The Added Worker Effect

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The term "added worker effect" usually refers to a temporary increase in the labor supply of married women whose husbands have become unemployed. This paper presents a new approach to the empirical study of the added worker effect, which emphasizes the role of employment uncertainty and credit constraints in generating short-run participation and employment patterns. The estimates are based on employment transition probabilities rather than static measures of labor supply and are used in a dynamic simulation of changes in the employment and participation rates of wives following an exogenous increase in unemployment among their husbands. The results show a small but significant added worker effect, at least for white families, and suggest that the apparent disagreement among previous studies may stem from different approaches to measuring responses to a transitory event such as an unemployment spell.

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I. Introduction

Cyclical fluctuations in the size of the labor force, and their effect on measured unemployment, have been controversial topics since the Depression.[1] The response of labor force participation rates to a demand-induced fall in employment consists, according to the familiar decomposition, of two components—the added worker effect and the discouraged worker effect. A widespread deterioration in employment opportunities results in discouraged workers, who drop out of the labor force or refrain from entering it in anticipation of reduced wages or more costly job search. Additional labor force participants, however, may appear in families whose employed members have experienced layoffs or restrictions in work hours.

Most studies of the added worker effect have concentrated on changes in the size of the aggregate labor force over time rather than on the behavior of individuals. There is clear evidence (see Cain 1966) that when the unemployment rate rises, the discouraged worker effect dominates the added worker effect on aggregate participation rates, even for "secondary workers" such as married women and teenagers. The few attempts to test for the presence of an added worker effect in individual households have produced varied results; some have found a strong added worker effect, while others have discerned no response. This paper presents new estimates of the added worker effect which utilize employment transition probabilities rather than static measures of labor supply. The results show a small but significant added worker effect, at least for white families, and suggest that the apparent disagreement among previous studies may stem from different approaches to measuring responses to a transitory event such as an unemployment spell.

In a static model of household labor supply, an added worker effect arises in the following manner. A spell of unemployment experienced by the male head of household affects the labor supply of a nonparticipating wife in two ways: the transitory reduction in household income and the increase in husband's nonmarket time both tend to reduce the relative value of the wife's nonmarket time. Since the wife's labor force entry is only one of several ways in which the household might adjust to the loss of income, the magnitude of the added worker effect should be related to the efficacy or costs of other methods, such as more intensive job search by the husband or borrowing.

In a life-cycle context, we would expect the added worker effect to be important only in the presence of credit constraints. The wealth effect of a short spell of unemployment is likely to be small in the absence of such constraints, so that contemporaneous movements in the labor

[1] See the references in Mincer (1966) and Wachter (1974).

supply of husband and wife will reflect only cross-substitution effects, which are expected to be small.

The classic 1962 study by Mincer showed that, in a cross-section, a transitory reduction in income due to husband's unemployment has a greater effect on the labor supply of married women than does a permanent income loss. Specifically, Mincer found a strong negative relationship between the proportion of wives who worked at some time during the year and the weeks worked by the husband, holding his earnings constant. Heckman and MaCurdy (1980), in a longitudinal study, found no significant relationship between the husband's annual hours of unemployment and hours worked by the wife. Though there are many differences in methodology between the two studies, the most important discrepancy concerns the measurement of the added worker effect. Heckman and MaCurdy are measuring, roughly, differences in average annual hours worked between women whose husbands are unemployed at some time during the year and women whose husbands are employed full-time. Mincer (1962), on the other hand, uses a 0–1 measure of wife's employment which represents *maximum,* rather than average, labor supply.

The distinction is likely to be an important one, since the added worker effect in the presence of credit constraints will be a transitory response to what is, in general, a brief spell of unemployment. Studies which use long-run average measures of labor supply are less likely to observe an added worker effect and will ignore one of the most important attributes of an added worker response: changes in labor supply behavior are timed to smooth out fluctuations in household income.

Suppose that hours at work are fixed, so that both husband and wife may be in one of two states: employed or unemployed. The simplest schematic representation of an added worker effect is shown in figure 1.

The illustrated response is a stylized version of what we expect from an added worker. A woman who is initially a nonparticipant enters the

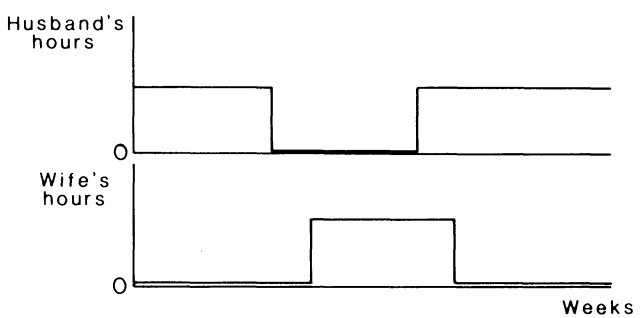

FIG. 1.—The added worker effect

labor force when her husband becomes unemployed and, with some lag due to job search activity, becomes employed. The job is a temporary one and its duration is related to the duration of the unemployment spell, though they need not end at the same time. This pattern can be described most completely if we distinguish between the probability of a labor supply response to unemployment (Mincer's measure) and the duration of responses which do occur. Heckman and MaCurdy's annual hours worked is, very roughly, the product of these two measures. The separation of incidence and duration of added worker responses can be accomplished by observing flows into and out of the labor force by wives. Since the decision to enter the labor force can be distinguished from the decision to accept a job offer when offers are uncertain, this can be generalized to flows into and out of employment and unemployment.

The next section introduces household transition rates and outlines the source of an added worker effect in a two-person model of labor supply under uncertainty. The effect is then restated as a set of predictions about transition probabilities among the possible states of employment, unemployment, and nonparticipation. Section III presents a technique for estimating the determinants of transition rates from actual employment histories and is followed by a description of the data. Section V contains the main empirical results and employs the entire household transition matrix to simulate the effects of increased unemployment among husbands on the labor supply of wives. The simulations reveal that increased unemployment among husbands has a small but definite effect on both unemployment rates and employment rates for white and Hispanic women. Among white families, the addition of 100 men to the ranks of the unemployed results in the participation of three additional wives, or 7% of the previous nonparticipants. Six months after the increase in unemployment has occurred, two of these three women have become employed. These magnitudes should be regarded as understatements of the "true" added worker effect, since there is some tendency, which can perhaps be attributed to assortative mating, for women whose husbands are not likely to be employed to be less likely to be employed themselves. The results for black families are completely dominated by this apparent selection problem, which also appears in the results for Hispanic families.

II. The Added Worker Effect and Labor Market Transitions

A. Household Employment Histories as a Markov Process

As figure 1 illustrates, the added worker effect consists of a temporary change in labor supply behavior. It will be reflected in conventional measures of labor supply such as annual average hours worked or participation probabilities, but can be described more completely using

the now-familiar device of flow rates between labor market states.[2] These states are conventionally defined as employment, unemployment, and nonparticipation, but they can be expanded or reduced as data permit and requirements suggest.

Marston (1976) found such a flow analysis useful for studying the determinants of unemployment and described the operation of the labor market in terms of a three-by-three matrix (see below) of flow rates.

Labor Force Status Previous Month	Labor Force Status Current Month		
	E_t	U_t	N_t
E_{t-1}	λ_{EE}	λ_{EU}	λ_{EN}
U_{t-1}	λ_{UE}	λ_{UU}	λ_{UN}
N_{t-1}	λ_{NE}	λ_{NU}	λ_{NN}

Each off-diagonal element λ_{jk} is the monthly rate at which transitions occur from state j to state k or, in a homogeneous population, the probability of making such a transition. Since each such probability depends only upon the initial state and the destination state, together they define a Markov process. In a continuous time framework, an analogous transition rate can be estimated as the number of transitions observed during the sample period, divided by the number of months spent in the initial state. Each row must sum to one, so the diagonal elements $\lambda_{jj} = 1 - \sum_{k \neq j} \lambda_{jk}$.

Together, these transition rates define a continuous time stochastic process for which we can calculate a corresponding steady-state probability distribution. Following Howard (1971), we define $\phi_j(t)$ as the probability that a continuous time Markov process occupies state j at time t and let $\Phi(t)$ be the row vector of state probabilities for all states. Let Λ be the square matrix such that the j-kth off-diagonal element is the transition rate λ_{jk} and the jth diagonal element is $-\lambda_j$. Then, if the initial probability distribution is $\Phi(0)$, we can write the distribution at any time t as

$$\Phi(t) = \Phi(0)e^{\Lambda t} \tag{1}$$

where

$$e^{\Lambda t} = I + \Lambda t + \frac{\Lambda^2 t^2}{2!} + \frac{\Lambda^3 t^3}{3!} + \cdots.$$

[2] Since Marston's (1976) influential article, which emphasized the volume of these flows relative to month-to-month changes in employment stocks, transition rates have been used extensively in the study of unemployment. In particular, they provide an alternative method of characterizing the frequency and duration of unemployment spells when lengthy employment histories for individuals are not available. For an example of this approach, see Clark and Summers (1979).

Differentiating this expression produces

$$\frac{d}{dt}\mathbf{\Phi}(t) = \mathbf{\Phi}(t)\mathbf{\Lambda},$$

so that the limiting state probability vector $\mathbf{\Phi}$ satisfies $\mathbf{\Phi\Lambda} = 0$ and $\sum_{j=1}^{n} \phi_j = 1$ and can be solved for in a straightforward manner.

In this paper, the household rather than the individual is the relevant decision-making unit, but the stochastic process described above can be modified accordingly. Choices between available states for husband and wife are made jointly, so the state space is expanded to nine, representing all possible combinations of employment, unemployment, and nonparticipation for the two members of the household. Equation (1) turns out to be very useful since, after estimating the elements of $\mathbf{\Lambda}$ and calculating the steady state $\mathbf{\Phi}$, we can perturb the employment distribution and trace its path back to the steady state. In Section V, such simulations are used to measure the response of wives to an exogenous increase in their husbands' unemployment.

When modeling the determinants of either individual or household transition rates, it seems natural to think of them as comprised of two conceptually distinct components—a stochastic element, which is not under the control of the individual household, and a second element representing household choices or strategy.[3] Each rate, therefore, depends both upon the arrival rates of opportunities to change state or of information about the value of alternative states and upon the household's preferences over the states available. The arrival of a job offer to one member of a household may be a random event, but the state occupancy that results will depend on the probability that this offer will be acceptable. In a standard search theory model, the individual's strategy is defined by the reservation, or lowest acceptable, wage. Below, we demonstrate that the household's strategy can be represented as a set of two "reservation" wages for each member—one that controls the participation decision and one that defines acceptable employment offers. It is through the effects of the husband's employment status on the reservation wages determining the wife's behavior that we can represent the added worker effect in terms of transition probabilities.

[3] For a more detailed treatment of the composition of transition rates, see Burdett and Mortensen (1978) or Lundberg (1981). Several attempts have been made to provide a "structural" interpretation of these rates and to separate arrivals from choice probabilities. These include Mortensen and Neumann (forthcoming), Flinn and Heckman (1982), and Olsen, Smith, and Farkas (1982). Other empirical applications include Burdett, Kiefer, Mortensen, and Neumann (1984); Tuma, Hannon, and Groeneveld (1979); and Tuma and Robins (1980).

B. Household Labor Supply under Uncertainty

Burdett and Mortensen (1978) have characterized a three-state individual employment process in terms of a model of labor supply with uncertainty in the arrival of job offers and job separations. This has been generalized to a two-person household with joint utility in Lundberg (1981), with the addition of shocks to the value of leisure. The latter model provides a rationale for an added worker effect in an uncertain labor market, and its implications for household transition rates are summarized below.

Let a two-person household maximize the expected value of utility, where the utility function is a discounted sum of the utility flow in each period. This utility flow is a strictly concave function, $u(x_t, l_{1t}, l_{2t})$, which depends on household commodity consumption in period t (x_t) and on the fraction of the period devoted to leisure by the husband (l_{1t}) and the wife (l_{2t}). Commodities and leisure are assumed to be complements in household production, while the leisure times of the two members are substitutes.[4]

Each member of the household can be in one of three states, employment, unemployment, or nonparticipation. Employment of member i requires that a fixed fraction of available time, h_i, be devoted to market work, and leisure time consumed is the residual $1 - h_i$. Unemployment requires that another fixed amount, $s_i < h_i$, be spent on job search. Each employed person receives a wage which, when added to a fixed quantity of nonlabor income, determines the budget constraint each period.

The household is subjected to a variety of random events, such as changes in the value of leisure time and job separations. The most important of these, for our purposes, is the random arrival of job offers to the unemployed. Each offer consists of a wage drawn from a known distribution which may vary across individuals. A choice between unemployment and nonparticipation will involve weighing the value of lost leisure against the expected benefits from future job offers, which arrive only to the unemployed. A choice between employment and unemployed search when an offer arrives will depend upon the relative values of employment income, and the leisure and expected future offer arrivals associated with unemployment.

The household's optimal strategy is derived by maximizing a value function which consists of current utility flow plus the discounted

[4] "Leisure" in this model can also be viewed as time devoted to nonmarket or household production. This interpretation renders the assumption of substitutability between l_1 and l_2 more palatable. The added worker effect may become ambiguous in sign if strong complementarities between l_1 and l_2 are permitted. The empirical evidence on this point is mixed, but Ashenfelter and Heckman (1974) conclude that the cross-substitution effect is zero.

expected value of future utility, given the stochastic parameters of the problem and the presumption of an optimal future strategy. Since time allocation and income are completely determined by the state occupied, this strategy can be derived simply by comparing the expected utility associated with occupying alternative states.

First, consider the value to the household of all possible allocations of the wife's time, given that the husband is working. To represent this, we introduce the function $V^j(w_1, w_2)$, which is the sum of the current utility flow when the wife is in state j earning a wage w_2 and the husband is earning w_1, plus the expected future utility gain attributable to the current allocation of the wife's time. The household's strategy will consist, in part, of two reservation wage functions which equate the value of the wife's employment to the values of unemployment and nonparticipation, and therefore determine her participation and acceptance decisions.

Let $w_2^r(w_1)$ be the solution to

$$V^E[w_1, w_2^r(w_1)] = V^U(w_1, 0) \tag{2a}$$

and $w_2^l(w_1)$ be the solution to

$$V^E[w_1, w_2^l(w_1)] = V^N(w_1, 0). \tag{2b}$$

The function $w_2^r(\cdot)$ represents the wage-equivalent value to the household of unemployed search by the wife and is analogous to the reservation wage in individual job search models. The wage-equivalent value of nonparticipation by the wife, $w_2^l(\cdot)$, is similar to the "reservation wage" in a static participation analysis (and would, in fact, be equivalent were job durations not uncertain).

An unemployed wife will accept a job offer $\hat{w}_2$ if the value of working at that wage exceeds the value associated with continued search, or $V^E(w_1, \hat{w}_2) > V^U(w_1, 0)$. This implies that a job offer $\hat{w}_2$ is acceptable only if $\hat{w}_2 > w_2^r(w_1)$. In deciding whether the wife should participate in the labor market, given no job attachment, the household will compare $V^U(w_1, 0)$ and $V^N(w_1, 0)$. This implies that a member of the household will participate as an unemployed job searcher if the cost of search, in terms of the utility loss from forgone leisure, is less than the expected return to search. An equivalent participation condition, in view of (2), is $w_2^r(w_1) > w_2^l(w_1)$. Given the assumption that the leisure of the two members are substitutes, it can be shown that

$$\frac{\partial w_2^l}{\partial w_1} > \frac{\partial w_2^r}{\partial w_1} > 0.$$

This proposition states that an increase in the husband's wage, by increasing the reservation wages of the wife, makes her less likely to

participate in the labor force and, if she does participate, less likely to accept a job offer. It follows immediately that the wife is more likely to search for work and to accept a given wage offer if her husband is unemployed, rather than employed at any acceptable wage. Reversing the identities of the household members leads to analogous results for the husband.

Figure 2 shows the reservation wages of the wife as functions of the wage earned by the husband, ceteris paribus. If the husband is employed at a wage w_1'', the wife will not participate in the labor force. If w_1 drops below w_1', however, or if the husband becomes unemployed, the value of the wife's search will exceed the value of full leisure, and she will become an added worker.

C. Components of the Added Worker Effect

The principal result of the previous section is that, all else equal, both reservation wages (the value of unemployed search and the value of nonparticipation) will be lower for wives whose husbands are not employed. This implies that the added worker effect will appear in a number of household transition rates. Denote each household state as JK where J refers to the employment status of the husband and K refers to the employment status of the wife. Controlling for wages and nonlabor income, we can make the following predictions:

$$1.\ \lambda_{EE\to EU} > \lambda_{UE\to UU}$$

$$\lambda_{EE\to EN} > \lambda_{UE\to UN}.$$

Employed wives will be *less* likely to leave employment, either for unemployment or nonparticipation, when their husbands are unemployed.

$$2.\ \lambda_{EN\to EU} < \lambda_{UN\to UU}$$

$$\lambda_{EN\to EE} < \lambda_{UN\to UE}.$$

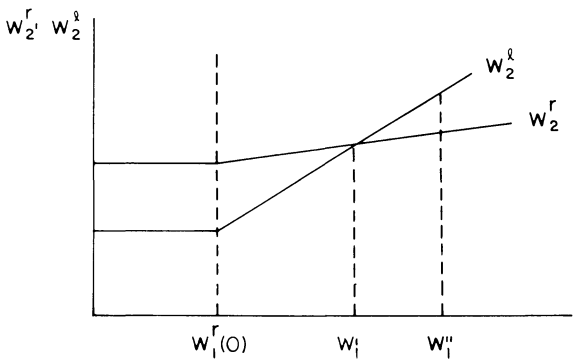

FIG. 2.—Wife's reservation wages as functions of husband's wage

Nonparticipating wives will be *more* likely to enter the labor force when their husbands are unemployed.

$$3.\ \lambda_{EU\to EE} < \lambda_{UU\to UE}.$$

Wives who are searching for work will find more jobs acceptable, and thus become employed more rapidly, when their husbands are unemployed.

In order to test these predictions using a heterogeneous sample of households, it will be necessary to control for observable characteristics which may indicate differences in preferences, as well as for differences in budget constraints.

In the next section, a method for estimating transition rates as functions of characteristics such as age, wages, and city of residence is described.

III. Estimating Labor Force Transition Rates

There exists a special case of the model described in the previous section which generates transition rates that can be simply estimated. If the arrivals of all random events are Poisson with constant parameters, and if the household's strategy (w_i^r, w_i^l) is stationary,[5] then each type of transition will be a time-independent Poisson process. It is well known (see, e.g., Tuma and Robins 1980) that these constant transition rates lead to state occupancy durations which have a negative exponential distribution. In particular, the cumulative distribution function representing the probability of a transition from state j before t_1, given that the household occupies state j at time t_0, is

$$F_j(t_1|t_0) = 1 - e^{-\lambda_j(t_1-t_0)} \tag{3}$$

where $\lambda_j = \sum_{k\neq j} \lambda_{jk}$ or the rate of leaving state j. The density function is

$$f_j(t_1|t_0) = \frac{dF_j(t_1|t_0)}{dt} = \lambda_j e^{-\lambda_j(t_1-t_0)}.$$

Given that a transition does occur from state j, the conditional probability that the destination is state k is λ_{jk}/λ_j, so that the probability of a spell in j which ends in a transition to state k at time t_1 is

$$f_j(t_1|t_0)\cdot\frac{\lambda_{jk}}{\lambda_j} = \lambda_{jk}e^{-\lambda_j(t_1-t_0)}. \tag{4}$$

[5] A stationary strategy results, in part, from the following assumptions: an infinite horizon, known and stable wage distributions, and no assets.

We can now construct a likelihood function for any sequence of state occupancies by a sample of households, in which the contribution of a completed spell is (4), and the contribution of an incomplete spell is

$$1 - F_j(t_1|t_0) = e^{-\lambda_j(t_1-t_0)}.$$

We do not, of course, wish to assume that transition rates are identical for households, but rather examine their dependence upon observable characteristics. A convenient specification, since λ_{jk} must be positive for all households, is

$$\lambda_{jk}(i) = \exp\{\boldsymbol{\theta}_{jk} X_j(i)\} \qquad \text{for} \quad \begin{matrix} i = & 1, \ldots, N \\ j, k \neq j, & 1, \ldots, n, \end{matrix}$$

where $\boldsymbol{\theta}_{jk}$ is a vector of parameters to be estimated by maximum likelihood methods for each transition rate and $X_j(i)$ are observable explanatory variables for household i which may be state dependent.

The above specification has some very convenient properties. The log of the likelihood function is separable in the individual transition rates, so that each parameter vector, $\boldsymbol{\theta}_{jk}$, can be estimated independently. In addition, each spell in state j can be easily divided into subspells to allow the values of exogenous variables to vary. However, the assumed time independence of the λ_{jk} rules out any duration dependence in the rate of leaving a state,[6] and no attempt is made here to employ multiple spells for the purpose of isolating unobserved individual effects. The possible bias resulting from such unobserved heterogeneity is discussed in detail with the empirical results below. A more complicated model can easily be constructed, but the simple exponential model offers obvious computational advantages for analyzing the movements of a large sample over a number of employment states.

IV. Data

Household transition rates were estimated using the monthly employment histories of a subsample of families from the Seattle and Denver Income Maintenance Experiments (SIME/DIME). The sample consisted of 603 families living in Denver and 478 in Seattle. Each contained both a male head and a female head, and all were from the control group, which did not receive income maintenance payments. Sample selection criteria, employment history construction, and important characteristics of the sample are described in Appendix A.

[6] There is some evidence that duration dependence, or some form of heterogeneity which is indistinguishable from duration dependence, does appear in some transitions with this sample (see Weiner, forthcoming).

Table 1
Distribution of Wives over Labor Market States by Employment Status of Husband

	Employment (%)	Unemployment (%)	Participation (%) ($E + U$)
All wives	37.1	5.2	42.4
Husband employed	37.9	4.7	42.6
Husband unemployed	37.7	9.7	47.4
Husband not participating	29.5	5.4	34.9

Did the wives in this sample respond to the unemployment of their husbands by increasing their labor supply? If so we would expect, as a first approximation, that the wives of unemployed men would have higher participation and/or employment rates than the wives of employed men. Table 1 presents such a comparison.

This simple cross-tabulation reveals that married women are most likely to participate in the labor force when their husbands are unemployed. However, a closer look shows that this increase in the participation rate comes entirely from an increase in the number of unemployed wives; the proportion employed is lower for the husband-unemployed group, except for black wives. This suggests that women do look for work when their husbands become unemployed but that they are less likely to be employed than are women with employed husbands. These apparently contradictory points can be reconciled in a number of ways. An employed husband may be able to assist his wife's job search directly by providing contacts or information, thereby hastening the transition from unemployment to employment. A more plausible explanation is that individual characteristics that affect tastes for leisure or employment opportunities may be positively correlated within households, due to assortative mating or simply to residence in the same labor market. A test for an added worker effect in wife's labor supply behavior must therefore control for such characteristics to the extent that they are observable. This is accomplished by estimating the transition rates described in the previous section.

V. Empirical Results

A. Transition Rate Estimates

Estimated parameters for 23 household transition rates are presented and discussed in Appendix B.[7] Transition rates between each two

[7] For the remaining 49 of the possible 72 transition rates, this sample did not supply enough observations for the conditional estimation to be performed. In the simulations below, which require the entire household transition matrix, unconditional or mean rates have been used for these transitions. Since many of these involved simultaneous changes in the employment status of husband and wife which could be ruled out on theoretical grounds, the few observations which do appear are probably the result of time aggregation.

household states are represented as functions of actual wages for those who are initially employed, and predicted wages as indicators of the wage distribution for those who are not employed. Predicted gross wage rates are derived from regressions on average annual wage observations for the entire sample of controls, run separately by race and sex. Other current income includes monthly receipts from all sources—earnings of family members other than the two heads, transfer payments, alimony, and asset income. All dollar amounts are deflated using Seattle and Denver Metropolitan Price Indices and are reported in July 1972 dollars. Age and number of children under 6 years of age are included in the transition rate equations to represent the relative value of nonmarket time. The values for wages and other income are averaged over the duration of the spell; age and number of children are set at their initial values for each spell.

Those results which are relevant to the predictions of the theory can be briefly summarized. Own wages are, in general, significant determinants of movements into and out of employment. As expected, higher wages make both husbands and wives less likely to leave employment, and higher predicted wages increase the probability that wives will enter employment. However, the cross-wage effects are generally insignificant, particularly the effect of the husband's wage on the wife's transitions into and out of employment. The effects of other standard labor supply variables are mixed, but Seattle residence appears to be a consistent indicator of aggregate demand effects, and the receipt of other income generally discourages employment.[8]

Since simultaneous transitions of the husband and wife are rather rare, the different employment patterns of wives with employed and unemployed husbands can be represented by a three-by-three matrix of transition rates, with husband's employment status held constant. Table 2 displays average monthly transition rates for wives in representative white, black, and Hispanic households in Denver (patterns in Seattle were very similar). Coefficient estimates from tables B1–B5 were used, with the husband's wage set at \$3.70, the wife's at \$2.20, and the husband's age at 30 years. We assume that they have one child under 6 years of age. Other income is set at the sample average for each employment state. For transitions with very few observations, the sample average transition rate has been used.

Once variations in wages, other income, age, and number of children

[8] The same model has also been estimated with only two states—employment and nonemployment—for each household member. This was attempted since, as table B5 demonstrates, transitions between unemployment and nonparticipation are not well explained. However, since the coefficient estimates for transitions between employment and each of these two states differ substantially, aggregating them into a single state of nonemployment is not statistically valid.

Table 2
Monthly Transition Probabilities for Wife, Husband's Employment Status Held Constant

	Husband Employed			Husband Unemployed		
	Employment	Unemployment	Nonparticipation	Employment	Unemployment	Nonparticipation
White, Denver:						
Employment	.9406	.0116	.0478	.9573	.0178	.0249
Unemployment	.2053	.7151	.0796	.1342	.8056	.0602
Nonparticipation	.0647	.0080	.9273	.0747	.0158	.9095
Black, Denver:						
Employment	.9620	.0105	.0275	.9605	.0178	.0217
Unemployment	.1650	.7554	.0796	.1147	.8251	.0602
Nonparticipation	.0530	.0159	.9311	.0293	.0158	.9549
Hispanic, Denver:						
Employment	.9436	.0108	.0456	.9532	.0178	.0299
Unemployment	.1678	.7256	.0796	.1466	.7932	.0602
Nonparticipation	.0477	.0091	.9432	.0298	.0158	.9544

NOTE.—Transition rates evaluated at following values of independent variables: MWAGE = 3.70, WWAGE = 2.20, AGE = 30 years, OTHINC = sample mean for each state, CHILD6 = 1.

have been controlled for, a transition rate pattern generally consistent with the predictions of Section II emerges. This pattern is clearest in the transitions of white wives. If her husband is unemployed, a woman's probability of entering the labor force (the sum of the transition rates $N \rightarrow U$ and $N \rightarrow E$) will be 25% higher than if her husband is employed, and her probability of leaving the labor force will be 33% lower. Women with unemployed husbands are also 28% less likely to leave employment. The only anomaly is that the transition rate from unemployment to employment is 35% lower when the husband is unemployed. Since all other results are consistent with the household strategies set out in Section II, it appears that unobserved characteristics which are common to husband and wife are particularly important in the arrival rates of job offers.

In black families, this selection problem appears even more strongly, with women whose husbands are unemployed having difficulty in both acquiring and maintaining employment. For black wives, the rate of labor force entry is 35% lower when husbands are unemployed, due to a low $N \rightarrow E$ rate, and the rate of leaving employment is slightly higher. But, as expected, women with unemployed husbands are more likely to remain in the labor force; their exit rate is 24% lower.

Hispanic families appear to be an intermediate case between the consistent results for white families and the heterogeneity-dominated results for black families. The rates of leaving employment and the labor force have the expected signs, though the rate of labor force entry is 20% lower for wives with unemployed husbands.

The racial pattern of these transition matrices is puzzling. It seems clear that the perverse results are caused by similarities in the tastes and/or employment opportunities of husbands and wives which are not being completely captured by the observable variables. It is not obvious why the added worker effect should dominate this selection problem for white but not for black wives, but it is consistent with the finding of Smith (1979) that wife's earnings are used to compensate for changes in the earnings of other family members to a greater extent in white than in black families.

One possible explanation takes us back to Mincer's central observation that the added worker effect is triggered by a *temporary* drop in family income. Permanent decreases cause an adjustment in consumption which, in the credit-constrained household, largely replaces a labor supply response. Suppose that the unemployment of white husbands in this sample (which has been selected on the basis of low household income) is more likely to represent a transitory income reduction, while the unemployment of black husbands is a signal of low permanent income. If average permanent income for the two groups of unemployed husbands differs, the different strengths of the added worker effect are not

surprising. Further investigation of this possibility may require a longer panel of observations.

B. Simulation Results

The transition rate estimates for white wives clearly demonstrate the presence of an added worker effect. It would be helpful, in assessing its magnitude, to be able to express this effect in terms of more familiar measures such as employment and participation rates. This revives the problem stated in the introduction: how to measure a labor supply response to a temporary phenomenon such as an unemployment spell.

A steady-state distribution could be calculated from each transition matrix in table 2. This would give an equilibrium employment rate for wives with employed husbands and another for wives with unemployed husbands. Any comparison of these rates would be a spurious measure of the added worker effect, however, since holding the husband's employment status constant implies that both employment and unemployment spells for men are of infinite duration.

There are two types of valid experiment which could be performed to get a simple measure of the added worker effect. Both involve calculating the steady-state employment distribution for husbands and wives, using the full nine-by-nine household transition matrix as described in Section IIA. The transition rates used are for a representative household, with the characteristics listed in table 2. For white households, this steady state implies an unemployment rate of 3.8% for husbands,[9] an employment rate of 54.8% for wives, and a participation rate of 58.5% for wives.

The first possible experiment would involve changing one or more transition rates to generate a higher steady-state unemployment rate for husbands (such as increasing $\lambda_{E\to U}$ or decreasing $\lambda_{U\to E}$). The steady-state employment rates of wives in the two equilibria could then be compared. It is important to note that this measure of the added worker effect would, in general, depend upon whether the husbands' unemployment was increased by generating longer or more frequent spells.

The alternative method, which is illustrated here, is to introduce a disturbance to the steady-state employment distribution of households. The adjustment of the system back to its steady-state distribution can be traced over time using interval transition probabilities, as in equation (1). This second experiment reflects more accurately the dynamic behavior of the economy when unemployment increases than does a comparison of alternative steady states. Leaving the transition matrix unchanged, the initial state distribution was altered so that the proportion of husbands

[9] This unemployment rate is the proportion of the population, not participants, who are unemployed.

unemployed was increased by 5 percentage points. The monthly changes in the participation and employment rates of the wives following this shock are shown in figures 3, 4, and 5 for all three groups in Denver. The same experiment was performed for white families in Seattle, and generated similar results.

For white families, the increase in husband's unemployment leads to increases in both the participation and the employment of wives. Although the peak in husband's unemployment occurs in month 1, wife's participation peaks at about 6 months and employment peaks a month or two later. If 100 men become unemployed, the maximum impact is the additional participation of about three wives and the additional employment of two. The employment effect is slightly larger in Seattle than in Denver.

Among black families, the increased unemployment among the hus-

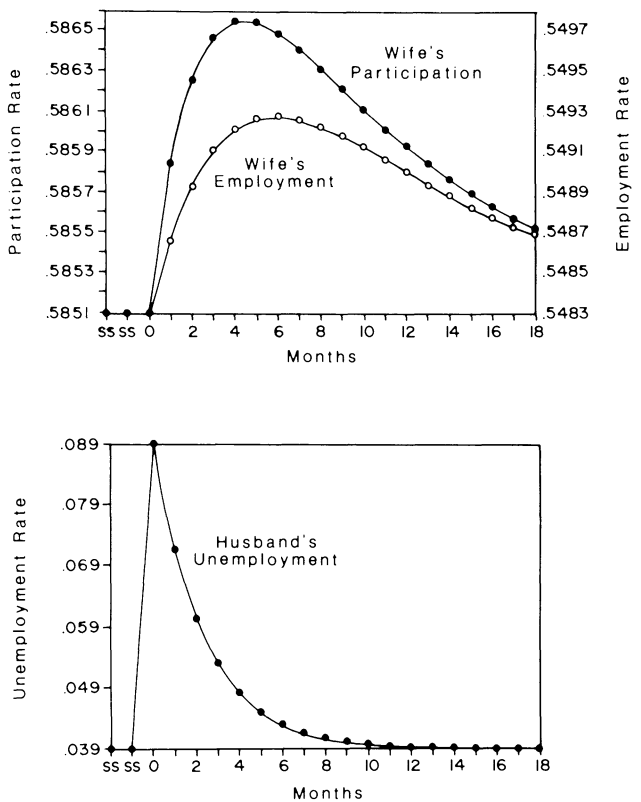

FIG. 3.—Effect on wife's employment and participation rate of increasing husband's unemployment by 5 points (white families, Denver).

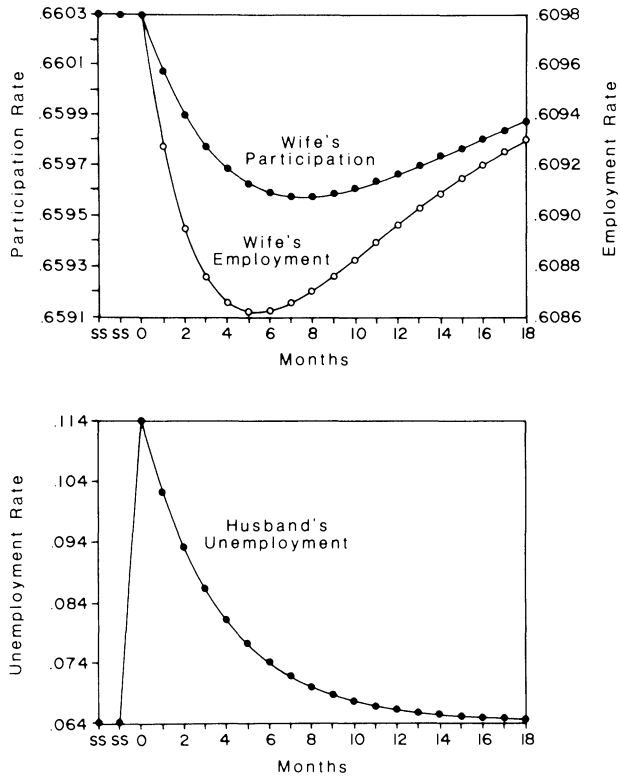

FIG. 4.—Effect on wife's employment and participation rate of increasing husband's unemployment by 5 points (black families, Denver).

bands is accompanied by a sharp *decrease* in the employment of wives and a small fall in participation rates.[10]

For Hispanic wives, a slight added worker effect is apparent in the participation rate, but the employment rate first falls as a switch to the lower employment entry rates of wives of the unemployed occurs, then rises as the reduced rate of labor force exit dominates.

VI. Conclusion

This paper presents a new approach to the empirical study of the added worker effect which emphasizes the role of uncertainty and of credit constraints in generating short-run labor force participation and

[10] In an earlier version of this paper, financial treatment as well as control families were included in the analysis, with the addition of variables representing tax rates and support levels to the transition rate estimates. For this expanded sample, a positive added worker effect appeared for black wives, and the added worker effect among white wives was larger than in the controls-only case.

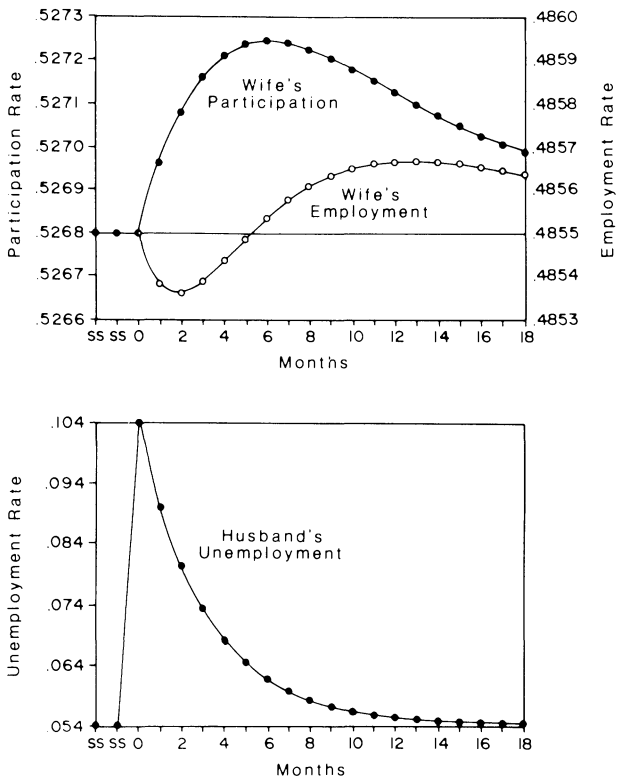

FIG. 5.—Effect on wife's employment and participation rate of increasing husband's employment by 5 points (Hispanic families, Denver).

employment behavior. A model of household labor supply with random arrivals of job offers and separations is outlined, and the added worker effect is restated in terms of changes in the probabilities of transitions between labor force states when one family member becomes unemployed.

The transition rates are expressed as functions of individual and household characteristics, and the parameters are estimated from the employment histories of a sample of husbands and wives enrolled in the Seattle and Denver Income Maintenance Experiments. These results show that own wages and own predicted wages are important determinants of the probabilities of leaving and entering employment but that cross-wage effects are generally insignificant.

The estimated transition rates for representative households are then used to generate the steady-state distribution of households over labor force states, and the effect of an exogenous increase in the unemployment of husbands on the employment and participation of wives over the succeeding 18 months is simulated. In general, the simulations show

that wives do respond to husband's unemployment by increasing labor supply. For white families, the unemployment of 100 additional men results in the labor force participation of three additional wives, and the employment of two, within the first 6 months.

The results for black, and to a lesser extent Hispanic, families reveal a species of selection bias, in that the wives of unemployed men are less likely to become employed than are women with employed husbands, even after observed characteristics are held constant. This effect, which may result from the marriage of individuals with similar tastes or market opportunities, dominates the added worker effect for black wives but not for white or Hispanic wives.

Appendix A

The SIME/DIME Household Sample

The Seattle and Denver Income Maintenance Experiments were conducted between 1969 and 1973 and were designed to test the effects of a negative income tax (NIT) on labor supply. About 4,800 families were initially enrolled in the experiment; data are available for 2,038 families in Seattle and 2,657 families in Denver. These families did not constitute a random sample from the populations of the two cities but were chosen both to facilitate the analysis of labor supply response and to correspond as closely as possible to the target population of a future, hypothetical NIT program. Four groups were therefore excluded from the sample: (1) families with heads over 58 years of age or under 18 years of age; (2) families with disabled heads who were unable to work; (3) families with pre-experiment earnings in excess of $9,000 for a family of four with one working head or above $11,000 for a family of four with two working heads; (4) individuals who did not belong to a "family," defined

Table A1
Characteristics of the Household Sample
(N = 1,081)

Black (%)	33.8
Hispanic (%)	16.2
White (%)	60.0
Seattle (%)	44.2
Mean age in years, January 1, 1972:	
Husbands	32.6
Wives	30.0
Mean predicted wages, 1972:	
Husbands	3.51
Wives	1.88
Education, highest grade completed:	
Husbands	11.2
Wives	11.1

as a unit consisting of either a married couple or a single parent with a dependent child, plus other relatives permanently residing with this unit.

The sample actually used in the estimation of household transition rates consists of 603 families living in Denver and 478 in Seattle. All were required to satisfy the following criteria: (1) the family contains two heads (i.e., consists of a married or cohabiting couple plus dependents); (2) the family was one of those originally enrolled in the experiment, which excludes families formed during the course of the experiment and guarantees that a full year of pre-experiment data is available for each; (3) the family remains in the sample until the second periodic interview has been administered, or approximately 6–8 months after enrollment (earlier attrition, due to the structure of the periodics, results in considerable missing data, including education); (4) the family was included in the control group and did not receive income maintenance payments.

Sample means for selected characteristics of these households are presented in table A1.

Continuous employment histories were constructed from monthly employment variables on the Public Use Files. These contain sufficient information to establish the date on which transitions into and out of employment occur. This characteristic, it should be noted, provides SIME/DIME with an advantage over Current Population Survey transition data, which are based on monthly observations only. The dates of transitions between unemployment and nonparticipation, however, should be regarded as approximations. SIME/DIME variables which characterize a spell of nonemployment apply to an entire spell and are derived from questions asked in periodic interviews. All such transitions, therefore, are recorded only during the months in which these interviews, which are administered every 3 or 4 months, took place.

Appendix B

Transition Rate Estimates

This Appendix presents estimated parameters for many of the household transition rates specified in Section III. Each rate has been compared, using a standard likelihood ratio test, to a single-parameter exponential process, which is equivalent to constraining all parameters except the constant term to be zero. Only the results for those rates in which the independent variables increase the explanatory power of the model at a 5% significant level are presented here.

A. Transitions into Employment: Wives

Table B1 displays the maximum likelihood estimates of θ_{jk} in the transition rate equation $\lambda_{jk} = e^{\theta_{jk}X_j}$ for transitions in which the wife moves from unemployment to employment or from nonparticipation directly into employment. The wife's own predicted wage has a signifi-

cantly positive but declining impact on her employment probability in four out of five cases. Her husband's actual or predicted wage has the expected negative impact, but only on nonparticipation-to-employment transitions and not when he is unemployed. Transitions from unemployment to employment do not seem to be explained by anything but Seattle residence (Seattle experienced very high unemployment rates for most of the sample period), the presence of young children (which discourages employment when the husband is employed), and the wife's own wage when her husband is unemployed. In general, age, other

Table B1
Rates of Transition into Employment for Wives
(Maximum likelihood estimates of θ_{jk} where $\lambda_{jk} = e^{\theta_{jk} X_j}$)

	EU → EE (1)	*EN → EE* (2)	*UU → UE* (3)	*UN → UE* (4)	*NN → NE* (5)
C	−1.70	−6.52*	−9.02	−9.52*	−2.81
	(1.58)	(10.04)	(1.71)	(2.97)	(1.17)
MWAGE	.05	−.19*	−1.46	1.42	−1.59*
	(.26)	(2.89)	(1.26)	(1.38)	(3.23)
MWAGESQ	.01	.01*	.21	−.15	.13*
	(.50)	(2.09)	(1.33)	(1.14)	(2.79)
WWAGE	.59	2.64*	9.88*	4.93*	3.78*
	(.92)	(7.74)	(2.24)	(2.54)	(2.84)
WWAGESQ	−.05	−.36*	−2.12*	−.81	−.51
	(.36)	(5.39)	(2.02)	(1.93)	(1.93)
AGE	−.47	.30	−.64	−2.00	−1.61
	(1.08)	(.99)	(.47)	(1.92)	(1.48)
AGESQ	.05	−.06	.07	.31*	.21
	(.78)	(1.41)	(.35)	(2.18)	(1.34)
OTHINC	−.12	−.07	−.22	−.10	−.05
	(1.64)	(1.90)	(1.51)	(.86)	(.60)
CHILD6	−.21*	−.03	−.28	−.11	.26
	(2.82)	(.70)	(.95)	(.60)	(1.27)
BLACK	−.22	−.20*	−.16	−.94*	−.49
	(1.53)	(2.10)	(.38)	(2.49)	(1.38)
HISP	−.20	−.30*	.09	−.92	−.80
	(.94)	(2.70)	(.11)	(1.56)	(1.44)
SEATTLE	−.46*	−.23*	−.37	−.15	−.06
	(3.24)	(2.55)	(.85)	(.44)	(.18)
χ^2	45.45	253.36	27.34	37.09	27.45
Number of spells	510	1,920	148	627	457
Number of transitions	258	673	34	47	47

NOTE.—The absolute values of asymptotic *t*-statistics are in parentheses. The independent variables in all equations are: MWAGE = actual hourly wage earned by husband in constant dollars if employed in initial state, imputed wage otherwise; MWAGESQ = (MWAGE)²; WWAGE = actual wage if wife employed in initial state, imputed wage otherwise; WWAGESQ = (WWAGE)²; AGE = age in years of husband/10; AGESQ = (AGE)²; OTHINC = other monthyly income from all sources other than spouse's earnings; averaged over spell and divided by 100; CHILD6 = number of children under 6 years at beginning of spell; BLACK, HISP, SEATTLE = 0, 1, dummies for race, ethnic origin, and city of residence.

* Significant at the 5% level in a two-tailed test.

income, and children have surprisingly little impact on these movements into employment.

B. Transitions into Employment: Husbands

In table B2, the husband's own predicted wage does not seem to be very important in explaining transitions into employment, although the wife's wage does affect when she enters employment. The only consistent influences are other income, which discourages employment, and Seattle residence, which has a similar effect. Black men also tend to have lower transition rates into employment than do white men.

Table B2
Rate of Transition into Employment for Husbands

	UE → EE (1)	*UU → EU* (2)	*UN → EN* (3)	*NE → EE* (4)	*NN → EN* (5)
C	−.84	−9.84*	−.63	−1.93	−5.15*
	(.88)	(2.48)	(.69)	(.92)	(3.42)
MWAGE	−.19	3.25	.25	−.08	1.30*
	(.53)	(1.60)	(.93)	(.09)	(3.35)
MWAGESQ	.07	−.43	.01	.04	−.09
	(1.56)	(1.48)	(.33)	(.38)	(1.90)
WWAGE	−.06	.80	−.03	−1.00*	1.03
	(.18)	(.71)	(.07)	(2.18)	(1.26)
WWAGESQ	.02	−.06	.07	.11	−.22
	(.34)	(.27)	(.60)	(1.33)	(1.20)
AGE	−.14	.79	−.82*	1.61	−.66
	(.29)	(.71)	(2.34)	(1.78)	(1.11)
AGESQ	.01	−.11	.12*	−.30*	.05
	(.15)	(.70)	(2.38)	(2.27)	(.54)
OTHINC	−.23*	−.34*	−.34*	−.26*	−.12*
	(3.61)	(2.76)	(8.20)	(2.90)	(2.57)
CHILD6	.07	.40*	.07	−.21	.09
	(.92)	(2.17)	(1.23)	(1.33)	(.93)
BLACK	−.44*	−.54	−.51*	−.06	−.75*
	(3.39)	(1.54)	(3.95)	(.26)	(3.00)
HISP	−.53*	.44	.06	.25	−.02
	(2.41)	(.81)	(.41)	(.49)	(.10)
SEATTLE	−.79*	−.42	−.55*	−.79*	−.45*
	(6.05)	(1.07)	(4.61)	(3.61)	(2.32)
χ^2	84.82	33.85	200.82	69.70	124.87
Number of spells	463	148	627	229	457
Number of transitions	302	59	433	102	167

NOTE.—The absolute values of asymptotic *t*-statistics are in parentheses. The independent variables in all equations are: MWAGE = actual hourly wage earned by husband in constant dollars if employed in initial state, imputed wage otherwise; MWAGESQ = $(\text{MWAGE})^2$; WWAGE = actual wage if wife employed in initial state, imputed wage otherwise; WWAGESQ = $(\text{WWAGE})^2$; AGE = age in years of husband/10; AGESQ = $(\text{AGE})^2$; OTHING = other monthly income from all sources other than spouse's earnings; averaged over spell and divided by 100; CHILD6 = number of children under 6 years at beginning of spell; BLACK, HISP, SEATTLE = 0, 1 dummies for race, ethnic origin, and city of residence.

* Significant at the 5% level in a two-tailed test.

C. Transitions out of Employment: Wives

Table B3 demonstrates that movements from employment to nonparticipation are explained much better by this model than are employment-to-unemployment movements. It is tempting to associate the former with voluntary separations and the latter with involuntary ones, and so conclude that the personal characteristics included in this model act as better proxies for tastes than for employment opportunities, but this temptation should perhaps be resisted. In general, the wife's wage has a negative impact on transitions out of employment, as does age. Other income and young children encourage dropping out of the labor force, except when the husband is unemployed. When the husband is unem-

Table B3
Rates of Transition out of Employment for Wives

	EE → *EU* (1)	*EE* → *EN* (2)	*UE* → *UN* (3)	*NE* → *NN* (4)
C	−2.73*	.51	1.65	6.52*
	(2.37)	(.97)	(.78)	(2.15)
MWAGE	.46	.10	−.62	−.05
	(1.17)	(1.64)	(.85)	(.03)
MWAGESQ	−.09	−.01	.12	−.01
	(1.62)	(.85)	(1.20)	(.02)
WWAGE	.29	−.64*	−2.09*	−2.52*
	(.78)	(6.59)	(3.92)	(5.87)
WWAGESQ	−.15	.05*	.29*	.35*
	(1.63)	(2.78)	(2.34)	(4.63)
AGE	−1.03	−1.46*	−.92	−3.60*
	(1.80)	(4.57)	(.83)	(3.20)
AGESQ	.11	.17*	.10	.38*
	(1.38)	(3.65)	(.62)	(2.51)
OTHINC	−.02	.08*	.03	.25*
	(.19)	(2.21)	(.36)	(3.32)
CHILD6	−.06	.12*	.25	.37*
	(.65)	(2.46)	(1.25)	(2.02)
BLACK	−.10	−.55*	−.14	−.11
	(.60)	(5.45)	(.41)	(.29)
HISP	−.07	−.05	.18	1.49*
	(.26)	(.39)	(.34)	(2.46)
SEATTLE	.41*	−.35*	−.16	.50
	(2.47)	(3.71)	(.47)	(1.47)
χ^2	45.51	236.22	32.12	77.28
Number of spells	1,663	1,663	463	229
Number of transitions	174	590	46	47

NOTE.—The absolute values of asymptotic *t*-statistics are in parentheses. The independent variables in all equations are: MWAGE = actual hourly wage earned by husband in constant dollars if employed in initial state, imputed wage otherwise; MWAGESQ = $(\text{MWAGE})^2$; WWAGE = actual wage if wife employed in initial state, imputed wage otherwise; WWAGESQ = $(\text{WWAGE})^2$; AGE = age in years of husband/10; AGESQ = $(\text{AGE})^2$; OTHINC = other monthly income from all sources other than spouse's earnings; averaged over spell and divided by 100; CHILD6 = number of children under 6 years at beginning of spell; BLACK, HISP, SEATTLE = 0, 1 dummies for race, ethnic origin, and city of residence.

* Significant at the 5% level in a two-tailed test.

Table B4
Rates of Transition out of Employment for Husbands

	EE → *UE* (1)	*EE* → *NE* (2)	*EN* → *UN* (3)	*EN* → *NN* (4)
C	−2.14*	−1.25	−3.31*	−2.19
	(2.75)	(1.00)	(3.57)	(1.82)
MWAGE	−.36*	−.43*	−.33*	−.51*
	(5.08)	(3.53)	(5.18)	(5.75)
MWAGESQ	.01*	.01	.01*	.02*
	(2.84)	(1.53)	(4.99)	(5.29)
WWAGE	.70*	.31	1.38*	1.26
	(2.44)	(.99)	(2.07)	(1.52)
WWAGESQ	−.14*	−.03	−.31*	−.25
	(2.34)	(.61)	(2.02)	(1.37)
AGE	−.79	−1.45	−.98*	−1.36*
	(1.84)	(1.89)	(2.90)	(2.88)
AGESQ	.10	.15	.12*	.16*
	(1.60)	(1.38)	(2.45)	(2.29)
OTHINC	−.28*	.16*	.16*	.15*
	(3.30)	(2.34)	(4.96)	(3.31)
CHILD6	−.003	−.18	.18*	−.03
	(.05)	(1.36)	(3.20)	(.38)
BLACK	.07	−.06	−.11	−.43*
	(.57)	(.29)	(.81)	(2.18)
HISP	−.10	−.57	.34*	.24
	(.47)	(1.35)	(2.22)	(1.22)
SEATTLE	.32*	.16	.84*	.44*
	(2.59)	(.74)	(6.86)	(2.61)
χ^2	76.22	43.98	137.00	94.50
Number of spells	1,663	1,663	1,920	1,920
Number of transitions	301	99	421	208

NOTE.—The absolute values of asymptotic *t*-statistics are in parentheses. The independent variables in all equations are: MWAGE = actual hourly wage earned by husband in constant dollars if employed in initial state, imputed wage otherwise; MWAGESQ = (MWAGE)²; WWAGE = actual wage if wife employed in initial state, imputed wage otherwise; WWAGESQ = (WWAGE)²; AGE = age in years of husband/10; AGESQ = (AGE)²; OTHINC = other monthly income from all sources other than spouse's earnings; averaged over spell and divided by 100; CHILD6 = number of children under 6 years at beginning of spell; BLACK, HISP, SEATTLE = 0, 1 dummies for race, ethnic origin, and city of residence.

* Significant at the 5% level in a two-tailed test.

ployed, nothing but a low own wage appears to explain transitions out of employment by wives.

D. Transitions out of Employment: Husbands

The husband's own wage has a strongly negative effect on all transitions out of employment, as table B4 shows. His wife's wage, and even her predicted wage when she is not participating, have a positive effect on employment-to-nonparticipation transitions of the husband, though not on employment-to-unemployment ones. Other income encourages leaving employment, living in Seattle probably compels it, and age tends to prolong employment, though its effect declines over time. Race and young children are generally insignificant (table B5).

Table B5
Other Transitions

	EN → EU (1)	*UE → NE* (2)	*UN → NN* (3)	*NN → UN* (4)	*NN → EE* (5)
C	−4.16*	−4.32	−5.30*	−2.22	−6.68*
	(4.03)	(1.41)	(2.08)	(1.16)	(3.64)
MWAGE	−.18	1.99	1.97*	−.21	.71
	(1.36)	(1.46)	(2.23)	(.67)	(1.04)
MWAGESQ	.01	−.29	−.22	.04	−.07
	(.58)	(1.50)	(1.93)	(1.45)	(.83)
WWAGE	.75	−1.75*	−1.74	−.94	.73
	(1.60)	(3.30)	(1.30)	(.91)	(1.09)
WWAGESQ	−.05	.34*	.37	.21	−.12
	(.60)	(3.31)	(1.35)	(1.03)	(.96)
AGE	−.72	−.28	−.50	.22	1.24
	(1.49)	(.24)	(.52)	(.24)	(1.68)
AGESQ	.08	.10	.07	−.10	−.16
	(1.10)	(.64)	(.51)	(.69)	(1.54)
OTHINC	−.02	.07	.20*	.12	−1.08*
	(.32)	(.65)	(2.35)	(1.73)	(7.61)
CHILD6	−.01	.20	.04	−.07	−.20
	(.10)	(.83)	(.27)	(.42)	(1.54)
BLACK	.69*	−.89*	−.59	−.26	.36
	(4.32)	(2.70)	(1.46)	(.68)	(1.48)
HISP	.13		.53	.29	.58
	(.58)	. . .[a]	(1.28)	(.82)	(1.74)
SEATTLE	.30*	−1.04*	−.33	−.34	−.37
	(1.96)	(3.17)	(.87)	(1.07)	(1.57)
χ^2	59.06	44.43	26.45	27.21	201.63
Number of spells	1,920	463	627	457	457
Number of transitions	218	43	57	66	111

NOTE.—The absolute values of asymptotic t-statistics are in parentheses. The independent variables in all equations are: MWAGE = actual hourly wage earned by husband in constant dollars if employed in initial state, imputed wage otherwise; MWAGESQ = (MWAGE)^2; WWAGE = actual wage if wife employed in initial state, imputed wage otherwise; WWAGESQ = (WWAGE)^2; AGE = age in years of husband/10; AGESQ = (AGE)^2; OTHINC = other monthly income from all sources other than spouse's earnings; averaged over spell and divided by 100; CHILD6 = number of children under 6 years at beginning of spell; BLACK, HISP, SEATTLE = 0, 1 dummies for race, ethnic origin, and city of residence.

* Significant at the 5% level in a two-tailed test.

[a] No observations.

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