to them (taking account of search costs). More generally, workers must search across firms not only for the highest wage, as in simple search models, but for the best package of attributes. However, there is no reason to believe that the hours component of the best offer will correspond to the labor supply level implied by the wage component of the offer or even lie on a market hours-wage locus. Workers may accept a job offering lower wages in order to obtain better hours.

In what follows, we provide a theoretical and empirical analysis of how constraints on work hours affect the decision to change jobs and the patterns of hours-wage tradeoffs which result from job changes. Previous labor supply studies by Rosen (1976), Lundberg (1984), and Moffit (1984) have been conducted in a hedonic framework in which workers must trade off hours and wages in accordance with a market locus. The theoretical framework underlying our study combines some aspects of simple search models and some aspects of hedonic labor market models. As in simple search models, workers search across jobs for the "best" job available. As in hedonic models, the shape of the offer distribution for hours and wages and the actual distribution of hours and wages are influenced by the distribution of both worker and firm preferences for hours. In a world of tied wage-hours offers with imperfect information, workers are not necessarily on their labor supply functions or on the market wage-hours locus at any point in time.

The analysis focusses on how hours constraints affect the wage-hours tradeoffs which occur when workers quit. Using a quadratic approximation to
preferences (and drawing upon Abowd and Ashenfelter's (1981) analysis of compensating differentials for unemployment risk) we show that the partial effect of a positive change in hours by job changers who were overemployed (underemployed) on their prior job is to increase (reduce) the size of the wage gain required to induce a quit. We also show that the partial effect of a positive change in hours by job changers who are overemployed (underemployed) on their new job is to increase (reduce) the size of the wage gain associated with the quit. We provide an empirical study of how the wage change is affected by interactions among the change in hours and indicators of overemployment and underemployment on the old job and the new job.

The paper proceeds as follows. Section 2 presents a simple theoretical discussion of the implications of tied hours-wage offers for the probability that workers quit and for the tradeoff between hours changes and wage changes associated with quits. Section 3 discusses the data used in the study. Section 4 provides a regression analysis of the effects of hours constraints on the tradeoff between hours changes and wage changes associated with quits. We provide a brief summary of the paper and an agenda for future research in Section 5.

II. JOB MOBILITY IN THE PRESENCE OF A DISTRIBUTION OF TIED HOURS-WAGE OFFERS

In this section we develop a simple model of labor supply and job mobility in the presence of tied wage-hours offers and imperfect information. We then use the model to analyze the effects of hours constraints on the relationship between hours and wage changes resulting from quits.

The main features of the model are as follows. Firm $j$ has a production function $F(H_j, e_j; j)$ relating the size of the work force $e_j$ and hours per worker $H_j$ to output. The relationship is firm specific due to differences in production technology across individual firms as well as across product types.
The references in footnote 3 provide a useful discussion of the factors which determine the firm's preferences for hours. For simplicity, assume (as in Deardorff and Stafford (1976)) that due to technological constraints all workers in the firm must work the same number of hours. Thus a job offer consists of an hours, wage package.

The labor market is characterized by imperfect information about the location of job opportunities and available workers. The costs of recruiting an additional worker and the probability of turnover is a function of the hours-wage ($H_j, W_j$) package offered by the firm. (See Pencavel (1972) for a discussion of the role of recruiting costs in determining the compensation level chosen by firms.) For a given hours requirement, recruiting and turnover costs fall as the wage offer is increased. Of course, the relationship between these recruiting and turnover costs and ($H_j, W_j$) depends upon the density $g(H, W)$ of job offers in the economy and on worker preferences. In choosing $(e_j, H_j, W_j)$ the firm must consider the effect of $H_j$ on labor productivity and turnover and the effect of $W_j$ on wage costs and turnover costs. The production function and turnover cost function may be combined into the cost function for a given output level $Q$.

$$C(H_j, W_j, e_j; g(H, W), Q, j)$$

Note that this function depends upon the density function $g$ of hours-wage combinations offered elsewhere, since this density influences the recruiting costs and turnover probability associated with $H_j$ and $W_j$. Firm $j$ picks $e_j, H_j,$ and $W_j$ to minimize the cost function $C$.

For the labor market to be in equilibrium, the $e, H, W$ decisions of individual firms given $g(H, W)$ together with turnover behavior of workers across job types must be consistent with the offer distribution $g(H, W)$ which they generate. ($e_j$ influences $g(H, W)$ since the number of offers firms of type $j$ make affects the weight of $H_j, W_j$ offers in the offer distribution.)
The behavior of workers is as follows. Individual i has a preference function \( U(H, W; x) \) over hours-wage combinations. We assume \( U_{11} < 0 \), \( U_{22} < 0 \), and \( U_2 > 0 \). The sign of \( U_1 \) depends upon the hours level. The sign of \( U_{12} \) may be positive or negative. For notational convenience, the individual subscript is left implicit. The individual specific vector \( x \) summarizes the effects of individual characteristics (e.g., wealth, tastes for consumption and leisure, etc.) which have bearing on the hours-wage tradeoff. Due to difficulties in dealing with expectations about future preferences and job offers, we assume in this initial analysis that workers base decisions on the one period utility function \( U(H, W; x) \) rather than a lifetime utility function. The use of a multi-period model would complicate the analysis considerably. One such complication is that the distribution of \( g(H, W) \) may enter the valuation of a job offering \( H, W \) because it affects the odds that the person will find a superior job.

Furthermore, expectations as to whether current preferences are transitory or relatively permanent will affect the valuation of a current job offer.

Assume worker i has preferences \( x = x_0 \) and holds a job which offers \( (H_0, W_0) \). In changing jobs, workers incur a cost \( M \) which is measured in utility units. \( M \) enters into the comparison of the utility from the present job with that from an alternative. For worker i, the set of acceptable alternative jobs \( A(H_0, W_0; x_0) \) contains \( H, W \) offers which provide a utility level which exceeds \( U(H_0, W_0; x_0) \) by at least \( M \). The set \( A(., ., .) \) is formally defined as

(1) \( A(H_0, W_0, x_0) = \{ H, W : U(H, W; x_0) > U(H_0, W_0; x_0) + M \} \).

For simplicity, we assume that all workers receive, at no cost, one offer each period with probability \( P \). They accept the offer if it is among the set of preferred jobs. Thus, the probability \( P_{\text{quit}} \) that worker i accepts a new job is the product of \( P \) and the probability that a random offer lies in \( A(H_0, W_0, x_0) \).

This is equal to
\[ P_{\text{quit}} = P \left\{ \int \int_{H, W \in \mathbb{A}(H_0, W_0, x_0)} g(H, W) \, dH \, dW \right\} \]

The expected value of $H$ and $W$ on a job which is accepted is

\[ E(H, W \mid \text{Quit}) = \left\{ \int \int_{H, W \in \mathbb{A}(H_0, W_0, x_0)} (H, W) \left[ g(H, W)/P_{\text{quit}} \right] \, dH \, dW \right\} \]

Note that equations (1, 2, 3) imply that the quit probability and the expected value of $H$ and $W$ on the new job conditional on a move depends upon the initial indifference curve but not on the particular location of the initial job on that curve.

2.1 The Tradeoff between Hours Changes and Wage Changes Resulting from Quits

In this section we show that the partial effect of a positive change in hours by job changers who wished to work fewer (more) hours on their initial job is to increase (reduce) the size of the wage gain required to induce a quit. We also show that the partial effect of a positive change in hours by job changers who wish to work fewer (more) hours on their new job is to increase (reduce) the size of the wage gain required to induce a quit.

Let $U(H_0, W_0)$ denote the utility from consumption of leisure and goods for an individual who receives a real wage of $W_0$ and must work $H_0$ hours on his current job. We have absorbed the preference shifter $x$ into the functional form of $U(\ldots)$ for notational convenience. As above, the worker accepts an alternative offering $H_1$ and $W_1$ if:

\[ 4. \text{ GAIN} \equiv U(H_1, W_1) - U(H_0, W_0) \geq M, \]

where $M$ is the mobility cost.

Let $W_{\text{min}}$ denote the wage which satisfies (4) with equality. Then (4) is equivalent to the condition

\[ 5. W_1 \geq W_{\text{min}}, \]

where $W_{\text{min}}$ is a function of $H_0$, $W_0$, and $H_1$. Consequently, the set of acceptable
offers for a person initially receiving \((H_0, W_0)\) has the probability distribution

\[
g(H_1, W_1 \mid U(H_1, W_1) - U(H_0, W_0) \geq M) = g(H_1, W_1 \mid W_1 \geq \min(H_0, W_0, H_1)) \]

Let \(g(W_1 \mid H_1)\) denote the distribution of \(W_1\) conditional on a specific value of \(H_1\):

\[
g(W_1 \mid H_1) = \frac{g(W_1, H_1)}{\int_0^\infty g(W_1, H_1) \, dW_1}.
\]

The expected value of \(W_1\) for an acceptable offer which requires \(H_1\) hours is

\[
E(W_1 \mid H_1, W_1 \geq \min(H_0, W_0, H_1)) = \frac{\int_0^\infty W_1 g(W_1 \mid H_1) \, dW_1}{\int_{W_0}^{\min(H_0, W_0, H_1)} g(W_1 \mid H_1) \, dW_1}.
\]

We wish to show how constraints on hours in both the initial job and the new job affect the relationship between the expected value of the wage for acceptable offers and the hours level on the new job. Equation (6) implies that a change in \(H_1\) affects the expected value of acceptable wage offers in two ways. First, a change in \(H_1\) will change \(\min(H_0, W_0, H_1)\). Second, a change in \(H_1\) alters \(g(W_1 \mid H_1)\), the density of wage offers conditional on \(H_1\). We begin by investigating how a change in \(H_1\) affects \(\min(H_0, W_0, H_1)\). We then show how the hours level on the offered job affects the expected value of a wage offer given that the wage is greater than \(\min(H_0, W_0, H_1)\).

The Relationship Between \(\min(H_0, W_0, H_1)\) and \(H_1\).

The methods used by Ashenfelter (1980) and Abowd and Ashenfelter (1981) to study compensating differentials for unemployment risk provide a useful approach for deriving the relationship between \(\min(H_0, W_0, H_1)\) and \(H_1\). We begin by approximating the difference in utility between an offer \(H_1, W_1\) and the current offer \(H_0, W_0\) using a second order Taylor expansion of \(U(\cdot, \cdot)\) around the desired
hours level $S_0$ at the initial wage $W_0$. This leads to

$$(7) \quad \text{GAIN} = U(H^1, W^1) - U(H^0, W_0) =$$

$$U_2[H^1 - W_0] + .5U_{11}[H^1 - S_0]^2 + .5U_{22}[W_1 - W_0]^2 +$$

$$U_{12}[H^1 - S_0][W_1 - W_0] - .5U_{11}[H_0 - S_0]^2,$$

where all derivatives are evaluated at $S_0$, $W_0$ and all second derivatives are assumed to be constant over the relevant range. In deriving (7) we have used the fact that $S_0$ is the solution to $U_1(S_0, W_0)=0$. The above equation may be rewritten as:

$$(8) \quad \text{GAIN} = U_2[H^1 - W_0] + .5U_{11}[S_1 - S_0]^2 + U_{12}[S_1 - S_0][W_1 - W_0]$$

$$+ .5U_{22}[W_1 - W_0]^2 + U_{12}[H^1 - S_1][W_1 - W_0] + U_{11}[H^1 - S_1][S_1 - S_0]$$

$$+ .5U_{11}[H^1 - S_1]^2 - .5U_{11}[H_0 - S_0]^2,$$

where $S_1$ is the desired hours level at $W_1$.

The term $ .5U_{11}[H^1 - S_1]^2 - .5U_{11}[H_0 - S_0]^2$ may be rewritten as:

$$ .5U_{11}[H^1 - S_1][H^1 - H_0] + .5U_{11}[H_0 - S_0][H^1 - H_0]$$

$$- .5U_{11}[S_1 - S_0][H^1 - S_1] - .5U_{11}[S_1 - S_0][H_0 - S_0],$$

and under a quadratic approximation to the utility function

$$S_1 - S_0 = -U_{12}/U_{11} [W_1 - W_0].$$

Using these two facts one may rewrite (8) as

$$(9) \quad \text{GAIN} = U_2[W_1 - W_0] + .5U_{22}[H^1 - W_0]^2 - .5[U_{12}/U_{11}][W_1 - W_0]^2$$

$$+ .5U_{11}[H^1 - S_1][H^1 - H_0] + .5U_{12}[H^1 - S_1][W^1 - W_0]$$

$$+ .5U_{11}[H_0 - S_0][H^1 - H_0] + .5U_{12}[H_0 - S_0][W_1 - W_0].$$

$W_{\text{min}}$ is implicitly defined as the solution to

$$(10) \quad U_2[W_{\text{min}} - W_0] + .5U_{22}[W_{\text{min}} - W_0]^2 - .5[U_{12}/U_{11}][W_{\text{min}} - W_0]^2$$

$$+ .5U_{11}[H^1 - S_1][H^1 - H_0] + .5U_{12}[H^1 - S_1][W_{\text{min}} - W_0]$$

$$+ .5U_{11}[H_0 - S_0][H^1 - H_0] + .5U_{12}[H_0 - S_0][W_{\text{min}} - W_0] - M = 0.$$

Conditional on $(W_0, H_0)$, the derivative of $W_{\text{min}}$ with respect to $H_1$ is
\[
\frac{\partial W_{\text{min}}}{\partial H_1} = \frac{.5(H_0 - H_1) - .5W_{\text{min}} - W_0 - .5[(H_0 - S_0) + (H_1 - S_1)]}{U_2 + \frac{U_{22}}{U_{11}}[W_{\text{min}} - W_0]} - .5 \phi^2 - .5\phi[H_1-S_1 + H_0-S_0] - .5\phi[H_1-H_0]
\]

where \(\phi = \frac{U_{12}}{U_{11}}\) is the uncompensated labor supply response.

For a sample of male heads of households, it is reasonable to assume that \(\phi\) is near 0. Setting to \(\phi\) to 0,

\[
(11) \quad \frac{\partial W_{\text{min}}}{\partial H_1} = \frac{.5(H_0 - H_1) - .5[(H_1 - S_1) + (H_0 - S_0)]}{U_2 + \frac{U_{22}}{U_{11}}[W_{\text{min}} - W_0]}
\]

The expression \(U_2 + \frac{U_{22}}{U_{11}}[W_{\text{min}} - W_0]\) in the denominator is the derivative of the gain from quitting with respect to \(W\) evaluated at \(W_{\text{min}}\). This certainly will be positive, which together with the assumption that \(U_{11} < 0\) implies that the denominator of the right hand side of (11) is negative. Consequently, \(\frac{\partial W_{\text{min}}}{\partial H_1}\) is a positive function of \([H_0 - S_0]\), and a positive function of \([H_1 - S_1]\).

Thus the relationship between \(W_{\text{min}}\) and \(H_1\) depends on the sign and magnitude of \(H_0 - S_0\) as well as \(H_1 - S_1\). Although \(S_0\) and \(S_1\) are unobserved, information about the sign of \((H_1 - S_1)\) and \((H_0 - S_0)\) is available. We introduce interaction terms between \([H_1 - H_0]\) and dummy variables which indicate whether \((H_1 - S_1)\) and \((H_0 - S_0)\) are less than or greater than threshold levels into the equation relating \(W_{\text{min}}\) and \(H_1\). Specifically, we define the underemployment indicator \(\text{UNDER}_j\) and the overemployment indicator \(\text{OVER}_j\) for job \(j\) as:

\[
\begin{align*}
\text{UNDER}_j &= 1 \text{ if } (H_j - S_j) < K_{\text{under}}, \quad j = 0, 1 \\
&= 0 \text{ if } (H_j - S_j) > K_{\text{under}} \\
\text{OVER}_j &= 1 \text{ if } (H_j - S_j) > K_{\text{over}}, \quad j = 0, 1 \\
&= 0 \text{ if } (H_j - S_j) < K_{\text{over}}.
\end{align*}
\]

where \(K_{\text{under}}\) and \(K_{\text{over}}\) are constants which correspond to the threshold levels of underemployment and overemployment (respectively) beyond which people indicate that they underemployed or overemployed. By "overemployment", we
mean that the person wishes to work fewer hours given the wage rate and other work conditions but is constrained from doing so as a condition of employment. By underemployment, we mean that the person wishes to increase hours worked on the current job but cannot do so.

After evaluating $H_1 - S_1$, $W_0 - S_0$, $H_1 - H_0$ and $W_{min} - W_0$ at the mean values for these variables conditional on the different values of UNDER\textsubscript{j} and OVER\textsubscript{j}, equation (11) suggests the following equation relating $W_{min} - W_0$ and $H_1 - H_0$:

\begin{equation}
W_{min} - W_0 = a_0 + a_1[H_1-H_0] + a_2\text{OVER}_0[H_1-H_0] + a_3\text{UNDER}_0[H_1-H_0] + a_4\text{OVER}_1[H_1-H_0] + a_5\text{UNDER}_1[H_1-H_0]
\end{equation}

In equation (12) $a_2 > 0$, $a_3 < 0$, $a_4 > 0$, $a_5 < 0$. The coefficient $a_1$ is ambiguous in sign. The positive sign of $a_2$ follows from the facts that the denominator of the right hand side of (11) is negative (see above) and $-0.5(W_0 - S_0) < 0$ if $\text{OVER}_0 = 1$. The signs of $a_3$, $a_4$, and $a_5$ are determined in a similar way. The positive sign of $a_2$ implies that persons who are currently overemployed will accept a job requiring an increase in hours only if the minimum acceptable wage rises by more than would be required in the absence of the constraint. A reduction in hours reduces the amount of overemployment and reduces $W_{min}$. The coefficients on the other variables have similar interpretations.

The Relationship Between $H_1$ and the Expectation of $W_1$

Equation (12) is the relationship between the minimal wage change required to induce a quit and the hours change $H_1 - H_0$. However, we observe the actual wage change, $W_1 - W_0$, rather than the minimal wage change $W_{min}(H_0, W_0, H_1) - W_0$. Thus, we need to see how $E(W_1 \mid H_1; W_1 \geq W_{min}(H_0, W_0, H_1))$ is affected by changes in $H_1$. For notational convenience, in what follows we will write $W_{min}(H_0, W_0, H_1)$ simply as $W_{min}(H_1)$ or as $W_{min}$, making the $H_0$ and $W_0$ arguments
implicit. As discussed above, a change in $H_1$ affects $E[W_1 | H_1; W_1 > \min(H_1)]$ in two ways. First, $H_1$ affects $\min$. Second, $H_1$ affects $g(W_1 | H_1)$, the conditional distribution of wage offers. Consequently, it is at least possible that $\partial E[W_1 | H_1; W_1 > \min(H_1)]/\partial H_1$ and $\partial \min/\partial H_1$ are opposite in sign. For example, suppose that the form of preferences and the values of $H_0$ and $W_0$ are such that an increase in $H_1$ leads to a decrease in $\min$. Holding $g(W_1 | H_1)$ fixed, it is easy to show by differentiating (6) that the fall in $\min$ leads to a decrease $E[W_1 | H_1; W_1 > \min(H_1)]$. (Intuitively, lowering the truncation point of a truncated distribution must decrease the mean of the truncated distribution.) However, if offers of $H_1$ and $W_1$ are positively correlated, then a larger value of $H_1$ will shift the mean of wage offers to a higher level. The overall effect of a higher value of $H_1$ could be to increase $E[W_1 | H_1; W_1 > \min(H_1)]$, despite the fact that $\min$ has fallen. Only if $H_1$ and $W_1$ are independently distributed, in which case changes in $H_1$ do not affect $g(W_1 | H_1)$ (i.e., the marginal distribution of $W_1$ and the distribution of $W_1$ are the same) can one definitely say that $\partial E[W_1 | H_1; W_1 > \min(H_1)]/\partial H_1$ and $\partial \min/\partial H_1$ have the same sign.

To make the empirical analysis tractable we assume that $\partial E[W_1 | H_1; W_1 > \min(H_1)]/\partial H_1$ is a positive linear function of $\partial \min/\partial H_1$. This assumption, together with (11) and (12) above leads to equation (18) on page 14. To provide insight into what this assumption involves, in the following paragraphs we derive the exact relationship between $\partial E[W_1 | H_1; W_1 > \min(H_1)]/\partial H_1$ and $\partial \min/\partial H_1$ in the case in which wages and hours have a bivariate normal distribution but are not necessarily independent. Casual readers may proceed to equation (18) without loss of continuity.

Let $g(W_1 | H_1)$, the joint distribution of hours and wage offers, be bivariate normal with $E(W_1) = \mu_1, E(H_1) = \mu_2, \var(W_1) = \sigma^2_1, \var(H_1) = \sigma^2_2$, and $\text{corr}(W_1, H_1) = \rho$. Then $g(W_1 | H_1)$, the distribution of $W_1$ conditional on $H_1$, is
also normal with mean $\mu$ and variance $\sigma^2$, where

$$
\mu = \frac{\mu}{\sigma H} + \frac{\rho \sigma W (H_1 - \bar{H})}{\sigma H} \quad \text{and} \quad \sigma^2 = \frac{\sigma^2 W (1-\rho^2)}{\sigma H}.
$$

Using well known properties of the normal distribution, $E[W_1|H_1; W_1 > W_{\min}(H_1)]$

can be expressed as:

$$
E[W_1|H_1; W_1 > W_{\min}(H_1)] = \sigma \lambda(-\frac{\min - \mu}{\sigma}) + \mu,
$$

where $\lambda(z) = \frac{n(z)}{1-N(z)}$, and $n(\cdot)$ and $N(\cdot)$ are the density and distribution functions of the standard normal. ($\lambda(\cdot)$ is the inverse of Mill's ratio).

The derivative of $E[W_1|H_1; W_1 > W_{\min}(H_1)]$ with respect to $H_1$ equals

$$
\sigma \lambda(-\frac{\min - \mu}{\sigma})/\partial H_1 + \partial \mu/\partial H_1.
$$

Since $\lambda(a) / \partial a = \{\lambda(a)^2 - a \lambda(a)\}$, we obtain

$$
(15) \quad \frac{\partial E[W_1|H_1; W_1 > W_{\min}(H_1)]}{\partial H_1} = \frac{\partial W_{\min}}{\partial H_1} \left\{ (\lambda(-\frac{\min - \mu}{\sigma}))^2 - \frac{W_{\min} - \mu}{\sigma} \lambda(-\frac{\min - \mu}{\sigma}) \right\}

+ \frac{\partial \mu}{\partial H_1} \left\{ 1 - (\lambda(-\frac{\min - \mu}{\sigma}))^2 + \frac{W_{\min} - \lambda}{\sigma} \lambda(-\frac{\min - \lambda}{\sigma}) \right\}.
$$

The fact that $\partial \mu/\partial H_1 = \sigma W / \sigma H$ and that

$$
(16) \quad \text{Var} \left(\frac{W_1 - \mu}{\sigma} \mid H_1; \frac{W_1 - \mu}{\sigma} > \frac{W_{\min} - \mu}{\sigma} \right) = \{ 1 - (\lambda(-\frac{\min - \mu}{\sigma}))^2 \} + \frac{W_{\min} - \mu}{\sigma} \lambda(-\frac{\min - \mu}{\sigma})
$$

together with equation (15) leads to
\[ \Delta E[W_1|H_1; W_{1,\text{min}}(H_1)]/\Delta H_1 = \]
\[ \frac{\Delta W_{\text{min}}(H_1)}{\Delta H_1} \{ 1 - \text{Var}(\frac{W_1 - \mu}{\sigma} | H_1; \frac{W_1 - \mu}{\sigma} > \frac{W_{\text{min}} - \mu}{\sigma}) \} \]
\[ + (\rho \sigma W/\sigma_H) \{ \text{Var}(\frac{W_1 - \mu}{\sigma} | H_1; \frac{W_1 - \mu}{\sigma} > \frac{W_{\text{min}} - \mu}{\sigma}) \} . \]

The term \( \text{Var}(\frac{W_1 - \mu}{\sigma} | H_1; \frac{W_1 - \mu}{\sigma} > \frac{W_{\text{min}} - \mu}{\sigma}) \) is between 0 and 1, since
\( \text{Var}(\frac{W_1 - \mu}{\sigma} | H_1) \) is equal to 1. Therefore, the coefficient on \( \Delta W_{\text{min}}(H_1)/\Delta H_1 \) is positive. If, as seems likely, \( \rho \) is positive (i.e., jobs requiring higher hours pay higher wages) then the second term in (17) is also positive.

If \( \text{Var}(\frac{W_1 - \mu}{\sigma} | H_1; \frac{W_1 - \mu}{\sigma} > \frac{W_{\text{min}} - \mu}{\sigma}) \) is relatively stable over the relevant range of values of \( H_1 \) and \( W_{\text{min}} \) for our sample of quits, then \( \Delta E[W_1|H_1; W_{1,\text{min}}(H_1)]/\Delta H_1 \) in (17) can be expressed as a linear transformation of the expression for \( \Delta W_{\text{min}}/\Delta H_1 \) in equation (11). Calculations of this conditional variance using (16) and tables for the standard normal distribution normal show that in fact the conditional variance does not vary much over a fairly wide range of \( (W_{\text{min}} - \mu)/\sigma \). For example, it is equal to .36, .24, and .20 when \( (W_{\text{min}} - \mu)/\sigma \) is equal to 0, .5, and 1 respectively.

Consequently, if \( W_{\text{min}} - \mu \) does not vary too much relative to the standard deviation \( \sigma \) of \( W_1|H_1 \), then the assumption is valid. We do not have any evidence on whether the variation in \( W_{\text{min}}(H_1) \) is small enough relative to \( \sigma \) for this to assumption to hold. Although we do not observe the offer distribution of \( H \) and \( W \), a regression of actual wages against actual hours (not reported) indicates that large changes in hours have only a small affect on the conditional expectation of the wage. This provides some support for the view that variation in \( H_1 \) has only a small affect on the conditional mean \( \mu \) of \( W_1 \) relative to \( \sigma \). However, we make the assumption that \( \Delta E[W_1|H_1; W_{1,\text{min}}(H_1)]/\Delta H_1 \) is a linear function of \( \Delta W_{\text{min}}/\Delta H_1 \) to make the empirical analysis tractable rather than because we have strong support for it.
With this assumption, we express \( E[W_1 - W_0 | H_1; W_{\text{min}}(H_1)] \) as a linear function of \( W_{\text{min}} - W_0 \). Using (12), we obtain the following equation relating the actual wage change and hours change when a quit occurs:

\[
W_1 - W_0 = c_0 + c_1[H_1 - H_0] + c_2\text{OVER}_0[H_1 - H_0] + c_3\text{UNDER}_0[H_1 - H_0] + c_4\text{OVER}_1[H_1 - H_0] + c_5\text{UNDER}_1[H_1 - H_0] + \epsilon,
\]

where \( c_1 \) is ambiguous in sign, \( c_2 > 0, c_3 < 0, c_4 > 0, c_5 < 0 \), and the error component \( \epsilon \) captures variation in \( W_1 - W_0 \) around \( E[W_1 | H_1; W_{\text{min}}(H_1)] - W_0 \) as well as approximation error.

The above analysis is of course predicated on the view that job offers consist of an \( H,W \) package. Most empirical job search and labor supply has been conducted using models in which workers may freely choose hours. Consequently, it is useful to consider the equation corresponding to (11) in the case of no hours constraints. In this case, (10) reduces to

\[
U_2[W_{\text{min}} - W_0] + 0.5U_{22}[W_{\text{min}} - W_0]^2 - 0.5[U_{12}/U_{11}][W_{\text{min}} - W_0]^2 - M = 0.
\]

This is a quadratic equation in \( W_{\text{min}} - W_0 \) with the solution:

\[
W_{\text{min}} - W_0 = \frac{-U_2 + \sqrt{\left(U_2\right)^2 + 2\left[U_{22} - U_{12}/U_{11}\right]M}}{U_{22} - U_{12}/U_{11}}.
\]

\( W_{\text{min}} \) is an increasing function of the mobility cost \( M \). The observed relationship between hours and wages will correspond to the inverted labor supply schedule, with

\[
[W_1 - W_0] = d_0 + d_1[H_1 - H_0] + \text{error},
\]

where \( d_1 = 1/\phi \), the inverse of the labor supply response to a change in the wage. Note that \( d_1 \) should be large if \( \phi \) is small. The presence of \( [H_1 - H_0] \) in equation (18) guards against the possibility that the relationship between wage changes and hours changes arise from movement along a conventional labor supply function. However, if one views (18) as an inverted labor supply
equation in light of (20), then $H_1 - H_0$ is likely to be correlated with the error term in (18). Measurement error in $[H_1 - H_0]$ might also result in such a correlation. This might bias the coefficient on $[H_1-H_0]$ and affect the interaction with the hours constraint indicators as well. If one takes the labor supply model as the null hypothesis, then determinants of wage offers across jobs might be used as instrumental variables for the hours change measures and the constraint variables. However, the PSID does not contain sufficient information on determinants of wage offers to attempt such as procedure, especially given that the analysis is conducted in first differences and given that the instrumental variables would have to be sufficient to identify the effects of several hours change and constraint variables.

Finally, we note that the empirical specifications used below differ from (18) in the three ways. First, although (18) pertains to quits only, we estimate the equation over observations for which there was either a quit or no job change. However, we include interaction terms between quits and all variables involving the change in hours, and include the indicators of overemployment and underemployment only if a quit occurred. Basically, we use the observations for which no job change has occurred only to help identify the effects of the variables used as controls in the analysis. Estimation of the equation with only quits would have resulted in a small sample size. Use of the combined sample also enables us to directly compare patterns of wage/hours changes for quits and non-quits.

Second, (18) implies that the coefficients on the change in hours and the change in hours/constraint interactions will be identical for increases and decreases in hours. However, we allow the coefficients on these terms to differ depending on whether the change in hours is positive or negative. It seems unreasonable to impose symmetry, given that we are working with dummy
variables which indicate the presence of a constraint but do not signify the magnitude of the constraint.

Last, we control for education, experience, experience squared and cubed, race, changes in marital status and changes in health status. Also, in some specifications of the model, we include the squared change in hours. The rationale for the inclusion of this variable is as follows. First, there may be measurement error in the constraint indicators, such that individuals who are constrained do not report themselves as being so. Second, there is reason to believe that those who experience large changes in hours (in either direction) when they change jobs are more likely to have been constrained than those whose hours change is small. For these reasons, the squared change in hours may provide an alternative indicator of constraints on the initial job. In this case, one would expect large hours changes (measured by the squared change in hours) to be associated with smaller wage gains.

III. DATA

The data are drawn from the 14 year (1968-1981) Panel Study of Income Dynamics (PSID) Individuals Tape. Observations on male heads of households for a particular year were included only if the individual was between the ages of 18 and 69, inclusive, and was not retired and data was available on all variables used in the analysis. Observations for a given year were eliminated if total annual work hours exceeded 5,000. Additional exclusions are discussed below.

The wage measure used in the analysis is the reported hourly wage at the survey date (typically March) divided by the implicit price deflator for consumption expenditures. It is available only from 1971 on for non-salaried workers, and from 1976 on for salaried workers. The dependent variable in the equation is the change in the log of the wage rate, Δln(wage) measured over a
two year time interval (i.e. $\Delta \ln(wage) = \ln(wage)_t - \ln(wage)_{t-2}$). The hours measure used is reported hours/week worked on the main job in the calendar year proceeding the survey. The change in hours, $\Delta \text{HOURS}$, is also computed over a two year time interval. The variable $|\Delta \text{HOURS}.\text{UP}|$ is equal to $\Delta \text{HOURS}$ if $\Delta \text{HOURS}$ is non-negative, and equal to 0 if $\Delta \text{HOURS}$ is negative. Likewise, $|\Delta \text{HOURS}.\text{DOWN}|$ is equal to the absolute value of $\Delta \text{HOURS}$ if $\Delta \text{HOURS}$ is negative, and equal to 0 if $\Delta \text{HOURS}$ is non-negative. The variable QUIT is a dummy variable for whether or not a quit occurred in the survey year $t-1$.

Observations were excluded from the analysis if a separation occurred in time periods $t$ or $t-2$, or if a layoff occurred in $t-1$. By eliminating observations with separations in $t$ or $t-2$, we reduce the possibility that reported hours refer to a mixture of hours worked on two jobs. We also ensure that the wage measure (which is the wage at the survey date, usually March) corresponds to the hours measure (which refers to the calendar year preceding the survey.) If a separation occurred in survey period $t-1$, the possibility still exists that hours in time $t$ is a mixture of hours on more than one job. Likewise, if a separation occurred in $t-3$, hours in $t-2$ could be a mixture. However, the construction of observations which unambiguously refer to only one job results in an excessive loss of observations, particularly for quits. Although the overall sample size is large (10,170 observations for the sample of all male heads of households), there are only 404 observations on quits and 277 observations on persons who quit and were overemployed or underemployed in either the old or new job.

The constraint indicators, UNDER$_j$ and OVER$_j$ ($j=0$ for the initial job, $j=1$ for the new job) are coded in the following way. If the respondent answered "no" to the question "Was there more work available on your job(s) such that you could have worked more if you had wanted to?" and "yes" to "Would you have liked to work more?" then UNDER$_j$ was set to 1 (otherwise 0).
If the respondent answered "no" to the question "Could you have worked less?" and "yes" to "Would you have liked to have worked less, even if it meant earning less money?" then \( \text{OVER}_j \) was set to 1 (0 otherwise). In the sample of all males, 27% reported underemployment (i.e. \( \text{UNDER}_0=1 \)) and 6% reported overemployment (\( \text{OVER}_0=1 \)) on the initial job. The wording of the questions pertaining to overemployment give a clue as to why there are so few reports of overemployment. Some respondents may have interpreted "even if you had earned less money" as "even if your wage was lower", rather than "even if your income was lower". It is possible that some individuals would like to reduce work hours at the current wage but would not like to reduce hours at a lower wage. This may be a source of measurement error in the overemployment indicator.

Descriptive statistics on the variables used in the analysis are presented in Appendix Table A1.

IV. RESULTS

Table 1 provides descriptive statistics on \( \text{OVER}_j \) and \( \text{UNDER}_j \) for persons who quit and persons who do not quit. The pattern of hours changes for quits with underemployment in the initial job, quits with overemployment in the initial job, and quits without under or overemployment are consistent with the notion that job changes are motivated by the desire to adjust hours. About 41% of underemployed quits reduced hours, while 17% of underemployed quits increased their hours. Similarly, 40% of the overemployed quits reduced hours, while only 28% increased hours. The sample mean for the change in hours/week is -3.2 for overemployed quits, .88 for quits who were satisfied with their hours, and 3.6 for underemployed quits.³

The ordinary least squares estimates of variants of (18) are reported in Table 2. Approximate t-values are in parentheses.⁹ Readers should keep in
mind that several approximations have been made in deriving the equation. Furthermore, biases may arise from measurement error in the hours variable, the limitations of the hours constraint indicators, and the fact that the hours change is an endogenous variable in the equation if labor supply preferences vary over time and individuals may in fact freely choose hours. For these reasons, we focus upon sign predictions of the model rather than quantitative magnitudes. We regard the analysis as suggestive of what may be done should better data become available than as a definitive test of the theory.

Turning to the specific results, columns 1 and 2 of Table 2 report estimates of the change in the log of wage/hour as a function of demographic characteristics, and the absolute value of positive and negative changes in hours. Column 2 contains, in addition, the squared change in hours. These equations show that there is a positive, although very small, relationship between wages and hours when no constraints are taken into account: the coefficient on $|Δ\text{HOURS}^{UP}|$ is $0.002_{(34)}$ and the coefficient on $|Δ\text{HOURS}^{DOWN}|$ is $-0.011_{(2.37)}$. (t-statistics in parentheses) When the squared change in hours is included, the coefficient on $|Δ\text{HOURS}^{DOWN}|$ falls to $-0.0007$ and is no longer statistically different from 0.

Columns 3 and 4 are the same as columns 1 and 2, with the addition of constraint terms on the initial job. The coefficients on $|Δ\text{HOURS}^{UP}|·\text{UNDER}^{0}·\text{QUIT}$ and $|Δ\text{HOURS}^{DOWN}|·\text{OVER}^{0}·\text{QUIT}$ are $-0.0005_{(24)}$ and $-0.0043_{(93)}$. Thus, they have the signs predicted by the model but are not statistically different from 0. However, the results indicate that constrained job changers who change hours so as to make the constraints more severe receive positive and more significant wage gains: the coefficient on $|Δ\text{HOURS}^{UP}|·\text{OVER}^{0}·\text{QUIT}$ and $|Δ\text{HOURS}^{DOWN}|·\text{UNDER}^{0}·\text{QUIT}$ are $0.0209_{(1.30)}$ and $0.0111_{(2.33)}$, respectively. The inclusion of the squared change in hours in
column 4 has little effect on these results. For columns 3 and 4, the hypothesis that the constraint terms are jointly insignificant is rejected at the 9% level.

Columns 5 and 6 contain terms for overemployment and underemployment on the new job as well as the old job. The results for the constraint terms on the new job are similar to those for constraints on the old job, although moving into jobs with constraints has smaller effects on wages throughout. For example, in column 5, the coefficient on $\Delta HOURS.UP \times OVER_1 \times QUIT$ is .0097 (3.46) and the coefficient on $\Delta HOURS.UP \times OVER_0 \times QUIT$ is .0212 (1.32).

Again, the addition of the squared change in hours has little effect on the results, and the hypothesis that the constraints on the initial job and constraints on the new job are jointly insignificant is rejected at the 3% level.

Columns 7-12 are identical to columns 1-6 except that the coefficients on $\Delta HOURS.UP$, $\Delta HOURS.DOWN$, and $(\Delta HOURS)^2/10$ are allowed to differ depending on whether or not a quit occurred. This is done to control for the possibility of systematic patterns of wage/hours tradeoffs which occur when the job changes. Column 7 shows that, with no controls for constraints, those who quit exhibit a flatter hours/wage profile than those who did not quit. The addition of terms for the squared change in hours (column 8) shows that large hours changes within jobs are not systematically related to wage changes, but that large changes in hours across jobs are associated smaller wage gains. This finding is consistent with the idea that individuals with large hours changes are those with constraints in the initial job, and are therefore willing to take smaller wage gains in order to improve work hours.10

The results for the constraint variables in columns 9-12 are similar to those in columns 3-6. The major difference is that the coefficients for $\Delta HOURS.DOWN \times OVER_0 \times QUIT$ and $\Delta HOURS.DOWN \times OVER_1 \times QUIT$, which should be
negative, are positive. However, the coefficients on these terms are small and, with the exception of column 12, are not statistically different from 0. The sensitivity of $\text{AHOURS\_DOWN} \cdot \text{OVER}_0 \cdot \text{QUIT}$ and $\text{AHOURS\_DOWN} \cdot \text{OVER}_1 \cdot \text{QUIT}$ to the more elaborate specification in columns 9-12 probably reflects the fact that a quit occurs, hours fall, and the person in overemployed in the initial job in only 10 cases and the fact that a quit occurs, hours fall, and the person is overemployed in the new job in only 3 cases.

The table below contains a summary of the results for the interactions of $\text{AHOURS\_UP}$ and $\text{HOURS\_DOWN}$ with $\text{OVER}_0$, $\text{UNDER}_0$, $\text{OVER}_1$ and $\text{UNDER}_1$ when a quit occurs.

**SUMMARY OF QUALITATIVE FINDINGS**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Expected Sign</th>
<th>Actual Sign</th>
<th>Statistically Significant for most specifications?</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{AHOURS_UP} \cdot \text{UNDER}_0 \cdot \text{QUIT}$</td>
<td>-</td>
<td>-</td>
<td>no</td>
</tr>
<tr>
<td>$\text{AHOURS_UP} \cdot \text{OVER}_0 \cdot \text{QUIT}$</td>
<td>+</td>
<td>+</td>
<td>no</td>
</tr>
<tr>
<td>$\text{HOURS_DOWN} \cdot \text{UNDER}_0 \cdot \text{QUIT}$</td>
<td>+</td>
<td>+</td>
<td>yes</td>
</tr>
<tr>
<td>$\text{HOURS_DOWN} \cdot \text{OVER}_0 \cdot \text{QUIT}$</td>
<td>-</td>
<td>mixed</td>
<td>no</td>
</tr>
<tr>
<td>$\text{AHOURS_UP} \cdot \text{UNDER}_1 \cdot \text{QUIT}$</td>
<td>-</td>
<td>-</td>
<td>no</td>
</tr>
<tr>
<td>$\text{AHOURS_UP} \cdot \text{OVER}_1 \cdot \text{QUIT}$</td>
<td>+</td>
<td>+</td>
<td>yes</td>
</tr>
<tr>
<td>$\text{AHOURS_UP} \cdot \text{UNDER}_1 \cdot \text{QUIT}$</td>
<td>+</td>
<td>+</td>
<td>no</td>
</tr>
<tr>
<td>$\text{HOURS_DOWN} \cdot \text{OVER}_1 \cdot \text{QUIT}$</td>
<td>-</td>
<td>mixed</td>
<td>no</td>
</tr>
<tr>
<td>$(\text{AHOURS})^2 \cdot \text{QUIT}$</td>
<td>-</td>
<td>-</td>
<td>yes</td>
</tr>
</tbody>
</table>

Despite the small number of observations on quits and the likelihood of problems with the econometric specification, the qualitative results are remarkably consistent with the theory that workers trade off wage gains
against the desirability of work hours, in that 32 of 40 coefficients on the hours constraint interactions have the correct sign. All of the variables have the correct sign in the basic specification reported in columns 3-6. We also find that job changers who make large hours adjustments receive smaller wage gains. However, many of the coefficients are not statistically significant.

VI. CONCLUSION

The paper examines how hours constraints affect the decision to change jobs and the patterns of hours-wage tradeoffs which result from job changes. Costs of mobility and imperfect information about alternative jobs will prevent workers from adjusting hours by costlessly moving to jobs which offer wage-hours combinations on the labor supply schedule. Consequently, workers will trade off wage gains for hours adjustments in making job changes. Specifically, we show that the partial effect of a positive change in hours by job changers who were overemployed (underemployed) on their prior job is to increase (reduce) the size of the wage gain associated with a quit. We also show that the partial effect of a positive change in hours by job changers who are overemployed (underemployed) on their new job is to increase (reduce) the size of the wage gain associated with a quit.

We have tested these propositions through an empirical study of the relationship between the wage change and the change in hours and interactions among the change in hours and indicators of overemployment and underemployment on the old job and the new job. Although the analysis is hampered by small sample sizes and lack of information on the magnitude of hours constraints, our results are supportive of the theory.

A long research agenda remains. On the empirical side, it would be useful to extend the analysis to other panel data sets (including the Negative Income Tax data and the Quality of Employment Survey) which contain information on hours constraints, although a definitive analysis of the role of hours
constraints in job mobility will probably require a new data collection
effort. On the theoretical side, it would desirable to extend the model to a
multiperiod setting. Our paper is only a first step toward a joint analysis of
labor supply preferences, employer preferences for hours, the mobility decision,
and the tradeoff between hours changes and wage changes.
FOOTNOTES

1 This is an overstatement, since in search models such as Burdett and Mortensen (1977) labor supply considerations enter the decision of how much to search on the job, which may influence the rate at which workers move from one job to another. Of course, labor supply considerations are important for transition rates between employment, unemployment, and nonparticipation.

2 Although almost all labor supply studies emphasize the role of the wage and personal characteristics in hours choice (see Killingsworth (1983) and Pencavel (1984)), it is possible that nonwage job specific characteristics (e.g., working conditions, commuting time, training opportunities) are key labor supply variables. In Altonji and Paxson (1985), we discuss nonwage job specific labor supply determinants as an alternative to firm imposed hours requirements as an explanation for our finding that work hours are heavily influenced by the job a person holds. Job specific characteristics which influence labor supply would probably also affect the utility associated with various jobs and thus affect mobility decisions as well as labor supply.


4 These include Ashenfelter (1980), Ashenfelter and Ham (1979), Ham (1982, 1985), Rosen and Quandt (1976), and Rea (1974). There is considerable debate over whether this literature offers convincing evidence that workers are constrained in hours choice. See Pencavel (1984). Ham (1979) and Moffit (1982) estimate models in which workers may be constrained in how little they can work.

5 Several previous studies have examined the role of job characteristics other than the wage in job mobility. Bartel (1982) and Mitchell (1984) emphasize that mobility decisions are based upon many factors other than wages and provide empirical evidence on tradeoffs of wages with fringe benefits and nonpecuniary factors in job changes. Viscusi (1979) finds that after controlling for earnings a variety of job characteristics affect quit intentions, including job security and danger. Bartel and Borjas find that those who quit because of a job related reason (defined to include dissatisfaction with hours, working conditions, location, disliked fellow employees, or found a better job) received higher wage gains than those who quit for personal reasons such as health or family. They also found some weak evidence that those who gave a non-wage, job related reason for a job change (with hours as one possibility) did not do as well as other quitters. This is suggestive of a tradeoff between hours and wages of the type discussed in this paper. Duncan and Stafford (1980) analyze the effects of changes in various job attributes on the wages received by workers and provide an interesting theoretical discussion of the implications of imperfect information and search costs for the behavior of firms. There is, of course, a large literature on compensating differentials for various job attributes (See Rosen (1983) and Smith (1979)), although most of it abstracts from search considerations. Within this literature the work of Abowd and Ashenfelter (1981) and Topel (1984) on compensating differentials for unemployment risk, and Ehrenberg and Schumann's (1981) study of mandatory overtime are most relevant to the present study.

6 Note that the tradeoffs between hours and wages discussed in the paper would arise even if there is no systematic relationship between the hours level and the wage level of offers in the market. This would not be true if there
were no search costs and mobility costs and all jobs offering a given hours level paid the same wage.

Kiefer (1984) analyzes a search model of the labor market with fixed hours offers. Kiefer's model is multiperiod, but does not distinguish between offers from the current firm and outside offers. His framework is well suited for the analysis of transitions among employment, unemployment and nonparticipation, which are the focus of his paper. With some major modifications, it might be possible to use Kiefer's model to study direct transitions from one employer to another, which is our main concern. It is also worth mentioning that Dickens and Lundberg (1985) investigate a labor supply model in which persons must select from a finite number of employment opportunities which differ in the number of hours they require. However, they assume that all jobs pay the same hourly wage and do not consider job mobility.

Additional information on the properties of UNDERT,j may be found in Ham (1982), who reports a probit equation relating UNDERT,j to a variety of demographic and labor market characteristics.

The standard errors are computed under the assumption that errors in the observations in the wage change equation are independent across time for a given individual. Because of overlap in the three year time intervals for a given person, this is unlikely to be the case. As a result, the reported t-statistics are probably upward biased to some extent, although we doubt that this bias is very large.

For quits and layoffs combined Mincer (1985) finds that workers who change hours per week by more than 5 hours have smaller wage gains than those who do not. His motivation for using this hours measure is similar to our motivation in working with the squared change of hours. He finds the affects are stronger for older than young workers using this measure and presents evidence suggesting that part of the fall in returns to mobility with age is due to a change in the motivation for mobility toward nonwage factors. For quits we do not find significant differences between full sample and sample restricted to persons with more than 10 years of experience.
References


Deardorff, A.V., and F.P. Stafford, "Compensation of Cooperating Factors" Econometrica 44: 621-638


and Stafford, Frank P., "Do Union Members Receive Compensating Wage Differentials?" American Economic Review 70 No. 3 (June 1980).


Mincer, Jacob, "Wage Changes in Job Transitions", unpublished paper (June 1985).


Table 1  
DESCRIPTIVE STATISTICS ON HOURS CONSTRAINTS

<table>
<thead>
<tr>
<th>Full Sample</th>
<th>Number of Obs.</th>
<th>% of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>10170</td>
<td></td>
</tr>
<tr>
<td>QUIT=1</td>
<td>404</td>
<td>4.0%</td>
</tr>
<tr>
<td>UNDER₀=1</td>
<td>2766</td>
<td>27%</td>
</tr>
<tr>
<td>OVER₀=1</td>
<td>565</td>
<td>5.5%</td>
</tr>
<tr>
<td>UNDER₁=1</td>
<td>2646</td>
<td>26%</td>
</tr>
<tr>
<td>OVER₁=1</td>
<td>576</td>
<td>5.7%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sub-Sample of Quits</th>
<th>Observations</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>404</td>
<td></td>
</tr>
<tr>
<td>UNDER₀=1</td>
<td>120</td>
<td>30%</td>
</tr>
<tr>
<td>OVER₀=1</td>
<td>25</td>
<td>6.2%</td>
</tr>
<tr>
<td>UNDER₁=1</td>
<td>107</td>
<td>26%</td>
</tr>
<tr>
<td>OVER₁=1</td>
<td>25</td>
<td>6.2%</td>
</tr>
<tr>
<td>UNDER₀=1; Hours rise</td>
<td>49</td>
<td>12%</td>
</tr>
<tr>
<td>UNDER₀=1; Hours fall</td>
<td>21</td>
<td>5.2%</td>
</tr>
<tr>
<td>OVER₀=1; Hours rise</td>
<td>7</td>
<td>1.7%</td>
</tr>
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<td>OVER₀=1; Hours fall</td>
<td>10</td>
<td>2.5%</td>
</tr>
<tr>
<td>UNDER₁=1; Hours rise</td>
<td>28</td>
<td>6.9%</td>
</tr>
<tr>
<td>UNDER₁=1; Hours fall</td>
<td>38</td>
<td>9.4%</td>
</tr>
<tr>
<td>OVER₁=1; Hours rise</td>
<td>15</td>
<td>3.7%</td>
</tr>
<tr>
<td>OVER₁=1; Hours fall</td>
<td>3</td>
<td>.74%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average Change in Hours</th>
<th>MEAN</th>
<th>STD. DEV.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Sample</td>
<td>-.05</td>
<td>6.92</td>
</tr>
<tr>
<td>Sample of Quits (QUIT=1)</td>
<td>1.43</td>
<td>11.26</td>
</tr>
<tr>
<td>QUIT=1, UNDER₀=0, OVER₀=0</td>
<td>.88</td>
<td>11.28</td>
</tr>
<tr>
<td>QUIT=1, UNDER₀=1</td>
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### Table 2

**Change in Wage Equations — Full Sample — Males**

**OLS t-statistics in parentheses**

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<td>.0004</td>
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**Note:** Rows 1-14 are jointly significant.

**Construction of Variables:** Changes in the wage, hours, and other demographics were computed between time periods t and t-1. QUIT = 1 if a quit occurs in t-1. Observations are excluded if a separation occurred in t or t-2, or a layoff occurred in t-1. Variable definitions: "HOURS" is hours/week. OVER indicates overemployment in the job held in t. UNDER indicates underemployment in the job held in t. OVER, and UNDER, indicates overemployment in the job held in t-2 and t (respectively). WAGE is the reported hourly wage at the time of the survey. Variables included in the regressions but not reported: t, Race, changes in marital and health status, education, experience, experience squared, experience cubed.
## Table A1
Definitions, Means, and Standard Deviations of Variables (observations=10170)

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<th>Variable</th>
<th>Definition</th>
<th>Mean</th>
<th>Std.Dev</th>
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<td>Δln(Wage)</td>
<td>Change in ln of reported hourly wage between t and t-2</td>
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<td>.22</td>
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<td>QUIT</td>
<td>QUIT equals 1 if a quit occurred in t-1, else 0.</td>
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<td>.20</td>
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<tr>
<td>ΔHOURS UP</td>
<td>Absolute value of the change in hours/week from t-2 to t, if the change is positive (else 0).</td>
<td>1.749</td>
<td>4.64</td>
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<tr>
<td>ΔHOURS DOWN</td>
<td>Absolute value of the change in hours/week from t-2 to t if the change is negative (else 0)</td>
<td>1.802</td>
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<td>QUIT x ΔHOURS UP</td>
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<td>1.78</td>
</tr>
<tr>
<td>QUIT x ΔHOURS DOWN</td>
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<td>1.38</td>
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<tr>
<td>QUIT x Δ(HOURS^2)</td>
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<td>5.113</td>
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<td>ΔHOURS UP x UND</td>
<td>UNDER_0 equals 1 if the individual was underemployed in t-2, else 0.</td>
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<td>OVER_0 equals 1 if the individual was overemployed in t-2, else 0.</td>
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<td>ΔHOURS DOWN x QUIT</td>
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<td>.0109</td>
<td>.47</td>
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<td>ΔHOURS UP x UND</td>
<td>UNDER_1 equals 1 if the individual was underemployed in t, else 0.</td>
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<td>.60</td>
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<td>ΔHOURS UP x QUIT</td>
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<td>OVER_1 equals 1 if the individual was overemployed in t, else 0.</td>
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<td>ΔHOURS DOWN x QUIT</td>
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<td>.44</td>
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<td>EXPERIENCE</td>
<td>Years of Work Experience</td>
<td>19.33</td>
<td>10.9</td>
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<tr>
<td>RACE</td>
<td>RACE equals 1 if Black, 0 if White</td>
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<td>.47</td>
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<td>BECOME MARRIED</td>
<td>Equal 1 if unmarried in t-2 and married in t, else 0.</td>
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<td>BECOME SINGLE</td>
<td>Equals 1 if married in t-2, unmarried in t, else 0.</td>
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<td>.16</td>
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<td>STAY MARRIED</td>
<td>Equals 1 if married in t and t-2, else 0.</td>
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<td>.34</td>
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<td>BECOME ILL</td>
<td>Equals 1 if there is no health limitation on work in t-2, and is limitation in t</td>
<td>.039</td>
<td>.16</td>
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<tr>
<td>BECOME WELL</td>
<td>Equals 1 if there is health limitation on work in t-2, and no limitation in t (else 0)</td>
<td>.027</td>
<td>.16</td>
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<td>STAY ILL</td>
<td>Equals 1 if no health limitation on work in t or t-2, else 0.</td>
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<td>.20</td>
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