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Part 2 of 3

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Chapter 2

An Intergenerational Model of Wages, Hours and Earnings

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Introduction

The degree to which economic success depends upon who one's parents happen to be and on the family environment in which one grows up is one of the fundamental questions in research on income distribution. Many studies have examined the intergenerational and sibling correlations among variables such as education, income, occupation, and socioeconomic status.[1] Studies such as Griliches (1979), and Hauser and Sewell (1986) have investigated the channels through which parental variables such as IQ, income, and education affect the cognitive ability, educational aspirations and attainment, and economic success of children. These and a number of studies by Taubman and others use data on identical and fraternal twins to examine the role of genetic and environmental factors in education and earnings. And a large number of studies use regression approaches to examine the effects of parental income and education on children's education and economic outcomes. Much of the discussion has focussed on (1) the size of the linkages in family income and education among siblings and across generations, and (2) the extent

1. See, for example, Corcoran and Jencks (1979), and studies summarized in Becker and Tomes (1986). Recent examples are Solon et al (1987) and Solon (1989).

to which the linkages reflect (a) genetic factors, (b) other influences on parents that in turn affect the development of their children, and (c) neighborhood and community influences on children that operate independently of the immediate family.[2]

In contrast to the large literature on family income, few studies have investigated family relationships in work hours, or examined the relative importance of family links in wages and in work hours in intergenerational and intragenerational correlations in income. It is common to say that an individual is from a family of "hard workers," but the question of whether leisure preferences are correlated among family members has received little study. Are there in fact similarities in work hours of family members? Do these similarities reflect labor supply responses to similarities in wages or to similarities in preferences? Are the wage rates and work preferences of young men and young women influenced primarily by fathers, mothers, or by characteristics of the family environment that are unrelated to the wages and labor supply preferences of the parents? To what extent does the correlation between the labor market outcomes of fathers and sons arise because of a direct effect of the father's characteristics on the son, and to what extent do they arise because of the process of assortative mating affects the characteristics of the mother which then directly influence the son's labor market outcome?

This paper is a first attempt at measuring the effects of parental and

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2. Individuals choose where to live, and so the characteristics of the neighborhood in which children are raised are not independent of the parents' characteristics. See Jencks and Mayer (forthcoming) for a recent survey of the effects of neighborhood characteristics on a variety of social outcomes. They cite only a few studies which have examined the effects of neighborhood characteristics on future earnings and family income; a recent one is Corcoran et al (1989).

"sibling" wage and work preference factors on the wages, hours, and earnings of young men and young women. We use intergenerational panel data from the National Longitudinal Surveys of Labor Market Experience to estimate a model of labor earnings of young men and young women. The two key components of the model are a factor model of wage rates, and a labor supply model. To be more precise, wages of young men and young women depend on the permanent component of the father's wage, the permanent component of the mother's wage, an unobserved sibling component representing background characteristics that are common to siblings but independent of the parents' factors, and an unobserved factor that is specific to each individual. Work hours depend on wages as well as labor supply preferences. Labor supply preferences of young men and young women depend on the father's preferences, the mother's preferences, a preference factor that is common to siblings, and an idiosyncratic preference factor. Finally, earnings depend upon wages and hours. Since we are particularly interested in gender differences in the determination of wages, earnings, and hours, most of the coefficients of the equations are gender specific. Since the underlying variables driving preferences, wages, hours, and earnings are unobserved, the model is a factor model.

The model is estimated from autocovariances and cross-covariances of hours, wages, and earnings for the young men and young women, and their fathers, mothers, and siblings who can be identified in the data sets. As we show, the model may be used to investigate the extent to which the parental and family characteristics that drive wage rates and work hours independently of wage rates are responsible for similarities among family members in labor market outcomes. In particular, we can distinguish among links in hours worked and earnings that reflect similarity in wages, and links that reflect similar preferences; the linkages can be broken down further into similarities that are due to the father's characteristics and to the mother's characteristics. We use the model to decompose the variances of wages, work hours, and earnings of young men, young women, fathers, and mothers, and the covariances of these variables for the various parent-child and sibling pairs. The decomposition allows us to measure the relative contributions of the wage factors and work preference factors of the father and the mother to each of the estimated variances and covariances.

The paper proceeds as follows. In section I we present the factor model of earnings, hours, wage rates and preferences. We also discuss our approach to estimating the model and how the model can be used to decompose the variances of labor market outcomes of young men and young women and the covariances across family members into parental, sibling, and idiosyncratic factors that determine wage rates and work hours independently of wage rates. In section II we provide a brief discussion of the data and estimation issues. In section III we discuss the model estimates of the preference, wage, hours, and earnings equations. In section IV, we present the variance and covariance decompositions. We discuss the implications of the results and a research agenda in section V.

I. A Factor Model of Preferences, Wages, Hours and Earnings

In this section we specify a factor model of the permanent components of earnings, hours, and wage rates which dominate differences across individuals in lifetime income. Our basic approach is to specify equations relating the wages and work preferences of young men and women to unobserved parental factors, "sibling" factors that are common to children from the same family but are uncorrelated with the parental factors, and individual specific factors. We also specify labor supply equations for young men and women and mature men and women that relate work hours to wages and to work preferences. Finally, we specify that earnings depend on wages and work hours, and make a set of assumptions about the covariances between the various unobserved factors in the model. We then discuss how the model may be used to analyze the sources of variation in labor market outcomes and how the model may be estimated.

I.1 Labor Supply Equations

The labor supply equations for young women, young men, mature women, and older men have the following form:

(1) $H_{ik} = \beta_k W_{ik} + U_{ik}$

(2) $H_{ikt} = H_{ik} + e_{ikt}$

where

- i = family indicator,
- k = person type, where k= b for young men (sons), g for young women (daughters), f for mature men (fathers) and m for mature women (mothers),
- t = year indicator,
- H_{ik} = the permanent value of the log of annual hours worked by person ik,
- H_{ikt} = log of measured annual hours worked by person ik in year t,
- W_{ik} = permanent wage of person ik,
- U_{ik} = permanent component of hours preferences of ik, and
- e_{ikt} = transitory determinants of hours and measurement error.

Since there may be more than one son and/or more than one daughter in family i, it is understood that subscript k is indexed by the person number j. However, we leave this index implicit except for when it is needed for clarity.

We refer to U_{ik} as the preference component of hours; for simplicity, we have normalized its coefficient to unity. The life cycle model of labor supply suggests that this interpretation of U_{ik} in (1) is an oversimplification. From the point of view of that model, β_k is the response of labor supply to a shift upward in the entire profile of lifetime wages. The term U_{ik} consists of the effects of preferences for goods and leisure on the marginal utility of lifetime income, and the direct effect of leisure preferences on labor supply. Later we will introduce the assumption that bequests and family transfers other than human capital investments of parents in children are unimportant. In this case similarities across family members in parental wealth should not produce large covariances in the marginal utility of incomes of relatives once we control for similarities in the permanent wage rates. However, if bequests and tranfers are important, then our interpretation of U_{ik} as "hours preferences" is incorrect, and, perhaps more importantly, the assumption made below that $Cov(U_{ik}, W_{ik'})=0$ for $k=g$ or b, and $k'=m$ or f would be unlikely to hold; that is, parents' wages may influence children's preferences for working.[3]

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3. The available evidence in Altonji, Hayashi and Kotlikoff (1989) and the papers that they cite suggests that altruistic links between parents and their adult children are relatively weak, and that transfers are a small component of income.

I.2 Earnings Equations

The permanent component of log earnings, E_{ik}, depends upon the log permanent wage, W_{ik}, and the log permanent hours level, H_{ik}, as given in (2); the <u>observed</u> earnings for person ik, E_{ikt}, includes a term capturing transitory influences and measurement error, ϵ_{ikt}:

$$(3) \qquad E_{ikt} = \phi_{kw} W_{ik} + \phi_{kh} H_{ik} + \epsilon_{ikt}$$

After substituting (1) into (3) the log earnings equation is

$$(4) \qquad E_{ikt} = [\phi_{kw} + \phi_{kh} * \beta_k] W_{ik} + \phi_{kh} U_{ik} + \epsilon_{ikt}$$

Note that the permanent wage component, W_{ik}, and the permanent preference component, U_{ik}, alone determine earnings and hours. Consequently, family linkages in earnings, hours, and wages are determined by family links in W_{ik} and in U_{ik}, which we now specify.

I.3 Family Links in Wages

In equations (5a, 5b) we specify that the permanent wages W_{ig} and W_{ib} of young women and men are determined by the permanent wages of their fathers and mothers, a family specific (or sibling) factor that is independent of the parental wage components, and an idiosyncratic factor:

$$(5a) \quad W_{ig} = a_{gf} W_{if} + a_{gm} W_{im} + a_{gs} \omega_{is} + \omega_{ig}$$

$$(5b) \quad W_{ib} = a_{bf} W_{if} + a_{bm} W_{im} + a_{bs} \omega_{is} + \omega_{ib}$$

where

W_{if} = father's permanent wage component,

W_{im} = mother's permanent wage (or potential wage if not working),

ω_{is} = common genetic or environmental factors that affect wages of children from family i independent of W_{if} and W_{im} -- we refer to this as the sibling factor, and

ω_{ik} = idiosyncratic component affecting a particular young man (k= b) or young woman (k= g) from household i.

We assume that the observed wage rate W_{ikt} is equal to the permanent wage W_{ik} plus an MA(2) error component, v_{ikt}, representing transitory factors and measurement error:

(6) $W_{ikt} = W_{ik} + v_{ikt}$ for k= b, g, f, and m.

I.4 Family Links In Preferences

Our factor model for children's preferences U_{ib} and U_{ig} has the same form as the model for their wages. Specifically,

(7a) $U_{ig} = \lambda_{gf} U_{if} + \lambda_{gm} U_{im} + \lambda_{gs} u_{is} + u_{ig}$

(7b) $U_{ib} = \lambda_{bf} U_{if} + \lambda_{bm} U_{im} + \lambda_{bs} u_{is} + u_{ib}$

where

U_{if} = father's permanent preference component,

U_{im} = mother's permanent preference component,

u_{is} = common genetic or environmental factors that affect work preferences of children from family i independent of U_{if} and U_{im}--we refer to u_{is} as the sibling preference factor, and

u_{ik} = idiosyncratic preference component affecting a particular young man (k= b) or young woman (k= g) from household i.

The models for the wage and preference factors are flexible enough to allow for differences between young men and young women in the influences of mothers and fathers and other common family characteristics.

I.5 Relationships Among the Wage and Preference Factors

Our assumptions about the preference factors U_{if}, U_{im}, u_{is}, u_{ib}, u_{ig}, and the wage factors W_{if}, W_{im}, ω_{is}, ω_{ib}, and ω_{ig} are as follows. First, we assume that they all are unrelated to the transitory components in hours, earnings, and wages: e_{ikt}, ϵ_{ikt}, and v_{ikt}. Next, we assume that covariances within the set of preference factors, and within the set of wage factors are zero, except for the parents' covariance of preferences, $Cov(U_{if}, U_{im})$, and covariance of wages, $Cov(W_{if}, W_{im})$. (These two covariances will be estimated in the model.) The key assumption, which will be discussed momentarily, is that all the preference factors are uncorrelated with all the wage factors.

We define ω_{is} to capture the sibling covariance in permanent wages remaining after both parents' wage influences are identified. Then any residual variation in wages is attributed to the idiosyncratic component ω_{ib} (or ω_{ig}) which is orthogonal to ω_{is} by construction; additionally, the individual components, ω_{ib} and ω_{ig}, are uncorrelated across all siblings. One can always perform such a decomposition, although ω_{is}, ω_{ig}, and ω_{ib} have clean interpretations as family influences and person specific influences only if there are no interaction effects between common family influences and person specific influences.[4] Similar remarks apply to the preference factors u_{is},

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4. The family factor ω_{is} may be a function of a large number of characteristics. One can summarize the influence of these characteristics with one factor provided that the function does not depend on the idiosyncratic characteristics of a particular young man or young women. Otherwise, ω_{is}, ω_{ig} and ω_{ib} provide a statistical decomposition of the set of interdependent family and person specific variables into a component that is common to siblings and one that is specific to the individual, while ignoring

u_{ib}, and u_{ig}.

Without additional indicators for preferences or components of the wage rate, it is necessary to make an identifying assumption about the relationship between preferences and the permanent wage rate. Our assumption that preferences are independent of the wage determinants is a particularly convenient one. It is also in line with standard practice in the male labor supply literature, which assumes that wages are unrelated to preferences once one controls for a small number of demographic variables that typically explain very little of the variance in work hours.[5] However, one might argue that leisure preferences have a direct effect on study time in elementary school, high school and college, as well as hours worked per year once one enters the labor market-- all of which may influence wage rates. Also, joint models of labor supply and human capital investment predict a positive relationship between schooling, on-the-job training, and preferences for market work.[6]

Special problems arise in the case of women, because hours of market work

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any interaction effects. For example, if the effect of neighborhood characteristics on the log permanent wage depends upon the IQ of the individual, then the dissimilarity of wage rates of brothers who have different IQs will change as one changes the neighborhood characteristics.

5. See Pencavel (1986). Some studies use instruments to control for preferences, but we do not find discussions of why particular variables, such as schooling, are exogenous to be particularly convincing. The use of instruments is also motivated as a means of reducing problems associated with measurement error in earnings divided by hours or to deal with missing data on wages for those who work zero hours.

6. With employee-financed on-the-job training, wage rates at a particular point in time underestimate productivity. We use a cubic specification in age to adjust our measures of earnings, hours, and wages for this possibility, and to eliminate any covariance between preferences and wages that might be associated with changes in preferences and wages over the lifecycle.

are a poor measure of the total labor supply of married women with children. Variables (such as attitudes toward raising children) that influence the allocation of time between market and nonmarket work are likely to influence the amount of time devoted to job training and the type of schooling that women select.[7] In future work, it would be interesting to add measures of nonmarket work (such as housekeeping and child care) to the hours of paid employment.[8]

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7. See Mincer and Polachek (1974), Polachek (1978) and Blakemore and Low (1981). For an opposing view emphasizing the role of discrimination, see England (1982).

8. Out of 1848 mother-daughter pairs, 296 are lost because the daughter dropped out of the sample before age 24 and/or before leaving school. The log work hours, age at the start of the sample, and education of the mother and daughter in the remaining 1552 cases that are potentially eligible for inclusion in the analysis are as follows.

		Daughter			Mother		
Sample:	% of Cases	Age in 68	Education	Log Hours	Age in 68	Education	Log Hours
Both Mother and Daughter Worked at Least Once	59.8	17.2	13.0	7.11	41.0	10.5	6.96
Mother Worked, Daughter Did Not	22.2	16.9	12.1	-	40.8	10.4	6.95
Daughter Worked, Mother Did Not	11.7	17.3	12.7	7.08	42.7	9.6	-
Neither Mother Nor Daughter Worked	6.3	17.1	11.6	-	41.6	9.6	-

The unconditional probability that a daughter does not work is .285. The probability that a daughter does not work conditional on the mother not working is .350. The means of log hours of mothers and of daughters are not very sensitive to whether or not the other works. The fact that the education levels are lower for those who do not work than for those who do is consistent with the positive labor supply elasticities we obtain. We do not wish to push these summary statistics too far, but they provide at least some suggestion that dealing with labor force participation will not

I.6 Assumptions About the Transitory Components of Wages, Hours, and Earnings

We assume the transitory components in wages, hours and earnings (v_{ikt}, e_{ikt}, and ϵ_{ikt}) are uncorrelated across different extended families i and across individuals within the same family. That is, the transitory components are uncorrelated across all individuals.[9] Formally,

$$(8) \qquad Cov(x_{ik(j)t}, z_{i'k'(j')t'}) = 0 \quad \text{if } ik(j) \neq i'k'(j');\ x,z = v,\ \epsilon,\ e.$$

We assume that the autocovariances and cross covariances of e_{ikt}, ϵ_{ikt}, and v_{ikt} over time for a given individual are zero for observations that are more than two years apart. Formally,

$$(9) \qquad Cov(x_{ik(j)t}, z_{ik(j)t'}) = 0 \quad \text{if } |t - t'| > 2;\ x,z = v,\ \epsilon,\ e.$$

As in Chapter 1, we are ignoring any persistent shocks to earnings, hours, and wages that occur during a career.

I.7 Some Limitations of the Model

In this paper we deal with non-participation in the labor market by

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dramatically change our conclusions.

9. This assumption could fail to the extent that relatives are in the same industry, occupation or region, and that shifts in these variables are important for wage and hours determination. In such a case, the covariances among family members' variables would probably be overstated. However, we believe the bias is likely to be small, both because we suspect industry, occupation, and regional factors are unimportant relative to job specific and person specific factors, and because most of pairs of year specific observations for the relatives that are used to compute the covariances are drawn from different years.

excluding observations in which an individual did not work from the analysis. Individuals who never work are excluded entirely. Unfortunately, we do not have wage data for such individuals. Furthermore, limited dependent variables techniques (which would allow us to remedy this problem) are very difficult to handle in models with a large number of unobserved factors. Consequently, we leave this extension to future research while recognizing its potential importance.

The model is also restrictive in the treatment of family labor supply. First, we have already mentioned that we ignore altruistic linkages among relatives that would imply cross substitution effects of wage rates on hours of work. We do not view this as a serious misspecification. A larger concern is that we also exclude the spouse's wage for those individuals who are married, which means that we are treating the labor supply of husbands and wives as separate decisions. Since the evidence in Chapter 1 indicates that their wages are positively correlated, this omission could lead to biases, for example, in our estimated labor supply elasticities. We hope to relax this assumption in future work by constructing separate labor supply equations for married and unmarried individuals. However, to analyze other linkages among extended family members-- for example, between fathers and sons-in-law-- it will be necessary to add equations relating marital status and the expected value of the permanent wage and hours preferences of the husband to the parental, family, and idiosyncratic factors of the young woman. This complicates matters considerably, and so we feel that it is preferable to start our investigation with the simpler model presented here.

I.8 Fitting the Model and Variance Decompositions

The parameters of the model described above consist of the coefficients in the preference, wage, hours, and earnings equations, the variances of the wage and preference factors, and the covariances of wage and preference factors of the parents. These parameters determine the variances and covariances among the labor market outcomes of young men and young women as well as covariances between the labor market variables of children and parents, and among siblings. For example, equation (5b) implies that the covariance between the wages of brothers j and j′ is

$$(10)\quad \mathrm{Cov}(W_{ib(j)},W_{ib(j')}) = \mathrm{Cov}(W_{ib(j)t},W_{ib(j')t'})$$
$$= a_{bf}^2\ \mathrm{Var}(W_{if}) + a_{bm}^2\ \mathrm{Var}(W_{im})$$
$$+ 2a_{bm}\ a_{bf}\ \mathrm{Cov}(W_{if},W_{im}) + a_{bs}^2\ \mathrm{Var}(\omega_{is})\ ,$$

for $j \neq j'$, and for all t and t′.

The variance of young men's wages can be constructed from (5b) as follows

$$(11)\quad \mathrm{Var}(W_{ib(j)}) = \mathrm{Cov}(W_{ib(j)t},W_{ib(j)t'})$$
$$= a_{bf}^2\ \mathrm{Var}(W_{if}) + a_{bm}^2\ \mathrm{Var}(W_{im}) + 2a_{bm}\ a_{bf}\ \mathrm{Cov}(W_{if},W_{im})$$
$$+ a_{bs}^2\ \mathrm{Var}(\omega_{is}) + \mathrm{Var}(\omega_{ib})\ ,\quad |t - t'| > 2.$$

Equation (11) may be used to assess the contribution of the parental variables to the variance in the permanent wages of young men. The father's contribution is $a_{bf}^2\ \mathrm{Var}(W_{if})$ plus the portion of the covariance term $2a_{bm}\ a_{bf}\ \mathrm{Cov}(W_{if},W_{im})$ that is assigned to the father. The contributions of the mother's wage, W_{im}, the family factor, ω_{is}, and the idiosyncratic factor, ω_{ib}, to the variance of the wages of young men are clearly laid out in the equation. The contributions of the various components to the brothers' wage covariance (equation 10) are the same as the contributions to the young men's variance, except that the idiosyncratic factor ω_{ib} which is uncorrelated across brothers, plays a role in (11) but not in (10). Below we plug the estimated parameter values into formulae similar to (10) and (11) for other key variance and covariances,[10] and measure the contributions of the various wage and preference factors to the estimated variances and covariances.

I.9 Estimation

The parameters of the model are estimated by fitting the theoretical variances and covariances implied by equations (2), (4), (5), (6) and (7) to the sample estimates of the corresponding variances and covariances. There are 90 unique theoretical autocovariances and cross-covariances and sample moments.[11]

The procedure used to estimate the sample variances and covariances was discussed in Chapter 1, where it was referred to as the method of moments procedure; we repeat the discussion here. We compute family covariances of a particular labor market outcome by first adjusting the data to have zero mean, then computing the unique set of crossproducts of the elements of the vector of labor market outcomes in different years for one family member with the elements of the vector of labor market outcomes of the other family

10. As another example, using equation (4), the covariance of daughters' and fathers' earnings is given by
$Cov(E_{ig}, E_{if}) = [\phi_{gw} + \phi_{gh}\beta_g][\phi_{fw} + \phi_{fh}\beta_f]Cov(W_{ig}, W_{if}) + [\phi_{gh}\phi_{fh}]Cov(U_{ig}, U_{if})$.

11. In Appendix Tables A1- A4 we present the sample estimates of the 90 unique variances and covariances of key variables and the corresponding correlation coefficients and sample sizes. For brevity's sake, we do not discuss them in the text, although many of the family covariances were discussed in Chapter 1.

member, and taking the mean of all the crossproducts for all of the pairs of family members. We estimate the variance of the permanent component of labor market outcomes for say, young men, by first computing the crossproducts of all unique pairs of yearly observations on a labor market outcome that are for the same individual and that are separated by more than two years in time and then taking the average of all of the crossproducts for all individuals.[12] We do the same for young women's, mature women's, and older men's variables.

The specific formulae for the method of moments covariances, variances, and correlations are as follows. Let $Y_{ik(j)t}$ be the adjusted[13] labor market outcome of an individual, where i denotes a set of related individuals, k is the type of individual (e.g., young man, young woman, older man, or mature woman) and j is an index indicating the specific individual of type k from family i. (The index j may exceed 1 when k refers to young men or young women and there is more than one young man or young woman from a given family.) The index t is a time subscript. Then the method of moments estimator of the covariance of variable Y with variable Z for family pair of type k,k' is

$$(12)\quad Cov(Y_{ik}, Z_{ik'}) = \sum_i \left(\sum_j \sum_{j'} \sum_t \sum_{t'} Y_{ik(j)t} Z_{ik'(j')t'}\right) / N_{YZkk'}$$

When k = k', as is the case for brother pairs and for sister pairs, then the covariance estimator when Z = Y is

12. If a labor market variable such as the wage rate is equal to a fixed component and a transitory component that can be represented by a moving average process of order 2 or less, then the transitory component will not bias our variance estimates.

13. We work with the residuals from a regression of each of the labor market outcomes against a cubic in age and a set of year dummies.

$$(13)\quad Cov(Y_{ik(j)}, Z_{ik(j')}) = \sum_i \{\sum_j \sum_{j' \geq j} \sum_t \sum_{t'} Y_{ik(j)t}\, Z_{ik(j')t'}\} / N_{YYkk}$$

and when $Z \neq Y$ the covariance estimator is

$$(14)\quad Cov(Y_{ik(j)}, Z_{ik(j')}) = \sum_i \{\sum_j \sum_{j' \neq j} \sum_t \sum_{t'} Y_{ik(j)t}\, Z_{ik(j')t'}\} / N_{YZkk}$$

The method of moments variance estimator for the variable Y for person type k is

$$(15)\quad Var(Y_{ik(j)}) = \sum_i \{\sum_j \sum_t \sum_{t' > t+2} Y_{ik(j)t}\, Y_{ik(j)t'}\} / N_{Yk}$$

And the method of moments covariance estimator for the variables Y and Z for person type k is

$$(16)\quad Cov(Y_{ik(j)}, Z_{ik(j)}) = \sum_i \{\sum_j \sum_t \sum_{\substack{t' > t+2 \\ t' < t-2}} Y_{ik(j)t}\, Z_{ik(j)t'}\} / N_{YZk}$$

In the above equations $N_{YZkk'}$, N_{YYkk}, N_{YZkk}, N_{Yk}, and N_{YZk} are the number of terms in the sums taken in (12), (13), (14), (15), and (16) respectively.

We point out in Chapter 1 that the samples used in estimation differ substantially for the different sample moments. That is, we use unbalanced data in estimating the model. This is necessitated by the fact that particular families i do not supply observations to all of the matched samples on family members, and not all of those individuals who are matched provide the same number of valid reports. We assume that the model parameters are the same for all families and in particular are not related to patterns of data availability. If this homogeneity assumption is false, then our model's estimates of the family linkages will be biased.[14]

We fit the theoretical model to the sample moments by minimizing the discrepancy between a given sample moment and the corresponding prediction of the model. We estimate the model using both ordinary least squares (OLS) and weighted least squares (WLS), but we discuss only the WLS estimates. The OLS estimation assumes that the sampling errors in the 90 sample moments are uncorrelated and homoscedastic. In fact, they are likely to be heteroscedastic for two reasons. First, the underlying distributions of wages, hours, and earnings are not all the same, and any differences in the distributions will affect the precision of the estimated covariances and variances. Second, as mentioned earlier, the sample moments are estimated using different numbers of observations. To remedy the potential inefficiency in the parameter estimates caused by the differences in the precision of the estimated moments, the WLS procedure is implemented in which each observation corresponding to one of the 90 sample moments is weighted by the estimate of its sampling variance.

In estimating the variances of the sample moments it is necessary to take account of the fact that individual crossproducts that enter the sums in (12) through (16) are <u>not</u> independent within each family i. We account for this by expressing each sample covariance as the sum of the sums of individual crossproducts contributed by each family i. The sums for a particular family i are the terms in brackets in (12), (13), (14) and (15). The sums in brackets are independent across families under our assumptions, and (after dividing by the average number of crossproducts per family) have an

14. Moderately large balanced samples can be generated using the Panel Study of Income Dynamics, and it would be useful to compare estimates of our model based on balanced and unbalanced PSID samples.

expectation (taken across families) equal to the particular covariance. It is then easy to formulate a consistent estimator of the variance of the sample covariance. For example, consider the covariance estimator in (12). One may rewrite $Cov(Y_{ik},Z_{ik'})$ as

$$Cov(Y_{ik},Z_{ik'}) = [1/I_{YZkk'}] \sum_i S_i$$

where $S_i = (\sum_j \sum_{j'} \sum_t \sum_{t'} Y_{ik(j)t} Z_{ik'(j')t'}) (I_{YZkk'}/N_{YZkk'})$

and $I_{YZkk'}$ is the number of different families contributing observations on variables Y and Z for persons of type k and k'. One may think of the S_i as independent and identically distributed random variables drawn from a distribution over all families. The expectation of S_i over this distribution is $Cov(Y_{ik}, Z_{ik'})$. It follows that a consistent estimator of the sampling variance of $Cov(Y_{ik},Z_{ik'})$ is

$$Var[(Cov(Y_{ik},Z_{ik'})] = \sum_i [S_i - Cov(Y_{ik},Z_{ik'})]^2 /I_{YZkk'}$$

It should be pointed out that neither the OLS standard errors nor the WLS standard errors account for correlation in the sampling errors across different sample moments.[15]

II. Data

The data used in this analysis are from the four Original Cohorts of the

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15. We have chosen not to use a full GLS estimator that would account for correlation in the sampling errors of the sample moments because of the difficulties in getting good estimates of the correlations among the sample moments when the sample is highly unbalanced.

National Longitudinal Surveys of Labor Market Experience.[16] Specifically, we work with the sample of Young Men who were 14 to 24 years old in 1966 and were followed through 1981, the samples of Young Women who were 14 to 24 in 1968 and Mature Women who were 30 to 44 years old in 1967 and continue to be followed, and the sample of Older Men who were 45 to 59 in 1966 and were last surveyed in 1983. We use data through 1982 in the case of the young women and through 1984 in the case of mature women. Some of the households contributed more than one person to the young men and young women surveys, and in some cases the households contributed to both the youth surveys and older men and mature women surveys. Consequently, it is possible to match data on sibling pairs and parent-child pairs. The Appendix to Chapter 1 summarizes information on the sample sizes of the original cohorts, the number of siblings of each sex, the numbers of brother, sister, and brother-sister pairs, and the number of parent-child pairs.[17]

We take advantage of the panel nature of the data sets and use as many of the yearly reports as possible for each individual, subject to the following selection rules. The data for a particular variable may be missing either because the individual left the sample prior to that year's survey or because the response is missing or invalid for other reasons. In the case of the young men and young women we restrict the sample to individuals who were at least 24 years old prior to leaving the survey. We chose this age cutoff to reduce the influence of transitory variation in labor market outcomes

16. Most of this data description is presented in Chapter 1. We repeat it here to make this chapter self-contained.

17. In Chapter 1 we discuss the possibility that the very fact that it is possible to match data across NLS cohorts may lead to biases in the estimates of the family linkages.

associated with the transition between school and work. We use labor market data (wages, annual hours, and earnings) from a particular year only if the individual was at least 24 and was out of school and did not return to school in a subsequent year.

The fact that many of the older men in the sample approach retirement age during the course of the survey raises additional complications. Earnings, work hours, and wage rates of such individuals after retirement may not be closely related to the typical or "permanent" values for these individuals over the course of their careers. To minimize this problem, we only use data on the labor market variables for individuals who had not yet retired, and who were less than 61 years old when the data were collected. Since the age in 1966 of the older men ranges from 45 to 59, there is substantial variance across sample members in the number of years of labor market data available. Retirement is not a concern for the mature women's sample through the years we study.

For all four cohorts we excluded wage observations of less than $.40 per hour, and earnings of less than $100 per year (both in 1967 dollars). Also, only annual hours (constructed as reported number of weeks worked times reported number of hours worked per week) greater than zero and less than 5000 hours were counted.

III. Estimates of Preference, Wages, Hours, and Earnings Equations

We begin with a discussion of the parameter estimates and the overall fit of the equations. We then turn in section IV to the analysis of sources of variation in wages, hours, and earnings.

Before turning to the results it is necessary to discuss a few additional restrictions that are imposed upon the model's parameters prior to estimation. Without loss of generality we normalize the son's sibling wage factor parameter, a_{bs}, to unity. Consequently, the daughter's coefficient a_{gs} is the effect of the family wage factor ω_{is} on young women relative to the effect on young men. We also normalize both the son's and daughter's sibling preference factor coefficient, λ_{bs} and λ_{bg}, to unity. Models in which this restriction is relaxed are not empirically identified. For some of our models, we restricted the earnings equation parameters on wages and hours, ϕ_{kw} and ϕ_{kh} for all k, to unity on the grounds that both log hours and the log wage should have coefficients of 1 in an equation for log earnings. As will be shown below, relaxing these restrictions produces coefficients on wages and hours which are, for the most part, reasonably close to unity.

To save space, we will focus our discussion on the WLS results in Table 1 for the model that does <u>not</u> restrict ϕ_{kw} and ϕ_{kh} to unity. We choose to present this specification for two reasons. First, the parameter estimates are not that sensitive to the inclusion of the earnings equations restrictions, and the model without them is more general. Second, the WLS estimates are likely to be more efficient than the OLS estimates. For comparisons, Appendix Table A5 presents the <u>OLS</u> estimates for the model without the earnings equation restrictions, and Table A6 shows the WLS estimates <u>with</u> the restrictions on the wage and hours parameters in the earnings equations.

The equations for the preferences and wages of young men and young women are in the top two panels of Table 1. The father's preferences U_{if} have a coefficient of .215 with a standard error of .072 in the equation for U_{ib}, the young men's preferences. In the same equation, the mother's preferences have a small negative coefficient which is statistically insignificant. Conversely, the father's preferences, U_{if}, have a negative but insignificant effect on the preferences of young women, while the mother's preferences have a coefficient (standard error) of .368 (.081). Apparently, parental influences on labor supply preferences depend upon gender, with the father playing a strong positive role for young men and the mother playing an even stronger positive role for young women.

The estimates of the standard deviations of the young men's and older men's preferences, $\sigma_{u_{ib}}$ and $\sigma_{U_{if}}$, are .142 and .179, respectively. The corresponding estimates for young women and mature women, $\sigma_{u_{ig}}$ and $\sigma_{U_{im}}$, are noticeably larger at .444 and .351. The covariance of the parents' preference factors is .016. Lastly, the sibling preference factor u_{is} has an estimated standard deviation of .066 and enters the preference equations with coefficients that have been normalized to unity; consequently, it plays an important role in the variation in preferences for both young men and young women.

The equations for the wages of young men (W_{ib}) and young women (W_{ig}) show strong and statistically significant effects of the parental factors. The coefficients (standard errors) on the father's and mother's wages, W_{if} and W_{im}, in the young men's wage equation are .280 (.033) and .258 (.037), respectively. The corresponding coefficients in the young women's wage equation are .282 and .209, both of which are significant. The family factor ω_{is} has a coefficient of .831 in the equation for W_{ig} with a standard error of .183. This estimate falls short of the corresponding coefficient of 1 in the young men's wage equation, but by less than one standard error; so there is no strong evidence that young women's wages are more sensitive than young men's to common family factors that are independent of the parental wage factors. The idiosyncratic wage factors for young men, ω_{ib}, and for young women, ω_{ig}, have estimated standard deviations of .281 and .255, which are smaller than the standard deviations of the parents' wage factors: .424 for fathers and .345 for mothers. The parents' wage factors have an estimated covariance equal to .054 which is more than three times larger than the covariance of their preference factors.

The bottom left hand side panel of Table 1 reports the estimated labor supply equations. The labor supply elasticity estimates (standard errors) are .056 (.015) for young men, .077 (.027) for mature men, .184 (.045) for young women, and .445 (.043) for mature women. The small estimates for men are basically consistent with a large body of evidence. The results for young women are on the low side, but consistent with the conclusions of Mroz' (1987) study of static labor supply for married women. The estimate for the mature women is well within the wide range of estimates available for women, but larger than the estimates suggested by Mroz' work. Overall, these labor supply elasticities estimates seem reasonable.

The estimated coefficients on wages and hours in the earnings equations (ϕ_{kw} and ϕ_{kh}, k= b, g, f, and m) are close to unity in all cases except for the older men's hours coefficient which is found to be .551 with a standard error of .294. Not surprisingly then, the model's parameter estimates are not very sensitive to whether or not we restrict the wage and hours parameters to unity in the earnings equation. (Compare Table 1 to Table A6.)

The factor model, which has 33 free parameters, explains 99 percent of the variance of the unweighted sample moments. Since we do not know the covariances among the sampling errors in the 90 moments, it is not possible to perform a formal test of the factor model as a description of the sample moments. However, if the covariances among the sampling errors are zero, then the weighted sum of squared errors of the model has a χ^2 distribution with (90-33= 57) degrees of freedom; in fact, the model's weighted sum of squared errors is 35.10, which has a p-value of .99. Since the covariances are not independent, this goodness of fit test may be biased either for or against the factor model. In any case, we conclude that the parameter estimates are basically sensible, and that the model fits the family covariances well enough to be used to perform variance decompositions.[18]

IV. Decomposing the Variances and Covariances Among Labor Market Outcomes

Tables 2a, 2b, and 2c examine the contributions of each of the wage and preference factors to the variances of permanent wages, hours, and earnings of young men and young women, and to the covariances of these three variables among siblings and parent-child pairs. The decompositions presented in the tables are based on the parameter estimates in Table 1 which were found using

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18. In the OLS version of the model-- the results of which are reported in Table A5-- the estimated parental preference factors are quite different from the corresponding WLS estimates, but the estimated standard deviations of the preference factors are very close to the WLS estimates. The estimated wage factor coefficients and the estimated standard deviations of the wage factors are quite close to the WLS estimates reported in the text. The estimated labor supply elasticities in the OLS model are consistently smaller than the WLS estimates, especially the fathers'. Finally, the OLS hours and wage coefficients in the earnings equations are also quite close to the WLS estimates, except for the fathers' hours coefficient. Overall, as one would expect, the standard errors of the OLS parameter estimates are larger than the corresponding WLS standard errors.

In the WLS version of the model with the hours and wage coefficients restricted to unity (Table A6), the preference and wage factors are essentially the same as in the WLS version without the restrictions. Unsurprisingly, the labor supply elasticities in the restricted version are consistently larger than those in the unrestricted version. The restricted version has a "goodness of fit" p- value of .69.

WLS on the factor model which did not impose restrictions on the wage and hours parameters in the earnings equations. The first column of each row lists the particular covariance or variance that we are examining. For example, in the first row of the Table 2a we examine $Cov(W_{ib(j)}, W_{ib(j')})$, the wage covariance of brothers. The sample estimates (derived using the method of moments approach described in section I.9) and the values predicted by the factor model for each of the moments are reported in the second and third columns. The actual and fitted values are .0562 and .0548 in the case of the brothers' wage covariance. Columns 4, 5 and 6 report the contribution of the father's wage factor, W_{if}, the mother's wage factor, W_{im}, and the combined contributions of both parents plus, $Cov(W_{if}, W_{im})$, the covariance of their wage factors. The contribution of the sibling factor, ω_{is}, and contribution of the idiosyncratic factor ω_{ib} or ω_{ig} are shown in the seventh and eighth columns. Columns 9 through 13 report the corresponding contributions of the various <u>preference</u> factors.

The number in parentheses below each factor contribution is the fraction of the predicted value of the particular moment (column 3) that is due to the particular factor. For example, the results in Table 2a indicate that W_{if} is responsible for 26 percent of the covariance of brothers' wages and 11 percent of the variance of wages of young men (the second row of the table). The mother's wage contribution, W_{im}, is 14 percent of $Cov(W_{ib(j)}, W_{ib(j')})$ and 6 percent of $Var(W_{ib(j)})$. The total contribution of the parents' wages--the father's plus the mother's plus their covariance--is 54 percent of the covariance between brothers' wages, and 22 percent of the variance of young men's wages. The sibling wage factor accounts for 46 percent of the similarity between brothers and only 19 percent of the variance in the wages of young men. Fifty-nine percent of the young men's wage variance is due to the idiosyncratic wage factor.

Given space limitations it is not possible to discuss the decompositions of each of the variances and covariances listed in the tables. Instead, we provide summaries of the main results for wages, hours, and earnings.

III.1 Wages (Table 2a)

The effects of parents' wage factors and siblings' wage factors are pretty much the same for different types of sibling pairs, although the combined parental wage factors are slightly more important relative to the sibling wage factors for sister pairs than for brother pairs or brother-sister pairs. To be precise, the parents' total contribution to the wage covariance of brothers is .029800 which constitutes 54 percent of the total covariance of brothers' wages; for brother- sister pairs, the parents contribute .027637, or 57 percent; and for sister pairs the contribution is .025756 or 60 percent. Sibling wage factors account for 46 percent of the covariance in brothers' wages, 43 percent of the brother-sister covariance, and only 40 percent of sisters' wage covariance.

Looking at the <u>variance</u> of wages, one sees that the father's wage factor and mother's wage factor explain 11 percent and 6 percent of the variance of young men's wages; however, since the two parental factors have a positive covariance, the total parents' contribution is 22 percent of the variance of young men's wages. The remaining variation in young men's wages is explained by the sibling wage factor which accounts for 19 percent and the idiosyncratic effect which explains 59 percent. For young women's wage variance, one sees a slightly larger parental contribution, 24 percent, and a slightly smaller sibling effect, 16 percent, and an individual effect which claims 60 percent. That sibling wage effects are slightly weaker for young women and sister pairs than for young men and brother pairs is a reflection of the finding that the sibling factor coefficient in the young women's wage equation in Table 1 was estimated to be .831, while the young men's coefficient was normalized to unity.

The decompositions of the covariances of the wages of parents and children are particularly interesting. The results for young men in row 3 of Table 2a indicate that the father's factor, W_{if}, explains 78 percent of the father-son wage covariance. The rest is attributed to the fact that the father's wage factor is positively correlated with the mother's wage factor, and the mother's wage factor has a direct effect on the wage of the son.[19] The results for the father-daughter wage covariance are very similar, with W_{if} explaining 82 percent of the covariance (see row 7). The mother's wage factor, W_{im}, accounts for only 67 percent of the wage covariance between mothers and sons, and for 62 percent between mothers and daughters. The remainder is due to the fact that the mother's wage factor is positively correlated with the father's wage factor and the father's wage factor has a direct effect on the children's wages. An implication of these findings is that studies that simply look at, say, the correlation between fathers and sons' wages or incomes overstate the size of the direct link by attributing part of the mother's influence to the father.

One explanation for the larger role of the father's factor in the wages

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19. To appreciate the size of the parents' wage covariance, note that the sample covariance of the wages of fathers and mothers (in row 12 of Table 2a) is .0532, which is more than 25 percent of the variance of the fathers' wages (row 10) and almost half the variance of the mothers' wages (row 11).

of both young men and young women is that the wage rate may be a less accurate measure of the human capital of mothers than of fathers because of the large role women play in productive activity outside of the labor market.

III.2 Hours (Table 2b)

In view of the relatively small wage elasticities for young men and young women found in Table 1, it is not surprising that parental wage factors play only a small role in the variances of hours of young men (zero percent) and young women (1 percent) and in the covariances of hours of siblings.[20] The sibling wage factor also plays a relatively small role (in no case more than 5 percent) in these same moments. For brothers, the parental and sibling wage factors together explain only 3 percent of the variance in hours. For sisters, the parental wage factor explains 4 percent of the hours covariance and the sibling factor explains 3 percent. And for brother- sister pairs, the combined parents' and sibling wage effects explain 11 percent of the hours covariance.

The idiosyncratic components of wages also explain very little (1 percent) of the variation in the hours of young men and young women. For mature men the wage factor explains only 3 percent of their hours variance (row 10, column 4) leaving 97 percent of their hours variation explained by variation in their preferences. However, for older women, who have a larger estimated wage elasticity, variation in their wage factor, W_{im}, explains a much larger fraction, 16 percent, of the variation in their hours (row 11,

20. It should be pointed out the model slightly underestimates the hours covariance of brothers and substantially underestimates the hours covariance of sisters. The model overestimates the hours covariance between brothers and sisters. Compare columns 2 and 3 in the first, fifth, and ninth rows.

column 5). Only 10 percent of the parents' hours covariance is attributable to their wage covariance. The remaining 90 percent is explained by the covariance of their preferences.

On the other hand, the parental and sibling <u>hours preference</u> factors make an important contribution to the variance in the hours of siblings, but there are large differences in the parental influences for males and females. The fathers' preference factor, U_{if}, contributes 25 percent of the covariance in brothers' hours, but only 5 percent of sisters' hours. At the same time, mothers' preferences account for essentially none of the brothers' or brothers-sisters' hours covariance, but a whopping 78 percent of sisters' hours covariance. Totalled, parental factors account for three times as much of the sisters' hours covariance than for the brothers'. The sibling preference factor explains 96 percent of the brother-sister hours covariance, 73 percent of the brothers', but only 20 percent of the sisters'.

A similar gender-specific pattern is seen in the hours <u>variances</u> of young men and young women. Fathers' preferences constitute the entire parental contribution for young men, and mothers' for young women. In both cases, the parental preference contribution to the hours variation is small, around 7 percent. The sibling factor u_{is} makes the same absolute contribution (.004410) to the variance of the hours of young women and of young men, but because young women have a much higher hours variance than young men (.1969 versus .0268) this contribution is only 2 percent of the young women's total versus 17 percent for young men. A large part of the difference in the variance of hours of young women and young men comes from the idiosyncratic factor, which has a variance of .197 (or 89 percent) for young women and only .020 (or 76 percent) for young men. The recurring pattern of relative roles of the father's preferences and the mother's preferences for young men and brothers and for young women and sisters reflects the gender-specific pattern of the coefficients in the preference equations shown in the top panel of Table 1.

III.3 Earnings (Table 2c)

Examining the results in Table 2c, one can obtain specific answers to the question of the relative importance of wage factors and hours preference factors in determining the variances and covariances of earnings. With respect to the variances of earnings of young men (row 2), the parental wage factors explain 19 percent, the sibling wage factor explains 16 percent and the idiosyncratic wage factor explains 50 percent of the total variance. Combined, some 85 percent of the variance of earnings among young men is due to wage factors. The remaining 15 percent can be broken up as follows: the parental hours preferences contribute 1 percent of the variance in earnings, and the sibling factor and the idiosyncratic hours preference factors explain 2 percent and 12 percent, respectively.

For young women, the relative importance of wage differences and preference differences are reversed. In row 6, the parental, sibling and idiosyncratic wage factors contribute 11 percent, 7 percent and 26 percent, or a total of 44 percent, of the variance of E_{ig}. The parental, sibling, and idiosyncratic hours <u>preference</u> factors contribute 4 percent, 1 percent and 51 percent of the remaining variance in young women's earnings. For young women, the mother's hours preference factor explains 4 percent of the total variance, and 19 percent of the similarity between sisters (row 5), while the mother's contribution for young men and for brothers are essentially both zero.

The pattern of relative influences is similar across sibling pairs: about 50 percent of the covariation in earnings is due to parental wage factors and 40 percent to sibling wage factors. For brother and brother-sister pairs, parental preference factors are small relative to sibling factors; not so for sister pairs for whom mothers' preferences contribute 19 percent of the covariance in earnings.

In light of the wage and hours results reported above, it is not surprising to find that 75 percent of the covariance in the earnings of fathers and sons is due to the father's wage factor, while only 4 percent is due to the father's preference factor. The covariances of the earnings of sons and mothers, and daughters and fathers are also dominated by the parental wage factors. However, the mother's preference factor explains a relatively large 37 percent of the covariance of earnings between mothers and daughters (and zero percent between mothers and sons).

Finally, it is interesting to note that the variation in earnings of fathers is dominated by the wage factor, which explains 97 percent of the variance in row 10. For mothers (in row 11), the wage factor explains 71 percent of their earnings, although a substantial fraction-- 28 percent-- of the influence of the mothers' wage factor on mothers' earnings was found to operate through the labor supply response to wages.[21]

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21. This fraction was calculated as the ratio of the indirect influence of wages on earnings, which operates through the labor supply response of hours to wages, to the sum of the direct effect of wages on earnings plus the indirect effect. From equation (4) the reader can verify this ratio is $\phi_{hm}\beta_m/[\phi_{wm} + \phi_{hm}\beta_m]$, which equals .28 when the appropriate parameter values from Table 1 are substituted. For fathers, the labor response to wages accounts for 4 percent of the wage contribution to their earnings.

V. Summary and Conclusions

In this paper we have used a simple factor model to explore the sources of variation and of family similarities in wages, hours, and earnings. We have estimated the model using matched intergenerational and intragenerational panel data on labor market outcomes. The model consists of a simple static labor supply equation, an equation relating earnings to hours worked and wage rates, and factor models relating wage rates and hours preferences to parental, sibling, and idiosyncratic factors. Although many different pairs of individuals are used to compute the covariances and variances of earnings, wages, and hours that we seek to explain, our factor model performs well in explaining most of the variation in the sample moments. Furthermore, we obtain reasonable labor supply elasticities; also, the gender differences in the relative importance of work preferences and wage rates in the determination of work hours, and in the relative influence of fathers and mothers have some intuitive appeal. To our knowledge, we are the first to use intergenerational and sibling covariances in wage rates to identify labor supply elasticities.

Our main findings are as follows. First, the wages of both sons and daughters are quite responsive to the wage factors of fathers and mothers, with coefficients between .2 and .3 for our preferred specifications. The effect of the father is somewhat larger, particularly for daughters. However, the father's wage explains a substantially larger fraction of the total variance in wage rates, in part because the variation of the father's wage factor is substantially larger (by about one-third) than the variation in the mother's wage factor.

Second, the sibling wage factor and combined parents' factors explain roughly the same percentages (45 percent and 55 percent) of the covariance of the wages of sibling pairs, no matter what type of sibling pair (brother-brother, sister-sister, or brother-sister) is considered. Furthermore, the relative contributions of fathers and mothers are the same for all sibling pairs, with the fathers' wage factor explaining twice as much of the sibling wage covariance as the mothers'.

We also document that intergenerational correlations substantially overestimate the direct influence of fathers, and especially mothers, on wages. A substantial part of the relationship between a parent and child arises because assortative mating induces a substantial positive covariance in the wage rates of the spouses (parents). We find, for example, that the covariance of the father's and mother's wages accounts for 22 percent of the covariance between father's and son's wages.

Without repeating our findings in detail, we should note that variation in hours preferences dominates the variation in wages in determining the permanent differences in hours among young men and young women. It is interesting to note, however, that 6 percent of the total variance is associated with parental preference factors and 17 percent is associated with the sibling preference factor in the case of young men. For young women only about 9 percent of the total variance is associated with parental plus sibling preference factors, the remainder is claimed by a large individual effect. The small influence of wage rates (particularly for young men, who have a low overall variation in hours), reflects the fact that our estimated labor supply elasticities are only .056 for young men and .184 for young women. For mature women (who have an estimated wage elasticity of .445), wage differences explain 16 percent of the total variance in hours, while for mature men, only

3 percent of the hours variance can be attributed to wage differences.

Our results for young men's earnings indicate that 85 percent of the variation is due to the wage factors and 15 percent to the hours preference factors; similarly, for mature men the figures are 97 percent and 3 percent. On the other hand, the hours preference factors are very important for the earnings of young women (claiming 56 percent), although almost all of the effect is accounted for by the idiosyncratic preference factor. For the mothers, 71 percent of the earnings variance is due to the wage factor, and 29 percent to the hours preference factor. Consequently, our decompositions of the earnings variances differ by gender, and by age in the case of women.

Most of the results that we have discussed are robust across the two specifications that we estimate and to the use of ordinary least squares rather than weighted least squares. However, we have highlighted a number of limitations of our model and methodology that will require further research. First, it would be useful to generalize the labor supply function to allow for parental wage effects on the children's marginal utility of income. Second, it would be useful to estimate labor supply models that depend upon marital status, which incorporate cross substitution effects of the spouse's wage. Third, and perhaps most important, it is important to address the problem of non- participation in the labor market.[22]

Fourth, our findings in Chapter 1 of strong covariances in wages, hours, and earnings between mothers and fathers and of substantial covariances in the

22. We think that this is important not so much because we are concerned about selection bias in estimation of the labor supply elasticities, but because exclusion of data points in which individuals work zero hours probably has serious effects on our measures of the hours variances and covariances and on our estimates of the variances and covariances of leisure preferences.

earnings of "in-laws" suggests that it would be useful to extend the model to include equations relating the hours preference factors and wage factors of say, a young woman's husband to her wages and hours preferences, as well as to the wage and hours preferences of her siblings and parents. Of course, such an extension will require one to deal with the endogeneity of marriage. Finally, there are a host of econometric issues involving the use of unbalanced data that we have chosen to ignore and that could be explored in future research. The Panel Study of Income Dynamics provides larger samples of parents and children and siblings and more complete data on spouses than does the NLS. For this reason, it would be useful replicate our work with the PSID.

Table 1
WLS Estimates of Preference, Wage, Hours, and Earnings Equations

Preference Equations (6):

$$U_{ib} = \underset{(.072)}{.215}\, U_{if} - \underset{(.035)}{.008}\, U_{im} + u_{is} + u_{ib}$$

$$U_{ig} = \underset{(.195)}{-.178}\, U_{if} + \underset{(.081)}{.368}\, U_{im} + u_{is} + u_{ig}$$

$\sigma_{u_{ib}} = .142$ (.010) $\quad \sigma_{U_{if}} = .179$ (.011) $\quad \sigma_{u_{is}} = .066$ (.018)

$\sigma_{u_{ig}} = .444$ (.017) $\quad \sigma_{U_{im}} = .351$ (.016) $\quad Cov(U_{if},U_{im}) = .016$ (.007)

Log Wage Equations (5):

$$W_{ib} = \underset{(.033)}{.280}\, W_{if} + \underset{(.037)}{.258}\, W_{im} + \omega_{is} + \omega_{ib}$$

$$W_{ig} = \underset{(.041)}{.282}\, W_{if} + \underset{(.040)}{.209}\, W_{im} + \underset{(.183)}{.831}\, \omega_{is} + \omega_{ig}$$

$\sigma_{\omega_{ib}} = .281$ (.011) $\quad \sigma_{W_{if}} = .424$ (.012) $\quad \sigma_{\omega_{is}} = .158$ (.019)

$\sigma_{\omega_{ig}} = .255$ (.011) $\quad \sigma_{W_{im}} = .345$ (.007) $\quad Cov(W_{if},W_{im}) = .054$ (.005)

Log Hours Equations (2):

$$H_{ib} = \underset{(.015)}{.056}\, W_{ib} + U_{ib}$$

$$H_{ig} = \underset{(.045)}{.184}\, W_{ig} + U_{ig}$$

$$H_{if} = \underset{(.027)}{.077}\, W_{if} + U_{if}$$

$$H_{im} = \underset{(.043)}{.445}\, W_{im} + U_{im}$$

Log Earnings Equations (3):

$$E_{ib} = \underset{(.044)}{1.151}\, W_{ib} + \underset{(.161)}{1.172}\, H_{ib}$$

$$E_{ig} = \underset{(.081)}{1.089}\, W_{ig} + \underset{(.062)}{1.017}\, H_{ig}$$

$$E_{if} = \underset{(.066)}{1.120}\, W_{if} + \underset{(.294)}{.551}\, H_{if}$$

$$E_{im} = \underset{(.101)}{1.072}\, W_{im} + \underset{(.101)}{.933}\, H_{im}$$

Notes:
1. Standard errors are reported in parentheses.
2. The WLS regression producing these results had $R^2 = .99$, RMSE= .7847, Sum of Squared Errors= 35.10, and 57 degrees of freedom.
3. The p- value for the SSE drawn from a χ^2_{57} is .99.

Table 2a: Decomposition of Variances and Covariances

Moment	Sample Estimate[1]	Factor Model Prediction	Source of Variance: Wage Factors: Father W_{if}	Wage Factors: Mother W_{im}	Wage Factors: Total Parents $W_{if}+W_{im}+Cov(W_f,W_m)$	Wage Factors: Sibling ω_{is}	Wage Factors: Individual ω_{ib} or ω_{ig}	Preference Factors: Father U_{if}	Preference Factors: Mother U_{im}	Preference Factors: Total Parents $U_{if}+U_{im}+Cov(U_f,U_m)$	Preference Factors: Sibling u_{is}	Preference Factors: Individual u_{ib} or u_{ig}
$Cov(W_b,W_{b'})$	.0562	.0546	.014124 (.26)	.007918 (.14)	.029800 (.54)	.024967 (.46)	--					
$Cov(W_b,W_b)$	.1351	.1337	.014124 (.11)	.007918 (.06)	.029800 (.22)	.024967 (.19)	.078868 (.59)					
$Cov(W_b,W_f)$	.0670	.0642	.050378 (.78)	--	.064213 (1.00)	--	--					
$Cov(W_b,W_m)$	.0454	.0458	--	.030714 (.67)	.045761 (1.00)	--	--					
$Cov(W_g,W_{g'})$	.0421	.0430	.014270 (.33)	.005179 (.12)	.025756 (.60)	.017221 (.40)	--					
$Cov(W_g,W_g)$	.1071	.1081	.014270 (.13)	.005179 (.05)	.025756 (.24)	.017221 (.16)	.065127 (.60)					
$Cov(W_g,W_f)$	.0545	.0618	.050636 (.82)	--	.061827 (1.00)	--	--					
$Cov(W_g,W_m)$	.0398	.0400	--	.024841 (.62)	.039966 (1.00)	--	--					
$Cov(W_g,W_b)$	.0498	.0484	.014197 (.29)	.006404 (.13)	.027637 (.57)	.020735 (.43)	--					
$Cov(W_f,W_f)$	.1957	.1797	.179683 (1.00)	--	--	--	--					
$Cov(W_m,W_m)$	.1196	.1191	--	.119142 (1.00)	--	--	--					
$Cov(W_f,W_m)$	.0532	.0537	--	--	.053670 (1.00)	--	--					

(continued)

[1] Sample estimates of moments are drawn from Appendix Tables A1- A4: "Family Covariances (and Correlations) Among the Permanent Components . . . " Note that covariances of hours and wages, hours and earnings, and wages and earnings for the various family member pairs were also predicted by the Factor Model, but are not reported here.

Note: Numbers in parentheses are the fractions of the Factor Model Prediction attributable to the particular factors.

Table 2b: Decomposition of Variances and Covariances--Continued

Moment	Sample Estimate[1]	Factor Model Prediction	Source of Variance: Wage Factors: Father W_{if}	Mother W_{im}	Total Parents $W_{if}+W_{im}+Cov(W_f,W_m)$	Sibling ω_{is}	Individual ω_{ib} or ω_{ig}	Preference Factors: Father U_{if}	Mother U_{im}	Total Parents $U_{if}+U_{im}+Cov(U_f,U_m)$	Sibling u_{is}	Individ u_{ib} or
$Cov(H_b,H_{b'})$	.0091	.0060	.000045 (.01)	.000025 (.00)	.000094 (.02)	.000079 (.01)	--	.001484 (.25)	.000009 (.00)	.001435 (.24)	.004410 (.73)	--
$Cov(H_b,H_b)$	.0268	.0264	.000045 (.00)	.000025 (.00)	.000094 (.00)	.000079 (.00)	.000249 (.01)	.001484 (.06)	.000009 (.00)	.001435 (.06)	.004410 (.17)	.02012 (.76
$Cov(H_b,H_f)$	.0069	.0070	.000219 (.03)	--	.000279 (.04)	--	--	.006893 (.98)	--	.006759 (.96)	--	--
$Cov(H_b,H_m)$	.0044	.0036	--	.000767 (.21)	.001143 (.32)	--	--	--	-.001027 (-.29)	.002443 (.68)	--	--
$Cov(H_g,H_{g'})$	.0542	.0215	.000482 (.02)	.000175 (.01)	.000870 (.04)	.000581 (.03)	--	.001009 (.05)	.016731 (.78)	.015634 (.73)	.004410 (.20)	--
$Cov(H_g,H_g)$	.1969	.2210	.000482 (.00)	.000175 (.00)	.000870 (.01)	.000581 (.00)	.002199 (.01)	.001009 (.00)	.016731 (.08)	.015634 (.07)	.004410 (.02)	.197296 (.89)
$Cov(H_g,H_f)$	.0001	.0011	.000719 (.64)	--	.000877 (.78)	--	--	-.005683 (-5.04)	--	.000251 (.22)	--	--
$Cov(H_g,H_m)$	.0408	.0459	--	.002029 (.04)	.003265 (.07)	--	--	--	.045450 (.99)	.042588 (.93)	--	--
$Cov(H_g,H_b)$	.0008	.0046	.000147 (.03)	.000066 (.01)	.000285 (.06)	.000214 (.05)	--	-.001223 (-.27)	-.000378 (-.08)	-.000300 (-.07)	.004410 (.96)	--
$Cov(H_f,H_f)$	.0333	.0331	.001072 (.03)	--	--	--	--	.032020 (.97)	--	--	--	--
$Cov(H_m,H_m)$	.1492	.1470	--	.023543 (.16)	--	--	--	--	.123461 (.84)	--	--	--
$Cov(H_f,H_m)$	.0183	.0180	--	--	.001843 (.10)	--	--	--	--	.016120 (.90)	--	--

(continued)

[1] Sample estimates of moments are drawn from Appendix Tables A1- A4: "Family Covariances (and Correlations) Among the Permanent Components . . . " Note that covariances of hours and wages, hours and earnings, and wages and earnings for the various family member pairs were also predicted by the Factor Model, but are not reported here.

Note: Numbers in parentheses are the fractions of the Factor Model Prediction attributable to the particular factors.

Table 2c: Decomposition of Variances and Covariances--Continued

Moment	Sample Estimate[1]	Factor Model Prediction	Source of Variance: Wage Factors: Father	Mother	Total Parents	Sibling	Individual	Preference Factors: Father	Mother	Total Parents	Sibling	Individua
			W_{if}	W_{im}	$W_{if}+W_{im}+Cov(W_f,W_m)$	ω_{is}	ω_{ib} or ω_{ig}	U_{if}	U_{im}	$U_{if}+U_{im}+Cov(U_f,U_m)$	u_{is}	u_{ib} or u_i
$Cov(E_b,E_{b'})$	.0853	.0891	.020919 (.23)	.011726 (.13)	.044135 (.50)	.036977 (.41)	--	.002037 (.02)	.000012 (.00)	.001970 (.02)	.006056 (.07)	--
$Cov(E_b,E_b)$	.2430	.2336	.020919 (.09)	.011726 (.05)	.044135 (.19)	.036977 (.16)	.116836 (.50)	.002037 (.01)	.000012 (.00)	.001970 (.01)	.006056 (.02)	.027628 (.12)
$Cov(E_b,E_f)$	.1061	.1014	.076115 (.75)	--	.097019 (.96)	--	--	.004448 (.04)	--	.004362 (.04)	--	--
$Cov(E_b,E_m)$	.0863	.0855	--	.055573 (.65)	.082800 (.97)	--	--	--	-.001122 (-.01)	.002670 (.03)	--	--
$Cov(E_g,E_{g'})$	.0970	.0907	.023241 (.26)	.008435 (.09)	.041948 (.46)	.028047 (.31)	--	.001043 (.01)	.017305 (.19)	.016169 (.18)	.004561 (.05)	--
$Cov(E_g,E_g)$	.3764	.4009	.023241 (.06)	.008435 (.02)	.041948 (.11)	.028047 (.07)	.106070 (.26)	.001043 (.00)	.017305 (.04)	.016169 (.04)	.004561 (.01)	.204057 (.51)
$Cov(E_g,E_f)$	.1329	.0981	.080228 (.82)	--	.097958 (1.00)	--	--	--	-.003183 (-.03)	.000140 (.00)	--	--
$Cov(E_g,E_m)$	.1027	.1162	--	.047134 (.41)	.075833 (.65)	--	--	--	.043103 (.37)	.040389 (.35)	--	--
$Cov(E_g,E_b)$	.0881	.0800	.022049 (.28)	.009946 (.12)	.042923 (.54)	.032204 (.40)	--	-.001458 (-.02)	-.000450 (-.01)	-.000358 (-.00)	.005256 (.06)	--
$Cov(E_f,E_f)$	.2992	.2867	.276951 (.97)	--	--	--	--	.009712 (.03)	--	--	--	--
$Cov(E_m,E_m)$	.3761	.3707	--	.263371 (.71)	--	--	--	--	.107361 (.29)	--	--	--
$Cov(E_f,E_m)$	.1142	.1073	--	--	.099067 (.92)	--	--	--	--	.008279 (.08)	--	--

[1] Sample estimates of moments are drawn from Appendix Tables A1- A4: "Family Covariances (and Correlations) Among the Permanent Components . . . " Note that covariances of hours and wages, hours and earnings, and wages and earnings for the various family member pairs were also predicted by the Factor Model, but are not reported here.

Note: Numbers in parentheses are the fractions of the Factor Model Prediction attributable to the particular factors.

Table A1

Family Covariances (and Correlations) Among the Permanent Components of Log Real Earnings, Log Real Wage Rates, and Log Annual Hours Using Method of Moments Estimators

Young Men

	Log Earnings	Log Wages	Log Hours
Themselves			
Log earnings	.2430 (1.0000) N=36630	.1555 (.8582) N=35057	.0365 (.4523) N=17390
Log wages	--	.1351 (1.0000) N=33468	.0103 (.1712) N=19180
Log hours	--	--	.0268 (1.0000) N=8922
Brothers			
Log earnings	.0853 (.3510) N=6966	.0658 (.3632) N=6505	.0127 (.1574) N=3754
Log wages	--	.0562 (.4160) N=6157	.0045 (.0748) N=3507
Log hours	--	--	.0091 (.3396) N=2166
Sisters			
Log earnings	.0881 (.2913) N=15629	.0689 (.3055) N=14841	-.0021 (-.0209) N=8868
Log wages	.0576 (.3570) N=15661	.0498 (.4140) N=14878	-.0009 (-.0168) N=8865
Log hours	-.0008 (-.0037) N=7794	-.0145 (-.0889) N=7376	.0008 (.0110) N=4415

(continued)

Table A1--Continued

	Log Earnings	Log Wages	Log Hours
Fathers			
Log earnings	.1060 (.3931) N=13143	.0812 (.4039) N=12518	.0005 (.0056) N=7231
Log wages	.0709 (.3251) N=10539	.0670 (.4121) N=10063	.0060 (.0828) N=5751
Log hours	.0135 (.1502) N=12333	.0056 (.0836) N=11694	.0068 (.2278) N=6828
Mothers			
Log earnings	.0863 (.2855) N=15960	.0707 (.3136) N=15070	.0061 (.0608) N=9290
Log wages	.0511 (.2997) N=19466	.0454 (.3572) N=18422	.0034 (.0601) N=11321
Log hours	.0373 (.1959) N=13684	.0216 (.1521) N=12893	.0044 (.0696) N=8003

Table A2

Family Covariances (and Correlations) Among the Permanent Components of Log Real Earnings, Log Real Wage Rates, and Log Annual Hours Using Method of Moments Estimators

Young Women

	Log Earnings	Log Wages	Log Hours
__Themselves__			
Log earnings	.3764 (1.0000) N=18067	.1449 (.7217) N=17626	.2865 (1.0524) N=7967
Log wages	--	.1071 (1.0000) N=17742	.0190 (.1308) N=10036
Log hours	--	--	.1969 (1.0000) N=3464
__Sisters__			
Log earnings	.0970 (.2577) N=4276	.0562 (.2799) N=4300	.0367 (.1348) N=2141
Log wages	--	.0421 (.3931) N=4417	.0031 (.0213) N=2187
Log hours	--	--	.0542 (.2753) N=1102
__Brothers__			
Log earnings	.0881 (.2913) N=15629	.0576 (.3570) N=15661	-.0008 (-.0037) N=7794
Log wages	.0689 (.3055) N=14841	.0498 (.4140) N=14878	-.0145 (-.0889) N=7376
Log hours	-.0021 (-.0209) N=8868	-.0009 (-.0168) N=8865	.0008 (.0110) N=4415

(continued)

Table A2--Continued

	Log Earnings	Log Wages	Log Hours
Fathers			
Log earnings	.1329 (.3960) N=9536	.0867 (.4843) N=9591	.0228 (.0939) N=4744
Log wages	.0762 (.2808) N=7292	.0545 (.3765) N=7353	-.0039 (-.0199) N=3594
Log hours	.0118 (.1055) N=8852	.0049 (.0821) N=8883	.0001 (.0012) N=4409
Mothers			
Log earnings	.1027 (.2730) N=17717	.0543 (.2706) N=18008	.0553 (.2032) N=5877
Log wages	.0617 (.2908) N=21550	.0398 (.3517) N=21953	.0138 (.0899) N=7142
Log hours	.0562 (.2372) N=15093	.0242 (.1914) N=15293	.0408 (.2380) N=5016

Table A3

Family Covariances (and Correlations) Among the Permanent Components of Log Real Earnings, Log Real Wage Rates, and Log Annual Hours Using Method of Moments Estimators

Older Men

	Log Earnings	Log Wages	Log Hours
Themselves			
Log earnings	.2992 (1.0000) N=6417	.1999 (.8261) N=4610	.0365 (.3659) N=6109
Log wages	--	.1957 (1.0000) N=3487	.0002 (.0025) N=2417
Log hours	--	--	.0333 (1.0000) N=3485
Sons			
Log earnings	.1060 (.3931) N=13143	.0709 (.3251) N=10539	.0135 (.1502) N=12333
Log wages	.0812 (.4039) N=12518	.0670 (.4121) N=10063	.0056 (.0836) N=11694
Log hours	.0005 (.0056) N=7231	.0060 (.0828) N=5751	.0068 (.2278) N=6828
Daughters			
Log earnings	.1329 (.3960) N=9536	.0762 (.2808) N=7292	.0118 (.1055) N=8852
Log wages	.0867 (.4843) N=9591	.0545 (.3765) N=7353	.0049 (.0821) N=8883
Log hours	.0228 (.0939) N=4744	-.0039 (-.0199) N=3594	.0001 (.0012) N=4409

(continued)

Table A3--Continued

	Log Earnings	Log Wages	Log Hours
Wives			
Log earnings	.1142 (.3404) N=5313	.0738 (.2720) N=4298	.0143 (.1279) N=4700
Log wages	.0688 (.3637) N=6411	.0532 (.3477) N=5227	.0115 (.1824) N=5690
Log hours	.0312 (.1477) N=4320	.0161 (.0942) N=3511	.0183 (.2598) N=3907

Table A4

Family Covariances (and Correlations) Among the Permanent Components of Log Real Earnings, Log Real Wage Rates, and Log Annual Hours Using Method of Moments Estimators

Mature Women

	Log Earnings	Log Wages	Log Hours
Themselves			
Log earnings	.3761 (1.0000) N=18284	.1753 (.8265) N=17645	.1906 (.8046) N=11893
Log wages	--	.1196 (1.0000) N=27304	.0521 (.3900) N=17564
Log hours	--	--	.1492 (1.0000) N=11593
Sons			
Log earnings	.0863 (.2855) N=15960	.0511 (.2997) N=19466	.0373 (.1959) N=13684
Log wages	.0707 (.3136) N=15070	.0454 (.3572) N=18422	.0216 (.1521) N=12893
Log hours	.0061 (.0608) N=9290	.0034 (.0601) N=11321	.0044 (.0696) N=8003
Daughters			
Log earnings	.1027 (.2730) N=17717	.0617 (.2908) N=21550	.0562 (.2372) N=15093
Log wages	.0543 (.2706) N=18008	.0398 (.3517) N=21953	.0242 (.1914) N=15293
Log hours	.0553 (.2032) N=5877	.0138 (.0899) N=7142	.0408 (.2380) N=5016

(continued)

Table A4--Continued

	Log Earnings	Log Wages	Log Hours
Husbands			
Log earnings	.1142 (.3404) N=5313	.0688 (.3637) N=6411	.0312 (.1477) N=4320
Log wages	.0738 (.2720) N=4298	.0532 (.3477) N=5227	.0161 (.0942) N=3511
Log hours	.0143 (.1279) N=4700	.0115 (.1824) N=5690	.0183 (.2598) N=3907

Table A5
OLS Estimates of Preference, Wage, Hours, and Earnings Equations

Preference Equations (6):

$$U_{ib} = \underset{(.173)}{.096}\, U_{if} + \underset{(.044)}{.030}\, U_{im} + u_{is} + u_{ib}$$

$$U_{ig} = \underset{(.255)}{.634}\, U_{if} + \underset{(.065)}{.277}\, U_{im} + u_{is} + u_{ig}$$

$$\sigma_{u_{ib}} = .141\ (.034) \qquad \sigma_{U_{if}} = .157\ (.032) \qquad \sigma_{u_{is}} = .058\ (.032)$$

$$\sigma_{u_{ig}} = .434\ (.013) \qquad \sigma_{U_{im}} = .356\ (.019) \qquad Cov(U_{if}, U_{im}) = \underset{(.006)}{.010}$$

Log Wage Equations (5):

$$W_{ib} = \underset{(.041)}{.299}\, W_{if} + \underset{(.051)}{.253}\, W_{im} + \omega_{is} + \omega_{ib}$$

$$W_{ig} = \underset{(.040)}{.323}\, W_{if} + \underset{(.049)}{.184}\, W_{im} + \underset{(.202)}{.866}\, \omega_{is} + \omega_{ig}$$

$$\sigma_{\omega_{ib}} = .280\ (.017) \qquad \sigma_{W_{if}} = .424\ (.012) \qquad \sigma_{\omega_{is}} = .157\ (.023)$$

$$\sigma_{\omega_{ig}} = .250\ (.018) \qquad \sigma_{W_{im}} = .349\ (.013) \qquad Cov(W_{if}, W_{im}) = \underset{(.005)}{.055}$$

Log Hours Equations (2):

$$H_{ib} = \underset{(.050)}{.025}\, W_{ib} + U_{ib}$$

$$H_{ig} = \underset{(.062)}{.167}\, W_{ig} + U_{ig}$$

$$H_{if} = \underset{(.042)}{.026}\, W_{if} + U_{if}$$

$$H_{im} = \underset{(.070)}{.397}\, W_{im} + U_{im}$$

Log Earnings Equations (3):

$$E_{ib} = \underset{(.106)}{1.127}\, W_{ib} + \underset{(.504)}{1.573}\, H_{ib}$$

$$E_{ig} = \underset{(.093)}{.992}\, W_{ig} + \underset{(.055)}{1.063}\, H_{ig}$$

$$E_{if} = \underset{(.081)}{1.161}\, W_{if} + \underset{(.439)}{1.307}\, H_{if}$$

$$E_{im} = \underset{(.123)}{1.061}\, W_{im} + \underset{(.111)}{.971}\, H_{im}$$

Notes:
1. Standard errors are reported in parentheses.
2. The OLS regression producing these results had R^2= .99, RMSE= .0115, Sum of Squared Errors= .0076, and 57 degrees of freedom.

Table A6
WLS Estimates of Preference, Wage, Hours, and Earnings Equations with Restrictions on Wage and Hours Parameters in Earnings Equations

Preference Equations (6):

$$U_{ib} = \underset{(.087)}{.193}\, U_{if} - \underset{(.043)}{.008}\, U_{im} + u_{is} + u_{ib}$$

$$U_{ig} = \underset{(.240)}{-.146}\, U_{if} + \underset{(.098)}{.367}\, U_{im} + u_{is} + u_{ig}$$

$\sigma_{u_{ib}} = .144$ (.012) $\quad \sigma_{U_{if}} = .175$ (.014) $\quad \sigma_{u_{is}} = .068$ (.022)

$\sigma_{u_{ig}} = .450$ (.016) $\quad \sigma_{U_{im}} = .346$ (.016) $\quad Cov(U_{if},U_{im}) = .015$ (.008)

Log Wage Equations (5):

$$W_{ib} = \underset{(.039)}{.274}\, W_{if} + \underset{(.047)}{.274}\, W_{im} + \omega_{is} + \omega_{ib}$$

$$W_{ig} = \underset{(.046)}{.264}\, W_{if} + \underset{(.048)}{.215}\, W_{im} + \underset{(.215)}{.813}\, \omega_{is} + \omega_{ig}$$

$\sigma_{\omega_{ib}} = .295$ (.013) $\quad \sigma_{W_{if}} = .444$ (.011) $\quad \sigma_{\omega_{is}} = .164$ (.024)

$\sigma_{\omega_{ig}} = .259$ (.014) $\quad \sigma_{W_{im}} = .347$ (.007) $\quad Cov(W_{if},W_{im}) = .057$ (.007)

Log Hours Equations (2):

$$H_{ib} = \underset{(.015)}{.082}\, W_{ib} + U_{ib}$$

$$H_{ig} = \underset{(.047)}{.218}\, W_{ig} + U_{ig}$$

$$H_{if} = \underset{(.027)}{.083}\, W_{if} + U_{if}$$

$$H_{im} = \underset{(.048)}{.445}\, W_{im} + U_{im}$$

Log Earnings Equations (3):

$$E_{ib} = W_{ib} + H_{ib}$$

$$E_{ig} = W_{ig} + H_{ig}$$

$$E_{if} = W_{if} + H_{if}$$

$$E_{im} = W_{im} + H_{im}$$

Notes:
1. Standard errors are reported in parentheses.
2. The WLS regression producing these results had $R^2 = .98$, RMSE= .9512, Sum of Squared Errors= 58.81, and 65 degrees of freedom.
3. The p- value for the SSE drawn from a χ^2_{65} is .69.

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