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January 1997

DRU-1578-NIA

Labor and Population Program

Working Paper Series 97-02

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ASSORTATIVE MATING AND FAMILY LINKS IN PERMANENT EARNINGS*

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Abstract

This paper provides a number of new results regarding the contribution of family background to individual permanent earnings. First, we show that sibling correlations include a gender-neutral family component associated with having the same parents and gender-specific components shared by only same-sex siblings. The magnitude of these sibling links is robust to generalization of the transitory earnings component to an auto-regressive moving average. The measured contribution of parents' earnings to the permanent earnings of their sons and daughters is quite sensitive to the specification of the transitory earnings component of the parents, which is measurement error in a model of intergererational links. Accounting for autocorrelation in parents earnings more than doubles the apparent effect of father's permanent earnings on that of both sons and daughters. Father's and mother's permanent earnings are strongly linked, indicating positive assortative mating in that dimension. The net direct contribution of mother's permanent earnings on her children is effectively zero. Children also positively assortatively mate on permanent earnings, and the correlation in permanent earnings of women who marry brothers and men who marry sisters is explained completely by the family components of the brothers and the sisters.

December 1996

* This research was supported by NIA Grant No. R37-AG08346. We want to thank Rita Szeto for her assistance in this work.

1. INTRODUCTION

Economic models of individual earnings have long recognized individual characteristics and family background as important contributors to individual earnings. The family background effects have been captured by models that include family characteristics, or, to capture unmeasured family effects, observations of multiple persons from the same family. One type of model has used data recording information on multiple siblings and identified a common sibling effect as the unmeasured family background measure (for examples, see Behrman, et al, 1994, Kearl and Pope, 1986, Curry and Thomas, 1995). Another approach has been to use data with similar information about parents and their children and estimate the correlation between parents and children as the unmeasured family effect (see Zimmerman, 1992, Lillard and Willis, 1996, for instance).

Most research in this area focuses on the relationships between the earnings of related men: siblings studies typically analyze the earnings of multiple brothers, and the bulk of intergenerational earnings transmission work examines the earnings of fathers and their sons. While several studies incorporate information about female relatives, their approach has been either to substitute the female relative for the corresponding male relative or to simply include the female relatives' earnings as an additional variable along with the males' earnings (Peters, 1992, Behrman and Taubman, 1985, and Altonji and Dunn, 1991).

These approaches to expanding family background models to include female relatives have three weaknesses. First, substituting mother's earnings for father's earnings ignores the fact that the earnings of mothers and fathers are highly correlated (Smith, 1979, Becker, 1981). This correlation suggests that including earnings from just one parent would overstate the contribution to children's earnings from that parent. Furthermore, including the earnings of only one parent is likely to understate the entire underlying family background components that both parents contribute to their children.

Second, in these models brothers and sisters are usually treated as if they were totally unrelated individuals, with separate equations describing the family links of sons and daughters. While there is evidence that family resources may be allocated differently to sons and daughters (Thomas, 1995), such a formulation ignores the fact that brothers and sisters do share common family background. Third, just as it is important to include the earnings of both parents to capture the contribution of one generation to the next, it is also important to include the earnings of both children and their spouses to characterize the earnings of the younger generation. Since the earnings of spouses are correlated, an important link between parents' earnings and the resources of children may operate through the marriage market. Therefore, not including the spouse's earnings as part of the second generation's resources might understate the earnings links between parents and their children.

In this paper, we use a dataset that contains information about respondents and their parents, siblings, and spouses to take a comprehensive approach to measuring family links in permanent earnings. Our approach is comprehensive in that we incorporate information about all the members of the parents' generation and the children's generation. We include female family members as well as male family members in our models. In adding mothers, we incorporate the notion of assortative mating, allowing mothers and fathers to share a common couple component as well as individual-specific components. When incorporating sisters, we estimate the permanent earnings of sons and daughters simultaneously, recognizing that brothers and sisters share a common family background but also allowing for the possibility that there are different family components for children of different gender. Finally, we recognize that family background links to successive generations might express themselves in part through the marriage market. If marital sorting is non-random, the relationship between the outcomes of individuals related by marriage could be just as strong as the relationship between individuals related by birth. As a result, in characterizing the links between the earnings

of parents and their children, we explore the possibility that capturing the full magnitude of the influence of family background requires including not only children's permanent earnings, but also the permanent earnings of their spouses.

Our approach is also comprehensive in that it places few restrictions on the links between individuals and other members of their families. For example, we utilize all three strategies for controlling for background effects—parent, sibling, and spouse components—rather than restricting the links to operating through one or the other. In addition, we allow links across successive generations to operate both through direct intergenerational earnings transmission (as in Becker and Tomes, 1979) as well as through unmeasured family variance components (as in Solon, et al., 1991). As mentioned above, we also estimate the earnings of sons and daughters simultaneously, allowing them to share common family-wide components as well as gender-specific family components rather than restricting the sons and daughters to different equations. Finally, we relax restrictions of the specification of the transitory components of permanent earnings. Studies have either assumed that the transitory terms are i.i.d. or follow an AR(1) process (see Solon, et al., 1991). Given evidence in the literature regarding even greater persistence in earnings (MaCurdy, 1982, Abowd and Card, 1990), we also explore the implications of richer transitory specifications for estimates of family links in earnings.

In the next section, we review the literatures that estimate the contribution of sibling effects, intergenerational earnings transmission, and spouse correlations to individual earnings. The third section describes the dataset we use. We outline the innovations we make to models that incorporate a shared sibling component in the fourth section and to the intergenerational earnings transmission model in the fifth section. We also present estimates for these models in their respective sections. The estimates in the sixth section incorporate spouse correlations, and the seventh section discusses the results.

2. LITERATURE

This section reviews three strands of the economics literature which associate individual earnings with the earnings of other individuals related by either birth or marriage. The three branches of the literature we review are: sibling links, intergenerational earnings, and assortative mating.

Sibling Links

If family background exerts important effects on individual earnings, then siblings should show more resemblance in earnings than would randomly chosen individuals. It is reasoned that siblings share much of the same genetic material and that they have been subjected to the same cultural influences both from their parents and from other factors in their shared environment. The degree of commonality in both genetic and environmental influences on brothers is considered to vary along a spectrum from identical twins who would be expected to share exactly the same genetic traits and environmental variables, to dizygotic twins who share less genetic material but the same environmental influences, to same-sex siblings who share the same genetic material as dizygotic twins but less environmental influences, to different-sex siblings and siblings born far apart in time who share the least similar environments (see Behrman, et al, 1994).

Such brother correlations have been used to estimate the contribution of family background to the variance of earnings, wages, and income. Not surprisingly, the highest sibling correlation estimates are for identical twins: Behrman, et al (1977) find a brother correlation of 0.54 for log earnings. Estimates of the correlation in economic status of brothers who are not twins range from around 0.1 to just over 0.5 (see review in Solon, et al, 1991). Improving upon the methods used in earlier work by distinguishing between permanent and transitory earnings, controlling for autocorrelation in earnings, and using more representative samples, Solon, et al (1991) estimate correlations in brothers' economic status that is higher than the rest of the literature--ranging from .34 to .53. They also find sister correlations ranging from .28 to .51. To summarize, these results

imply that family background effects shared with siblings explain half or less of an individual's earnings.

Intergenerational Earnings Transmission

A second way the literature has measured the relationship between family background and individual earnings is to examine intergenerational earnings transmission. While the pioneering work in the empirical estimation of intergenerational mobility estimated the correlation between father's and son's earnings as a measure of mobility (Sewell and Hauser, 1975), the subsequent literature centers around a different approach. This research typically begins from the regression-to-the-mean model (Galton, 1889). Becker and Tomes (1976, 1979) were the first to apply this model to the problem of intergenerational mobility, specifying the relationship between sons' log earnings, Y_i, and fathers' log earnings, Y_F, as

$$Y_i = \beta Y_F + u_i . \tag{1}$$

If β is zero then there is no intergenerational link, there is a high degree of intergenerational mobility, and family background is unimportant. If β is between zero and one, then family background does play a role in earnings. In this case, sons' earnings regress toward the mean and β indexes the degree of mobility. If β is one then intergenerational earnings follow a random walk, family background explains a large amount of earnings outcomes, and children and parents are likely to attain the same economic status. Earnings in this formulation refers to the father's or son's lifetime earnings or permanent earnings component. The previous literature sought to accurately measure β--that is, the goal of these papers was to assess the degree of intergenerational mobility.

Behrman and Taubman (1985) estimate this model in the first study to use actual income or earnings data for U.S. fathers and their sons. They state: "We would like to have the present discounted values of lifetime earnings. Instead we must make use of data for each generation drawn from one year" (p.145). This discrepancy between the

data the model calls for--measures of lifetime or permanent earnings--and the data available in most panel data sets--one or at most several observations for each father or son--presents one of the primary challenges to estimating this class of models. The literature in the area of estimating intergenerational mobility focuses on developing strategies to minimize the bias resulting from the measurement error due to not observing lifetime income.

Because the sons in the Behrman and Taubman study have a low average age of 28, the authors indicate that sons' current earnings are likely to deviate from the present discounted value of lifetime earnings in ways that are predicted by human capital theory. Primarily, earnings at lower ages are biased downward from lifetime earnings because of upwardly sloping earnings profiles. Behrman and Taubman correct for this by adjusting individuals' earnings based on regressions of sample log earnings on linear and quadratic experience terms. To measure intergenerational mobility, they examine both β and the R^2 from regressions relating experience-adjusted log son's and father's earnings. Their estimates of β range from .09 to .23, depending on the subsample used, while correlations range from .05 to .16. The values of both of these measures indicate that family background is relatively unimportant--that is, there exists a large degree of intergenerational mobility. Solon (1992) and Zimmerman (1992) also estimate cross sectional models with life cycle adjustments as base cases and obtain slightly higher estimates.

Later additions to this literature estimated the regression-to-the-mean model using data sets which provided panels of father's and son's earnings rather than just one observation on each individual's earnings (Altonji and Dunn (1991), Peters (1992), Solon (1992), and Zimmerman (1992)). The availability of panel data allows these authors to explore additional means of compensating for the fact that only a subset of subjects' earnings are observed rather than the entire path of lifetime earnings. In addition to including life cycle adjustments like age and experience terms, the authors also average

earnings or income.[1] The basic idea is that averaging reduces the variance of the "noise" in the income values relative to the variance of the "signal", providing a still imperfect yet less biased indicator of permanent or lifetime income (see Solon, 1992). When Zimmerman (1992) and Solon (1992) compare estimates of β from specifications which average father's observations to those which do not, they both find higher estimates with averaging and that the estimates are larger the greater the number of years included in the average.[2]. After implementing these methodological improvements, Solon (1992) and Zimmerman (1992) estimate regression coefficients ranging from 0.41 to 0.53. These estimates also suggest that family background factors explain at most half of individual earnings.

Assortative Mating

In the assortative mating model (Becker 1973, 1974), husband-wife pairs match to maximize joint output. While Becker predicts that spouses would negatively sort on wages, most empirical studies find positive assortative mating on wages (see Smith, 1979, Becker, 1981, Lam and Schoeni, 1993). Spouses' schooling is also found to be positively correlated with estimates routinely over one-half (Becker, 1981, Jensen, 1978). In their review article, Epstein and Guttman (1984) find positive assortative mating on a range of traits including height, age, religion, and aptitude and personality test scores. The results in these studies all indicate that marital partners sort on the basis of both observed and unobserved characteristics.

We relate this finding to individual earnings, asking whether information about the spouse can explain a portion of individual earnings in the same way that information about parents and siblings can explain a portion of individual earnings. The literature

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[1] Although the authors may have examined one or more measures of economic status--wages, earnings, or income--we use these terms interchangeably in this discussion.

[2]Two other strategies the literature has used for approximating lifetime or permanent economic status are to minimize the distance between father's and son's age at wage observations (Behrman and Taubman, 1985, Peters, 1992, and Zimmerman, 1992) and to use father's years of education as an instrument for father's permanent income (Solon, 1992, Behrman and Taubman, 1985). We discuss these in a later section.

contains at least two justifications as to why spouse characteristics would provide information about an individual's wages above and beyond that contained in the individual's observables. First, it has been proposed that individuals sort into marriages based on personal characteristics that are also valued in the labor market (Korenman and Neumark, 1991). These characteristics may be both observable--such as schooling--and unobservable--such as personality. Korenman and Neumark (1991) find evidence of unobservable characteristics that are positively correlated with both marriage and wages. To the extent that family background represents unobservable worker attributes, we may observe positive sorting on family background in marriage as well.

Second, Lam (1988) develops a model of marriage focusing on joint consumption economies. He shows that when spouses bring exogenous wealth into marriage, individuals will positively sort on spouses' wealth. If we consider family background to be a stock that an individual brings to a marriage, we may observe the same type of sorting on family background that we observe for other forms of wealth. Lam and Schoeni (1993) demonstrate that information contained in the characteristics of both parents and parents-in-law provide information about the unobservables of workers. As mentioned earlier, they find that the characteristics of the father-in-law explain a larger amount of a worker's outcome than the characteristics of the worker's own father. In sum, their work shows that there is an important role for background information about one's family of marriage as well as one's family of birth in models of individual earnings.

Given findings of positive assortative mating, correlation in outcomes of parents and their children, and correlation in the outcomes of siblings, we would expect that parents' and siblings' would also be correlated with the characteristics of children's spouses.[3] This implies that information gained from parent and sibling effects will help

[3]In a paper which explores the implications of marriage markets for intertemporal household behavior, Laitner (1991) points out that positive assortative mating tends to match individuals with similar family characteristics as well as similar education, attractiveness, or other individual characteristics. He shows that this implies that the marriage market reduces income mobility because it keeps wealth classes separate through time.

explain the earnings of individuals who married into the family as well as the earnings of the family's own members. We develop this notion in more detail below.

3. DATA AND METHODS

The data for this study are from the Panel Study of Income Dynamics (PSID). A number of studies of family background effects and intergenerational earnings have utilized these data (see Solon, 1992, Mulligan, 1996). This survey has several features which make it well suited for studying the relationship between the earnings of related individuals. First, the PSID contains a panel of earnings observations for fathers and mothers enabling the measurement of parents' permanent earnings. Second, the data also report earnings histories for multiple sons and multiple daughters permitting the study of intra-family correlations in earnings. Third, the data also include earnings histories for the spouses of the sons and daughters so that we can assess the correlation of earnings within the family of marriage as well as the family of birth.

The PSID is a large, national longitudinal data set that began in 1968 with approximately 5,500 households. The sample has been resurveyed each year since that time. We use the panel through the 1992 survey, i.e., the longitudinal history of the respondents spans up to 25 survey waves. Each year, the PSID collects detailed information on socioeconomic and demographic variables including earnings.

The sample covered by the PSID evolves continuously. When respondents marry after the initial wave, the spouses are included in the sample only while married to the sample respondent.[4] Also, sample individuals that split-off from the original household and form their own household (mainly sample children) are followed, along with their spouses, increasing the number of households in the sample.

The sample includes individuals from both the PSID Survey Research Center (SRC) subsample and the PSID Survey of Economic Opportunity (SEO) subsample,

[4] Note that we only include information on the respondent's first spouse within the panel period.

which over-sampled poor households in the initial wave in 1968. Because of the non-random sample in the SEO subsample, we weight all statistics by the 1968 family weight.

Our subsample contains 1444 families from the PSID for which at least one son or one daughter are also PSID sample members and the child was at least 18 years of age and out of school at some time during the panel.[5] A "family" in this case refers to two married parents in the sample and their children who lived in the household in 1968 and any children's spouses. Table 1 shows the number of fathers, mothers, sons, daughters, and spouses of the sons and daughters. Throughout this paper, the spouses of the sons are referred to as "wives" and the spouses of the daughters are called "husbands."

We restrict our sample in several ways. First, we exclude children who were 18 or older in 1968 so that we do not oversample children who lived in the home of their parents at older ages. Second, we include observations for individuals younger than age 25 only if it has been more than a year since the respondent was enrolled in school and we include observations for individuals over age 25 if they are out of school. Third, we required that age and earnings be non-missing for each individual. We observe up to seven sons per family and up to nine daughters per family. Table 2 presents the distribution of numbers of sons and daughters per family for which earnings data are available.

We also include the spouses of children in the analysis. While all parents in our sample are married, only some of the children in the sample are married. There are a total of 1738 sons in 1047 families, of which 1241 sons (71.4 percent) are married in 845 of those families. Similarly, there are a total of 1892 daughters in 1065 families, of which 1410 daughters (74.5 percent) are married, in 889 of those families.

Respondents report earnings annually. Table 3 reports the distribution of earnings observations for each type of respondent in the sample. Note that not all individuals

[5] This is approximately the definition applied in Solon (1992) for sons also applied to daughters.

report earnings, but we include in our sample individuals who report earnings themselves or whose spouses report earnings.

Methods

Following the literature, we focus on the permanent earnings of a person and its relationship to the permanent earnings of related individuals – parents, siblings and spouses. Here we lay out the basic principles used in exploring these relationships in a fairly general way so as to illustrate the method for all of the analyses that follow.

The current annual earnings y_{pkit} of individual i of type k in the family associated with parents p at time t is given by

$$y_{pkit} = \pi' age_{pkit} + Y_{pki} + v_{pkit}$$

where age_{pkit} is a vector of piece-wise linear spline variables in age that account for life cycle effects (and π is the corresponding vector of regression parameters), Y_{pki} is the individual's permanent earnings, and v_{pkit} is a transitory component.

Solon, et al (1991) include an AR(1) specification rather than an i.i.d. error. They reason that it is important to take into account the autocorrelation in transitory earnings over time because some of it would otherwise be mistakenly attributed to the permanent component, overstating the size of the permanent earnings component. For parents this manifests itself as measurement error in permanent earnings. For children, since the transitory components would not be correlated across family members, this overstatement of variance would all be mistakenly attributed to the individual-person permanent earnings variance, and overstate its importance. With this in mind, we made further modifications of the error structure on theoretical grounds based on results in the literature regarding the persistence of individual earnings across time. Specifically, MaCurdy (1982), and Abowd and Card (1990) point out that when estimating earnings from panel data, it is necessary to allow for more persistence over time than the AR(1) affords. For this reason, we test whether we need to specify the persistence using a moving average in addition to the AR(1).

We find that persistence in the transitory component can be represented by an ARMA(1,2) process, so

$$v_{psi(t)} = \gamma v_{psi(t-1)} + \phi_2 \eta_{psi(t-2)} + \phi_1 \eta_{psi(t-1)} + \eta_{psi(t)}$$

where $\eta_{pki(t)}$ is an i.i.d disturbance term. We will provide evidence on the consequences of using more restrictive covariance structures appearing in the literature including: (1) AR(1) = ARMA(1,0) for which $\phi_1 = \phi_2 = 0$, and (2) *iid* = ARMA(0,0) for which $\gamma = \phi_1 = \phi_2 = 0$.

Our tables of results present estimates of the standard deviation of the permanent component and the parameters of autocorrelation for each type of family member – father, mother, sons, sons-in-law (husbands), daughters, and daughters in-law (wives). Since the parameters of the age effects are unremarkable, we do not present them as part of the results. We present parameters of the transitory components $\left(\gamma, \sigma_\eta^2, \phi_1, \phi_2\right)$ only when they are required to make a point. In all cases we present and discuss estimates of these *standard deviations* of permanent earnings components, and when necessary compute and report other functions of parameters such as ratios of variances.

A brief discussion of the estimation procedure will assist in the interpretation of the results presented later. We use maximum likelihood based on the multivariate normal distribution, assuming the permanent and transitory components are normally distributed. That is, for each person i of type k (F or f for father; M or m for mother; s for all sons and i for an individual son; d for all daughters and j for an individual daughter; H for husbands of daughters and j for the husband of an individual daughter; and W for wives of sons and i for the wife of an individual son) in family p, $Y_{pki} \sim N\left(0, \sigma_{Y_k}^2\right)$ and $\eta_{pkit} \sim iid\, N\left(0, \sigma_{\eta_k}^2\right)$ for every t.

There is a vector $\underline{y_i}$ of T_i observation on earnings for each person i in the sample. This vector is multivariate normally distributed

$$\underline{y_{pki}} \sim N\left(\underline{\{\pi' age(t)\}}, \sigma_{Y_{pki}}^2 \underline{11'} + \Sigma_{\underline{vv}}\right)$$

where $\{\underline{\pi' age(t)}\}$ is the vector of mean earnings by age including the intercept, $\underline{1}$ is a column vector of ones, and $\Sigma_{\underline{\nu}\underline{\nu}}$ is the $T_{pki} \times T_{pki}$ autocovariance matrix for the ARMA(1,2) with parameters $(\gamma, \sigma_\eta^2, \phi_1, \phi_2)$.

The relationships of primary interest are the covariances between multiples of observed earnings vectors for family members, which we illustrate here for a pair. The only source of correlation across family members is the theoretical relationship generated by a particular model, e.g., the regression of a child's permanent earnings on that of the child's parents or components common to the multiple family members such as brothers or sisters. The covariance matrix for a pair of family members, say son i and daughter j of types $k=s$ and $k=d$, respectively, is given by

$$Cov\left(\underline{y_{psi}}, \underline{y'_{pdj}}\right) = \sigma_{Y_{psi}Y_{pdj}} \underline{1}_{T_{psi}} \underline{1}'_{T_{pdj}}$$

where the lengths of the vectors of observed earnings may be of arbitrary and different lengths. Consider, for example, a model in which the son and daughter share a family component in permanent earnings so $Y_{psi} = \lambda_p + \xi_{psi}$ and $Y_{pdj} = \lambda_p + \xi_{pdj}$. The λ_p is shared by the brother and sister and ξ_{psi} and ξ_{pdj} are unique to the person, and thus independent. The variances and covariance in permanent earnings are given by

$$\sigma^2_{Y_{psi}} = \sigma^2_\lambda + \sigma^2_{\xi_s}, \quad \sigma^2_{Y_{pdj}} = \sigma^2_\lambda + \sigma^2_{\xi_d} \quad \text{and} \quad \sigma_{Y_{psi}Y_{pdj}} = \sigma^2_\lambda.$$

We estimate parameters for many family members jointly by "stacking' the observed earning vectors for all family members involved and using the joint likelihood function. For each family we observe two parents plus up to seven sons and up to nine daughters, each with up to twenty-four observed earnings values. We maximize the log-likelihood summed over all families using analytic first derivatives and scoring second derivatives based on the cross product of first derivatives. However, reported standard errors are Huber-corrected to account for potential model misspecification.

The remainder of the paper focuses on the covariance structure of permanent earnings among the various members of a family.

4. THE PERMANENT EARNINGS OF BROTHERS AND SISTERS

In this section we utilize the earnings of siblings to measure the strength of the effects of common family background. Whereas the literature has primarily examined the family links between brothers, we include both brothers and sisters to test whether sisters and brothers share a family-wide component in addition to gender-specific sibling components. This enables us to ask whether sibling links operate through only one family component, or whether in addition to this family-wide factor, brothers share something among themselves that they do not share with their sisters and whether sisters share a unique component. In this section we review the methods used to identify sibling components in the literature, describe our extensions of this model, and present estimates.

Approach from The Literature

Solon, et al (1991) use a simple variance components model to formalize the concept of siblings' earnings sharing a common family background component.[6] They decompose the permanent earnings component into two orthogonal components, in our notation:

$$Y_{psi} = \lambda_{ps} + \xi_{psi}.$$

The term λ_{ps} represents a permanent component common to siblings from a family, and ξ_{psi} is an individual-specific permanent component not shared with siblings.

The population variance of the permanent earnings component for individual i in sibset of brothers s, Y_{psi}, is then equal to the sum of the variances of the two components:

$$\sigma^2_{Y_{psi}} = \sigma^2_{\lambda_s} + \sigma^2_{\xi_s}.$$

Solon, et al (1991) measure the fraction of permanent variance attributable to family background by the ratio of the variance from the sibling effect and the total permanent variance:

$$\rho = \frac{\sigma^2_{\lambda_s}}{\sigma^2_{\lambda_s} + \sigma^2_{\xi_s}}.$$

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[6] Consistent with the one presented above, except that only an AR(1) transitory error structure is used.

If ρ is large, then a large portion of the variance in permanent earnings is shared by siblings and hence attributable to family background. If ρ is small, then family background does not contribute much to the variance in earnings.

Extending The Model

We add to this model by further decomposing the overall family background component that siblings share into three components: a family-wide component, a component shared only by brothers, and a component shared only by sisters. Hence, the permanent earnings of sons, Y_{psi}, and the permanent earnings of daughters, Y_{pdj}, are:

$$Y_{psi} = \theta_p + \zeta_{ps} + \xi_{psi} \quad \text{and} \quad Y_{pdj} = \theta_p + \zeta_{pd} + \xi_{pdj}$$

respectively. The first components, θ_p, is a common component shared by all children in a family--brothers and sisters. The second component, ζ_{ps}, is shared by brothers, but is not shared with sisters; and the third component, ζ_{pd}, is shared by sisters, but is not shared with brothers. The individual person-specific components for sons and daughters are $\xi_{psi}$and ξ_{pdj}, respectively. Gender-specific components may have different magnitudes of variance. This implies that family and gender-specific components are allowed to account for different portions of total permanent earnings variation for sons and daughters. Note that this model requires using data on both sons and daughters in order to distinguish the family-wide component from the gender-specific sibling components.

We use two approaches to assess the relative sizes of these components. The first is to examine the size of the estimates of the components themselves--that is, to compare the relative magnitude of the standard deviations $\sigma_\theta, \sigma_{\zeta_s}, \sigma_{\zeta_d}, \sigma_{\xi_s}$ and σ_{ξ_d}. The second is to compare the relative contributions of the components to total variance in permanent earnings. For example, to evaluate whether the family-wide component, θ, or the gender-specific sibling components, ζ_{ps} and ζ_{pd}, contribute more to the variance in earnings due to the two family background components, we can compare the following:

$$\frac{\sigma_\theta^2}{\sigma_\theta^2+\sigma_{\zeta_s}^2+\sigma_{\xi_s}^2} > \frac{\sigma_{\zeta_s}^2}{\sigma_\theta^2+\sigma_{\zeta_s}^2+\sigma_{\xi_s}^2} \quad \text{and} \quad \frac{\sigma_\theta^2}{\sigma_\theta^2+\sigma_{\zeta_d}^2+\sigma_{\xi_d}^2} > \frac{\sigma_{\zeta_d}^2}{\sigma_\theta^2+\sigma_{\zeta_d}^2+\sigma_{\xi_d}^2}$$

for sons and for daughters, respectively. We continue to use both of these approaches to describe the relative magnitudes of the different components throughout the remainder of the paper.

Our specification of the links between the earnings of siblings enables us to test additional hypotheses that are not possible in the formulation of Solon, et al (1991). We can test whether same-gender siblings share anything among themselves that they do not share with their other siblings. This translates into testing whether $\sigma_{\zeta_s}^2 = 0$ and $\sigma_{\zeta_d}^2 = 0$. We can also ask what portion of the family background effect is represented by the permanent component that all siblings share, σ_θ^2, versus the gender-specific sibling components, $\sigma_{\zeta_s}^2$ and $\sigma_{\zeta_d}^2$. That is, for example, is $\sigma_\theta^2 > \sigma_{\zeta_s}^2$ or $\sigma_\theta^2 > \sigma_{\zeta_d}^2$? As in the Solon, et al (1991) framework, we can examine whether family background components versus individual components explain the bulk of permanent earnings, or whether $\sigma_\theta^2+\sigma_{\zeta_s}^2 > \sigma_{\xi_s}^2$ or $\sigma_\theta^2+\sigma_{\zeta_d}^2 > \sigma_{\xi_d}^2$.

Results

Results for our estimates of the contribution of family and individual effects to permanent earnings are in Table 4 and Table 5. Table 4 reports the point estimates for the permanent components and Table 5 reports results about the variances. The first four columns of Table 4 report results for specifications where the permanent components of the model include only brother, sister, and individual-specific permanent components but do not include a family-wide component. Column five adds the family-wide component to the model. The specification of the transitory component differs in each of the first four columns.

In the first column, we estimate model that specifies the transitory component simply as a normally-distributed *i.i.d.* error component. The estimate reported in the table is σ_η, the standard deviation of this term, and indicates the relative size of the random

innovations. Both the permanent components shared with same-gender siblings and the one specific to the individual are highly significant. Results in this column show that daughters share a larger common component with each other than do sons: the estimate of σ_{ζ_s} is 0.42 compared to an estimate of 0.55 for σ_{ζ_d}. The estimated individual-specific components are also larger for daughters: the daughter component estimate is 0.67 and the son component estimate is .49. Despite the overall higher estimates of the permanent components for daughters, the fraction of variance in permanent components due to the component shared with other siblings of the same gender versus the individual component is about the same for sons and daughters.

In the second column we allow the transitory component to have an autoregressive structure, AR(1). Solon, et al (1991) also estimate their model of sibling components assuming autoregression in earnings. They argue that assuming that the transitory component is serially uncorrelated would lead to overestimates of the individual-specific components: one would attribute to the individual-specific permanent component persistence that was really due to autocorrelation in the transitory component of earnings. Our results in fact show that upon incorporating the AR(1), estimates of the individual-specific components do drop substantially. However, this modification makes little difference in the estimates of the components that individuals share with their siblings, σ_{ζ_s} and σ_{ζ_d}. The estimate of the son-specific component, σ_{ξ_s}, drops from 0.49 to 0.40 while the estimate of the daughter-specific component, σ_{ξ_d}, drops from 0.67 to 0.47. Like the results reported by Solon, et al (1991), we find that the estimated individual component drops after allowing for serial correlation.

The results in Table 4 indicate that the specification of the error structure has implications for the estimates of the individual components but has little impact on the estimates of the shared family components. We began in Column 2 with the AR(1) specification suggested by Solon (1991) which shows that the effect of introducing

autoregression in the transitory component, as in Lillard and Willis (1978), reduces the apparent magnitude of the individual component relative to the shared component.

Due to findings in the literature that suggest the need to allow for even more flexibility in the transitory component than an AR(1) when estimating earnings from panel data, we also explore adding moving average terms as suggested by MaCurdy (1982), and Abowd and Card (1990). The third column of Table 4 reports results using an ARMA(1, 1) error specification and the fourth column reports results using an ARMA(1,2) specification. For brothers and sisters, both moving average terms are highly significant and of non-negligible magnitudes. As was the case when incorporating the AR(1), adding a moving average to the transitory component has little impact on estimates of the component shared with siblings but substantially reduces the estimate of the individual-specific components. In fact, in the fourth column which uses ARMA(1,2), the individual-specific terms are not significantly different from zero. In other words, upon exploring the potential persistence of earnings beyond the AR(1) specification, we find that what once appeared to be an individual-specific component of permanent earnings can be attributed to autocorrelation. This result differs dramatically from the sibling estimates reported in the literature. For example, in their estimates of sibling components and individual components with an AR(1), Solon et al (1991) attribute only half of the variance in permanent earnings to family background.

Taken literally, this implies that the entire permanent component of earnings is due to family background components with none due to individual-specific components. This result will appear again in estimates for models presented later, so we discuss it further at this point. The flexible form of the ARMA(1,2) allows the correlation between earnings values at different points in time to decline rapidly in the first two years and then remain high thereafter due to the autoregression parameter, $\gamma = .87$. This large autoregression parameter resembles a permanent component in the short run but yields a correlation in earnings of .24 after a decade and .06 after 20 years.

Recall that the children are observed over a relatively short period early in their life cycle.[7] When there are many children in a family, some will be observed for short periods of time. We explored the possibility that the length of observation biased the estimates by including only the two or three oldest children with the longest periods of observation in specifications not reported here. The results were comparable to those reported here. Lillard and Reville (1996) report evidence suggesting that there is individual variation in life cycle earnings growth, as in Lillard and Weiss (1979), and that individual profiles cross after about a decade into the life cycle as suggested by Mincer (1972). This suggests that zero variation in mean earnings for the relatively young children may not reflect differences among siblings in earnings growth which will generate greater differences later in the life cycle, and so our estimates will understate individual variation over a longer time frame.[8]

In the final column of Table 4, we include the family-wide component, θ, in addition to the gender-specific sibling components. The family-wide component indicates the amount of permanent earnings that individuals share with all siblings, regardless of gender. The estimate of 0.38 for this component is highly significant and accompanies a decline in the common brother component of about half and a decline in the common sister component of about a third. The overriding implication of the results reported in this table is that the family components are more important contributors to permanent earnings than indicated by the estimates from other studies.

The variance in the family component of permanent earnings for brothers and for sisters is attributable to either the component that all siblings share or the component that is shared only with same-gender siblings. Table 5 shows that brothers share nearly 80 percent with their sisters, while sisters only share about half of their family component with their brothers. In other words, our estimates show that sisters share as much of a

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[7] See Table 3 for the distribution of number of periods for which earnings are observed.

[8] The model with individual growth is outside the scope and focus of this paper and complicates the modeling considerably, so we do not consider the issue further here.

common component with their sisters exclusively as they share with all their siblings whereas brothers share little with their brothers that they don't also share with their sisters. This may reflect in part correlation in the labor supply decisions (part-time vs. full-time work) of sisters as suggested by Altonji and Dunn (1991). From the last row of the table, the correlation in the family components of earnings of brothers and sisters generated by the shared component is 0.63.

5. TRANSMISSION OF EARNINGS FROM PARENTS TO CHILDREN

In the last section we used observations on siblings from the same family to distinguish unobserved family background components from individual components in earnings estimates. In this section we employ a related but distinct approach to estimating the contribution of family background to earnings: we estimate intergenerational earnings transmission models. We extend the traditional model of intergenerational earnings transmission in two important ways. First, we include mothers' earnings when estimating intergenerational earnings transmission. Much of the literature has focused on the relationship between fathers' earnings and the earnings of their sons, without taking into account the likelihood that children's earnings are also related to the earnings of their mothers. If mothers' and fathers' earnings are correlated, estimates using fathers only may overstate the contribution of fathers to children's earnings and understate the total parental contribution to children's earnings. While most research in this area limits the analysis to sons, we include daughters throughout our analysis.[9]

Second, in order to also capture unobserved family components that are not represented by parents' earnings, we incorporate components representing the family-wide, gender-specific sibling, and individual-specific factors that we found to be important in the last section. This is significant because it will not limit our assessment

[9] Exceptions are Peters (1992), Behrman and Taubman (1985), and Altonji and Dunn (1991).

of the role of family background in earnings to only those factors that would operate through parents' earnings. As in the last section, we begin by reviewing the standard model in the literature, explain our extensions of the model, and finally, present results.

Traditional Model of Intergenerational Earnings Transmission

We outline the intergenerational earnings transmission model described in Solon (1992), Zimmerman (1992), Peters (1992) and others. As mentioned above, the literature has typically examined the degree to which fathers' and sons' earnings were related by estimating the following first-order Markov model:

$$Y_{psi} = \beta Y_{pF} + \varepsilon_{psi}.$$

In this formulation, Y_{psi} is the permanent earnings of a son and Y_{pF} is a measure of the permanent earnings of the father, in family p. We expect β to be between zero and one, with low values of β indicating that sons' earnings are unrelated to fathers' earnings and high values of β indicating that sons' earnings are highly related to fathers' earnings. Various papers have taken slightly different approaches to estimating permanent earnings but generally include averaging multiple years' earnings observations and netting out age and year effects (see Solon, 1992, Zimmerman, 1992, Peters, 1992).

Our first modification of this model is to conceive that the earnings of children might be related to mothers' earnings as well as fathers' earnings *and* that the earnings of mothers and fathers are correlated. We then incorporate both father's and mother's permanent earnings in the model of intergenerational transmission.

Assortative Mating Of Parents

From the assortative mating literature, we know that mother's and father's earnings are likely to be positively correlated. Using the standard partial regression formulation, if the "true" model includes both mother's earnings and father's earnings, their correlation implies that the traditional model, which includes only fathers' earnings, has produced biased estimates of the contribution of father's earnings to son's earnings. If mother's

earnings were omitted in this case, the father's earnings estimate would really include both the relationship between father's and son's earnings and the correlation in father's and mother's earnings times the contribution from mother's earnings.

Several papers (Altonji and Dunn, 1991, Peters, 1992) have allowed children's earnings to be related to mothers' earnings as well as fathers' earnings, but these papers regressed children's earnings on either mothers' or fathers' earnings, not both. That is, they did not account for the correlation in parents' earnings or allow each parents' earnings to make a marginal contribution to children's earnings independent of the portion of earnings shared with the other parent. We separate the permanent earnings of each parent into two terms, one of which represents the permanent component of parents' earnings that is shared with the spouse and the other of which is the permanent component of their earnings that is unique to that parent. For fathers, their total permanent earnings, Y_{pF}, is decomposed into a common parent component, Y_p, and a father-specific permanent component, Y_{pf}: $Y_{pF} = Y_p + Y_{pf}$. Analogously, mother's permanent earnings, Y_{pM}, equals the sum of a common parent component and a mother-specific permanent component: $Y_{pM} = Y_p + Y_{pm}$. As above, we can also decompose the total variance in father's and mother's earnings, σ_F^2 and σ_M^2, respectively, into the variance in the shared permanent component and the variance in the father- or mother-specific component:

$$\sigma_F^2 = \sigma_p^2 + \sigma_f^2, \text{ and } \sigma_M^2 = \sigma_p^2 + \sigma_m^2.$$

In Table 6 we report estimates of the parameters of this model. The first column reports estimates where we assume no autocorrelation in earnings. Both the common and individual-specific components are significant at the one percent level. The estimate of the component unique to the mother is much larger than the component unique to the father: .99 compared to .64, likely reflecting greater variability in hours worked for women. Mothers' earnings also exhibit greater transitory variation than do the earnings of fathers as shown by the much larger estimate of σ_η for mothers.

As we did in the previous section, we add the AR(1) autocorrelation in earnings in the second column, and the ARMA(1,1) and ARMA(1,2) in the third and fourth columns, respectively. We see results similar to the estimates for sibling links in earnings as we add more flexibility to the autocorrelation structure: the shared component remains stable while the individual-specific components drop significantly. However, unlike the individual-specific components in the sibling estimates which completely disappeared after adding the ARMA(1,2) specification, the estimates of σ_f and σ_m remain sizable and significant. This is most likely due to the fact that parents' earnings are observed over a longer time horizon than are children's earnings and hence the ARMA does not capture all of the individual persistence.

Mothers' individual-specific terms, estimated at 0.52, are still larger than those of fathers, estimated at 0.32, after incorporating the richer error structure. The common component of 0.33 in the last column is not very different from the common component of 0.35 estimated in the first column. Table 7 reports the fraction of total father and mother variance in permanent earnings made up by the common component. We conclude from these estimates that fathers and mothers do share a common component in permanent earnings.

Two-Gender Model of Intergenerational Links

In our model of intergenerational earnings transmission we include both fathers' and mothers' permanent earnings and allow for them to be correlated through a common component of parents' earnings. Moreover, we also know from the previous section that components representing family-wide and gender-specific sibling components are important. As a result, the second modification we make to the standard intergenerational model is to include these components of the children's earnings.[10] Our model for the permanent earnings of sons and daughters including intergenerational transmission from both parents and allowing for unobserved variance components is the following:

[10] See Lillard and Kilburn (1995) for a similar model.

$$Y_{psi} = \beta_{Fs} Y_{pF} + \beta_{Ms} Y_{pM} + \theta_p + \zeta_{ps} + \xi_{psi} \qquad \text{for sons, and}$$

$$Y_{pdj} = \beta_{Fd} Y_{pF} + \beta_{Md} Y_{pM} + \theta_p + \zeta_{pd} + \xi_{pdj} \qquad \text{for daughters.}$$

In the same way that we decomposed the variance in parents' earnings into the variance of the shared parent component and the parent-specific component, we can decompose the variance of sons' and daughters' permanent earnings into various components. The variance of sons' earnings and daughters earnings, respectively, are:

$$\sigma^2_{Y_{psi}} = (\beta_{Fs} + \beta_{Ms})^2 \sigma^2_p + \beta^2_{Fs}\sigma^2_f + \beta^2_{Ms}\sigma^2_m + \sigma^2_\theta + \sigma^2_{\zeta_s} + \sigma^2_{\xi_s}$$

and

$$\sigma^2_{Y_{pdj}} = (\beta_{Fd} + \beta_{Md})^2 \sigma^2_p + \beta^2_{Fd}\sigma^2_f + \beta^2_{Md}\sigma^2_m + \sigma^2_\theta + \sigma^2_{\zeta_d} + \sigma^2_{\xi_d}.$$

The covariance between the permanent earnings of two brothers (i and i') is

$$\sigma_{Y_{psi}Y_{psi'}} = (\beta_{Fs} + \beta_{Ms})^2 \sigma^2_p + \beta^2_{Fs}\sigma^2_f + \beta^2_{Ms}\sigma^2_m + \sigma^2_\theta + \sigma^2_{\zeta_s};$$

the covariance between the permanent earnings of two sisters (j and j') is

$$\sigma_{Y_{pdj}Y_{pdj'}} = (\beta_{Fd} + \beta_{Md})^2 \sigma^2_p + \beta^2_{Fd}\sigma^2_f + \beta^2_{Md}\sigma^2_m + \sigma^2_\theta + \sigma^2_{\zeta_d};$$

and the covariance between the permanent earnings of a brother and a sister is

$$\sigma_{Y_{psi}Y_{pdj}} = (\beta_{Fs} + \beta_{Ms})(\beta_{Fd} + \beta_{Md})\sigma^2_p + \beta_{Fs}\beta_{Fd}\sigma^2_f + \beta_{Ms}\beta_{Md}\sigma^2_m + \sigma^2_\theta$$

We test a number of hypotheses with this model of permanent earnings that have not been examined before. First, we investigate the whether estimates of the intergenerational transmission of earnings from fathers to their children has been biased by the fact that they did not account for the possible correlation between fathers' and mothers' earnings and that mothers' earnings might also be related to children's earnings. That is, we compare estimates of β_{Fs} and β_{Fd} when mothers' earnings are and are not included as covariates. Second, we can investigate whether mothers' and fathers' earnings have differential contributions to sons' and daughters' earnings. The literature has found that resources controlled by mothers and fathers are not equally allocated to sons and daughters (see Thomas, 1995). We test related hypotheses by examining whether the coefficients on the same parent's earnings are equal in sons' and daughters' equations – $\beta_{Fs} = \beta_{Fd}$ and $\beta_{Ms} = \beta_{Md}$ – and whether coefficients on different parents' earnings are the same in both children's equations – $\beta_{Fs} = \beta_{Ms}$ and $\beta_{Fd} = \beta_{Md}$.

The first four columns of Table 8 illustrate the effects of increasing the flexibility of the parents transitory earnings specification, reported in Table 6, whereas an ARMA(1,2) transitory earnings structure is assumed throughout for the children. The results of correcting for measurement error in parents' permanent earnings are clear. The apparent effect of the father's permanent earnings on the earnings of sons and daughters increases dramatically, more than doubling in size from the *iid* specification to the ARMA(1,2) specification for parents. For mothers' earnings the result is a decline in the very small and insignificant effect on sons and a modest increase in the small effect on daughters, although the effect becomes insignificant because of increased imprecision of the estimate. The increased explanatory power of the father's earnings leads to a modest reduction in the size of the residual sibling component, but leaves the size of the same-gender sibling components unaffected.

In the fourth column we estimate coefficients on both fathers' (Y_{pF}) and mothers' permanent earnings (Y_{pM}) for both sons and daughters, our preferred specification.[11] We observe a strong relationship between fathers' permanent earnings and sons' and daughters' permanent earnings. The coefficients on fathers' permanent earnings in the fifth column of 0.75 for sons and .68 for daughters are nearly double estimates of intergenerational correlation between fathers and their sons estimated in other studies using the PSID (Solon, 1992). The gender-specific sibling components are significant but are slightly below estimates in previous specifications that do not contain parents' permanent earnings.[12] Surprisingly, for both sons and daughters, the coefficient for mothers' earnings is not significantly different from zero. Unlike the estimates that only included fathers' earnings, when incorporating both parents' earnings the family-wide component is significant at the 10 percent level. The family-wide component estimate of

[11] In estimates not reported we explored the possibility of a separated effect of permanent earnings shared by the parents, Y_p, on children's earnings, and found none.

[12] We do not include individual-specific components for each child since by this restriction they are very small and insignificant in the presence of the ARMA(1,2). Other parameters are little affected.

0.15 in the third column is almost half that estimated in the second column where only mothers' earnings are entered.

These estimates show that mothers' earnings contribute nothing to children's earnings that is not captured by the fathers' earnings and the common parent component. This implies that studies that have used only fathers' earnings to examine the contribution of family background to children's earnings have not been too far afield when not including mothers' earnings. We also observe that the relationship between fathers' earnings and sons' earnings is not significantly different from the relationship between fathers' earnings and daughters' earnings: while the estimate of β_{Fs} is larger than the estimate of β_{Fd}, they are not significantly different.

Another way to identify the relative contribution of fathers' and mothers' earnings to the variation in children's earnings generated by the parents combined effect, as reported in Panel A of Table 9. These results corroborate the results above. For sons, the combination of the shared parent term and the father-specific component account for 99 percent of the contribution from the two parents. In other words, the mother-specific component does not contribute to sons' permanent earnings. For daughters, the shared parent term and the father-specific component still make up the bulk of the parents' contribution at 56 and 39 percent, respectively. The variance due to the mother-specific term accounts for none of the variance in daughters' permanent earnings, either.

The fraction of variance in children's permanent earnings explained by the parents' components is reported in Panel B of Table 9. The parents together "explain" about 67 percent of the variance for sons and about 49 percent for daughters. The correlation between a brother and a sister in permanent earnings is .54. Including the residual common family-level component (θ_p) in the calculation increases the percent of variance explained to 81 percent for sons and 58 percent for daughters, and generates a cross-gender correlation of .65.

The last two columns of Table 8 are designed to illustrate the potential biases from including only one parent or the other. Including only father's permanent earnings leads to an overstatement of the father's effect on daughters (about 25 percent), but no bias in his effect on sons. Including only mother's permanent earnings leads to a dramatic overstatement of the estimated mother's effect on both sons and daughters, due to the correlation between father's and mother's permanent earnings. The estimate including only mother's earnings restricts the coefficient on the common parent component and the unique mother component to be the same, when the unique mother's component is actually very small and the parent component has as effect as large as the father's. Note that when including only mothers' earnings, the family-wide sibling component is larger and more significant since it includes the effects of omitted father's earnings.

These models do not attempt to model labor force participation or unemployment for either mothers or fathers but rather represent earnings net of work decisions and unemployment. Labor force participation would be expected to have an especially important impact on the earnings of mothers who have less stable labor force participation. A promising area for future research would be to explore the degree to which mothers' propensity to work and her potential earnings versus her realized earnings are related to the labor market outcomes of their sons and daughters.

To summarize, first, while we find that fathers' and mothers' permanent earnings share significant common components, we do not find that this common component enters separately from fathers' and mothers' individual-specific permanent earnings into sons' and daughters' permanent earnings--that is, we cannot reject that we obtain the same results by simply entering fathers' and mothers' total permanent earnings rather than breaking out the shared component. Second, we find that estimates of the contribution of fathers' permanent earnings to sons' earnings is not biased if mothers' permanent earnings are excluded. However, we did learn that in order to accurately measure the contribution of fathers' earnings, it is important to properly specify the

structure of the transitory component. Third, this contribution of fathers' permanent earnings is the same for sons and daughters. Fourth, the contributions from mothers' permanent earnings are very different from the patterns for fathers' permanent earnings. When controlling for fathers' earnings, mothers' permanent earnings adds nothing to sons' or daughters' permanent earnings. In other words, for describing children's permanent earnings, nothing is lost by omitting mothers' permanent earnings.

6. ASSORTATIVE MATING OF CHILDREN AND THEIR SPOUSES

In the previous section we found significant positive assortative mating of parents on permanent earnings. In this section we consider whether there is assortative mating of the same magnitude between the children and their spouses. If there is, then there should be common components shared by the wives of brothers and by the husbands of sisters. We test for these components and a gender neutral family component linking persons who "marry into" the same family. Also, we measure the extent to which the components shared by in-laws can be explained by the family components of their spouses, or whether that which in-laws share results strictly from correlation in components unrelated to family background. Finally, we examine whether including the spouses into the measure of the economic well-being of the second generation alters our findings about the relationship between family background and earnings. That is, if the earnings of spouses are highly correlated, are we missing an important manifestation of family links if we ignore the yields of family links in the marriage market?

Children in Couples

As we did for fathers and mothers, we separate the permanent earnings of the child and of the child's spouse each into two terms: one which represents the component of permanent earnings that is shared by the couple and the other of which is the component of permanent earnings that is unique to that partner. For sons, their total permanent earnings, Y_{cSi}, is decomposed into a common couple component, Y_{cs}, and a

son-specific permanent component, Y_{csi}: $Y_{cSi} = Y_{cs} + Y_{csi}$. Analogously, his wife's permanent earnings, Y_{cWi}, is the sum of the same common couple component and a wife-specific component: $Y_{cWi} = Y_{cs} + Y_{cwi}$. A similar decomposition into shared and spouse unique components is assumed for daughters and their husbands: $Y_{cDj} = Y_{cd} + Y_{cdj}$ and $Y_{cHj} = Y_{cd} + Y_{chj}$.[13] Therefore, the total variance in males' and females' earnings is composed of the variance in the shared couple component and the variance in the individual spouse-specific components:

$$\sigma_S^2 = \sigma_{cs}^2 + \sigma_s^2 \quad \text{and} \quad \sigma_W^2 = \sigma_{cs}^2 + \sigma_w^2,$$
$$\sigma_D^2 = \sigma_{cd}^2 + \sigma_d^2 \quad \text{and} \quad \sigma_H^2 = \sigma_{cd}^2 + \sigma_h^2.$$

Estimates of these parameters are presented in Table 10.

Not surprisingly, our results here are similar to the results for mothers' and fathers' earnings. The estimated size of the common component is not sensitive to the specification of the transitory residual component, but the individual components decline in magnitude as the autocorrelation structure is allowed more flexibility, as in most other models for the children. The common couple component is similar in magnitude for both sets of couples—0.40 for couples involving sons and 0.32 for couples involving daughters—and is very close to the size of the common component shared by the father and mother—0.32.

Spouses of Siblings

Do women who marry brothers, men from the same family, share some common attributes or background characteristics among themselves? And do men who marry sisters share some common attributes or background among themselves? And do they all—wives and husbands of siblings—share something common? If the siblings share some common background and spouses in couples share a common component, then we

[13] This specification focuses on couples and imposes independence of siblings, but uses all sibling-spouse pairs. Standard errors in Table 10 are corrected for non-independence of the siblings.

would expect that they do. We address these questions with the following model using only spouses of siblings, and not the siblings or parents themselves.

The permanent earnings of the wives of brothers, Y_{psW}, is conceptualized as being composed of a component common to all spouses of siblings from a family, τ_p, a component shared only by wives of brothers, ω_{ps}, and a component unique to each individual wife, η_{psw}. The permanent earnings of the husbands of sisters, Y_{pdH}, is composed of three analogous components. That is, for wives and husbands, respectively,

$$Y_{psW} = \tau_p + \omega_{ps} + \eta_{psw}$$

$$Y_{pdH} = \tau_p + \omega_{pd} + \eta_{pdh}.$$

Table 11 reports estimates of these components. As in the proceeding tables, we begin with the simplest specification of the transitory component and then work up to the ARMA(1,2). Consistent with our earlier findings, the individual-specific component drops to zero or close to zero in the ARMA(1,2) specification while the shared components do not change appreciably.

The first four columns in Table 11 estimate the parameters separately for wives of brothers and for husbands of sisters, so both couple-shared components include the family part but are estimated separately: the shared components are, $\sigma_{\tau+\omega_s}$ and $\sigma_{\tau+\omega_d}$. The fifth column distinguishes the separate component shared by all spouses of siblings. There is a strong common component shared by the wives of brothers and a strong common component shared by the husbands of sisters, and they are roughly the same magnitude. From the last column, while about half the variance is shared by both the wives of brothers *and* the husbands of sisters, the remaining half is shared only among the wives of brothers and only among husbands of sisters, respectively. In the next sub-section, we explore the family components of the brothers and the sisters as a source of this variation shared by individuals who married into the same family, but are otherwise unrelated.

Spouses of Siblings in the Full Family Context

It may be that what couples share is correlation in family background or that individuals choose to marry individuals from families that are "like" the one in which they grew up. Just as the earnings of mothers and the earnings of fathers are correlated, we have found that the earnings of children and the earnings of their spouses to be correlated. The earnings of individuals related by birth is expected to help explain individual earnings because siblings or parents and their children are expected to share more factors contributing to earnings than two randomly-selected persons. They might share common genetic factors, or common surroundings such as culture, upbringing, and community factors. Individuals related by marriage would not be expected to share common genes or even necessarily to share common surroundings, but would be expected to have correlated outcomes simply because people choose mates who are similar to themselves. While individuals select a spouse to marry, since so much of that spouse's outcomes are related to their family background, the individual is in effect also choosing the spouse's family background.

We incorporate this notion by relating the spouses' earnings to the components of the children's earnings via a linear regression parameter, κ_W or κ_H:

$$Y_{pWi} = \kappa_W\left(\beta_{Fs}Y_{pF} + \beta_{Ms}Y_{pM} + \theta_p + \zeta_{ps} + \xi_{psi}\right) + \omega_{pWi} \quad \text{for wives, and}$$

$$Y_{pHj} = \kappa_H\left(\beta_{Fd}Y_F + \beta_{Md}Y_M + \theta_p + \zeta_{pd} + \xi_{pdj}\right) + \omega_{pHj} \quad \text{for husbands.}$$

The term in parentheses is the expression for the sons' and daughters' permanent earnings as a function of parents' permanent earnings and family components estimated earlier. Estimates of κ_W and κ_H appear in Table 12. For wives, their permanent earnings are highly related to the sons family components: κ_W highly significant and is estimated at .83. The estimate of κ_H for husbands is also highly significant but is only about three-quarters of the estimate for wives, or .59. Net of these family components, neither sons nor daughters share any further common component with their spouses. These estimates demonstrate that family background is the primary source of wives' and husbands'

correlation in permanent earnings with that of the spouses (sons and daughters) rather than individual factors. In other words, family background plays a prominent role in the positive assortative mating in the marriage market. Furthermore, when examining the importance of the relationship between family background and the economic well-being of individuals, it is important to include the earnings of spouses.

7. DISCUSSION

This paper provides a number of new results regarding the contribution of family background to individual earnings and assortative mating on earnings. First is the striking finding that after specifying a richer structure for the serial correlation in transitory earnings, the family-wide and gender-specific family components remain stable while the individual permanent earnings component declines to a negligible magnitude, so that a very large fraction of permanents earnings appears to be attributable to components shared with all siblings and with same-sex siblings. Solon, et al (1991) argued for the importance of correctly specifying the transitory component to avoid overstating the individual-specific component and showed that moving from an error structure with no autocorrelation to one with an AR(1) structure in fact reduced estimates of individual-specific permanent earnings. Given evidence in the literature regarding the persistence of earnings, we take this argument even further and move to an ARMA(1,2) structure which yields an estimate near zero for the individual-specific component. Although there is a strong autoregressive component on the order of .90 for each gender, the implication of the estimates is that the correlation in individual earnings is not permanent. This aspect of our results suggests the need for further exploration, but the primary results related to the strength of family links should be robust.

This leaves family background components—from parents and siblings—as the primary source of variation in permanent earnings. This finding contrasts with the literature on the contribution to earnings from both sibling components and parental

components. Other studies (Solon, et al, 1991, Solon, 1992, Zimmerman, 1992, and others) find that family background factors contribute at most half of the variance in permanent earnings. These results suggest that more work should be done to explore the specification of transitory earnings in models that hinge upon accurately measuring permanent and transitory components of earnings.

In our second set of new findings, we present evidence regarding the differential relation of mothers' and fathers' permanent earnings to their children's earnings. Our hypothesis was that past studies, which often only considered the contribution of fathers' permanent earnings to the permanent earnings of children, were obtaining biased estimates of both the fathers' earnings contribution and the parents' earnings contribution given that fathers' and mothers' earnings were likely to be correlated. That is, we suspected that the estimate of the fathers' earnings component was really capturing both the contribution from fathers and mothers. We wanted to decompose fathers' and mothers' permanent earnings into a shared component and individual-specific components, representing the marginal contribution from each parent. Our null hypothesis was soundly rejected: we found that fathers' earnings captured both the shared component and the fathers' marginal contribution to children's earnings and that the mother-specific component added nothing to children's permanent earnings. In other words, including only fathers' earnings was not yielding results much different than our richer model. However, we did find that previous studies that had only included fathers' earnings would have obtained biased estimates given that they had not taken out all the transitory variation (measurement error) in fathers' permanent earnings. After specifying a richer error structure we obtain estimates for the fathers' permanent earnings term as much as 50 percent higher than that in the literature. What do these results imply for findings that mothers' earnings, when entered by themselves, make large contributions to children's permanent earnings? Most likely that the mothers' earnings are picking up the correlation between her earnings and the earnings of her husband (the shared component).

A third area where we obtain new results is in understanding differences by gender of the children—that is, whether sons or daughters share more or less of their permanent earnings components with their parents and siblings. We find no difference in the contribution of parents' permanent earnings for sons and daughters and that sons and daughters also share a significant family-wide common component. However, we find that daughters share a component with only their sisters that is nearly twice as large as the component that sons share with only their brothers. In other words, while parents contribute the same amount to the permanent earnings of sons and daughters, daughters share more with the family because the common sister component is so much larger than the common brother component.

Finally, we have provided evidence that individuals married to people from the same family share common components. Like we found for mothers and fathers, the children in the PSID share common components with their spouses. However, we find that the spouses share as much with other spouses as the children share with their siblings. This implies that the common components among individuals related by marriage are as strong as the common components among individuals related by birth. In addition, our findings show that the links between sons and their wives and between daughters and their husbands are completely due to the family background components. Hence, it is important to include the earnings of spouses when measuring the links between parents' earnings and the economic well-being of their children.

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TABLES

Table 1
Sample Sizes by Family Member Type

	PSID
Fathers	1444
Mothers	1444
Sons	1738
Daughters	1892
Wives	1241
Husbands	1410
Total	9169

Table 2
Number of Sons and Daughters per Family with Earnings Data

Number of Daughters	Number of Sons								
	0	1	2	3	4	5	6	7	Total
0	21	227	91	34	5	0	1	0	379
1	224	198	98	29	16	2	1	0	568
2	105	98	62	20	11	1	3	0	300
3	31	38	30	9	2	3	0	1	114
4	9	15	17	6	2	1	1	0	51
5	5	6	1	5	3	0	0	0	20
6	1	6	1	0	0	0	0	0	8
7	1	0	0	2	0	0	0	0	3
9	0	1	0	0	0	0	0	0	1
Total	397	589	300	105	39	7	6	1	1444

Table 3
Number of Wage Observations per Respondent with Earnings Data

	Sample Size	Number of Observations	1	2-9	10-19	20+
Fathers	1444	24,997	28	240	486	690
Mothers	1303	18,594	60	337	506	400
Sons	1623	14,639	100	822	651	50
Daughters	1749	15,334	112	905	684	48
Wives	1152	6646	195	733	219	5
Husbands	1361	10,151	159	755	408	39

Table 4
MLE Estimates of Parameters – Sons, Daughters and Family

	Model (1) VC+IID	(2) VC+AR(1)	(3) VC+ARMA(1,1)	(4) VC+ARMA(1,2)	(5) VC+ARMA(1,2)
Sons					
$\sigma_{\lambda_{bro}}, \sigma_{\zeta_{bro}}$	0.4221 ***	0.4227 ***	0.4230 ***	0.4199 ***	0.1939 ***
	(0.0266)	(0.0256)	(0.0249)	(0.0244)	(0.0571)
σ_{ξ}	0.4873 ***	0.4049 ***	0.2861 ***	0.0523	0.0864
	(0.0229)	(0.0293)	(0.0567)	(0.0485)	(0.0645)
γ		0.5203 ***	0.7660 ***	0.8663 ***	0.8642 ***
		(0.0219)	(0.0318)	(0.0180)	(0.0191)
σ_{η}	0.5710 ***	0.5584 ***	0.5643 ***	0.5687 ***	0.5681 ***
	(0.0142)	(0.0140)	(0.0141)	(0.0142)	(0.0142)
ϕ_1			-0.2770 ***	-0.3529 ***	-0.3508 ***
			(0.0368)	(0.0272)	(0.0279)
ϕ_2				-0.0787 ***	-0.0785 ***
				(0.0241)	(0.0244)
Daughters					
$\sigma_{\lambda_{sis}}, \sigma_{\zeta_{sis}}$	0.5492 ***	0.5465 ***	0.5463 ***	0.5433 ***	0.3775 ***
	(0.0331)	(0.0343)	(0.0338)	(0.0323)	(0.0422)
σ_{ξ}	0.6700 ***	0.4688 ***	0.2668 **	0.0000[b]	0.0000[b]
	(0.0259)	(0.0429)	(0.1076)		
γ		0.6429 ***	0.7845 ***	0.8345 ***	0.8349 ***
		(0.0174)	(0.0227)	(0.0125)	(0.0126)
σ_{η}	0.8294 ***	0.7598 ***	0.7713 ***	0.7760 ***	0.7765 ***
	(0.0152)	(0.0129)	(0.0132)	(0.0133)	(0.0133)
ϕ_1			-0.1958 ***	-0.2333 ***	-0.2315 ***
			(0.0304)	(0.0233)	(0.0232)
ϕ_2				-0.0555 ***	-0.0579 ***
				(0.0203)	(0.0203)
Family					
σ_{θ}					0.3755 ***
					(0.0253)
ln-L	-34,981.7	-32,290.5	-32,180.2	-32,164.4	-32,133.35

Notes: [a] Huber standard errors in ().; Significance levels: '*' 10%; '**' 5%; '***' 1%
[b] Estimate converged to zero. Remaining estimates conditional on zero.
[c] Intercept and age effects not reported for brevity.

Table 5
MLE Estimates of Gender – Neutral Share of Family Variation for Sons and Daughters

Share of Son Variance Shared with Daughters $\sigma_\theta^2 / (\sigma_\theta^2+\sigma_{\zeta bro}^2)$	0.7895 *** (0.1112)
Share of Daughter Variance Shared with Sons $\sigma_\theta^2 / (\sigma_\theta^2+\sigma_{\zeta sis}^2)$	0.4973 *** (0.0708)
Correlation between a Son and Daughter $\sigma_\theta^2 / \left(\sqrt{(\sigma_\theta^2+\sigma_{\zeta bro}^2)(\sigma_\theta^2+\sigma_{\zeta sis}^2)}\right)$	0.6266 *** (0.0738)

Notes: [a] Huber standard errors in ().; Signif. levels: '*' 10%; '**' 5%; '***' 1%

Table 6
MLE Estimates of Parameters – Fathers and Mothers

	Model			
	VC+IID	VC+AR(1)	VC+ARMA(1,1)	VC+ARMA(1,2)
Father				
σ_f	0.6442 ***	0.5978 ***	0.3927 ***	0.3196 ***
	(0.0311)	(0.0322)	(0.0791)	(0.1108)
γ		0.6979 ***	0.9054 ***	0.9213 ***
		(0.0196)	(0.0134)	(0.0127)
σ_η	0.5244 ***	0.4583 ***	0.4607 ***	0.4623 ***
	(0.0111)	(0.0089)	(0.0089)	(0.0090)
ϕ_1			-0.3116 ***	-0.3156 ***
			(0.0215)	(0.0203)
ϕ_2				-0.0291 *
				(0.0164)
Mother				
σ_m	0.9927 ***	0.8272 ***	0.6258 ***	0.5177 ***
	(0.0320)	(0.0394)	(0.0763)	(0.1140)
γ		0.7220 ***	0.8699 ***	0.8988 ***
		(0.0146)	(0.0143)	(0.0144)
σ_η	0.8204 ***	0.7128 ***	0.7165 ***	0.7190 ***
	(0.0123)	(0.0106)	(0.0106)	(0.0106)
ϕ_1			-0.2362 ***	-0.2537 ***
			(0.0238)	(0.0209)
ϕ_2				-0.0508 **
				(0.0210)
Common				
σ_p	0.3518 ***	0.3454 ***	0.3276 ***	0.3287 ***
	(0.0453)	(0.0431)	(0.0487)	(0.0473)
ln-L	-46428.08	-39532.78	-39091.38	-39077.25

Notes: [a] Huber standard errors in ().; Significance levels: '*' 10%; '**' 5%; '***' 1%
[b] Intercept and age effects not reported for brevity.

Table 7
MLE Estimates of Common Share of Permanent Earnings for Fathers and Mothers

Fraction of Father Variance Shared with Mother $\sigma_p^2 / (\sigma_p^2+\sigma_f^2)$	0.5141 **
	(0.2119)
Fraction of Mother Variance Shared with Father $\sigma_p^2 / (\sigma_p^2+\sigma_m^2)$	0.2873 **
	(0.1186)
Correlation between a Father and Mother $\sigma_p^2 / \left(\sqrt{(\sigma_p^2+\sigma_f^2)(\sigma_p^2+\sigma_m^2)}\right)$	0.3843 ***
	(0.1340)

Notes: [a] Huber standard errors in ().; Signif. levels: '*' 10%; '**' 5%; '***' 1%

Table 8
MLE Estimates of Parents' Coefficients for Sons and Daughters and Sibling Components

	Parent Transitory Specification [d]					
	VC+IID	VC+AR(1)	VC+ARMA(1,1)	VC+ARMA(1,2)	VC+ARMA(1,2)	VC+ARMA(1,2)
Father's Coefficients						
β_{Fs}	0.2948 ***	0.3437 ***	0.6116 ***	0.7465 ***	0.7285 ***	
	(0.0321)	(0.0382)	(0.1291)	(0.1842)	(0.1306)	
β_{Fd}	0.3030 ***	0.3404 ***	0.5853 ***	0.6849 ***	0.8215 ***	
	(0.0406)	(0.0493)	(0.1329)	(0.1791)	(0.1665)	
Mother's Coefficients						
β_{Ms}	0.0257	0.0284	-0.0155	-0.0617		0.3537 ***
	(0.0210)	(0.0283)	(0.0573)	(0.0925)		(0.0569)
β_{Md}	0.0975 ***	0.1300 ***	0.1456 **	0.1605		0.5272 ***
	(0.0295)	(0.0402)	(0.0742)	(0.1141)		(0.0762)
Residual Sibling Components						
σ_θ	0.2991 ***	0.2814 ***	0.2011 ***	0.1531 *	0.1167	0.2719 ***
	(0.0294)	(0.0311)	(0.0588)	(0.0844)	(0.0907)	(0.0364)
σ_{ζ_s}	0.1874 ***	0.1879 ***	0.1890 ***	0.1845 ***	0.2148 ***	0.2438 ***
	(0.0637)	(0.0637)	(0.0643)	(0.0666)	(0.0558)	(0.0469)
σ_{ζ_d}	0.3598 ***	0.3550 ***	0.3500 ***	0.3466 ***	0.3511 ***	0.3278 ***
	(0.0415)	(0.0421)	(0.0434)	(0.0454)	(0.0443)	(0.0508)
ln-L	-78460.61	-71561.04	-71123.22	-71110.33	-71112.79	-71173.05

Notes: [a] Huber standard errors in ().; Significance levels: '*' 10%; '**' 5%; '***' 1%
[b] Intercept, age effects and autocorrelation not reported.
[c] Parent parameters jointly estimated, but not reported.
[d] Children's transitory specification always VC+ARMA(1,2).

Table 9
MLE Estimates of Variation in Children Generated by Parents

Panel A - Decomposition of Variance Generated by Parents	
Sons	
Fraction Common to both parents	0.4412 ***
$(\beta_{Fs}+\beta_{Ms})^2\sigma_p^2 \Big/ (\beta_{Fs}+\beta_{Ms})^2\sigma_p^2+\beta_{Fs}^2\sigma_f^2+\beta_{Ms}^2\sigma_m^2$	(0.1200)
Fraction Unique to Father	0.5501 ***
$\beta_{Fs}^2\sigma_f^2 \Big/ (\beta_{Fs}+\beta_{Ms})^2\sigma_p^2+\beta_{Fs}^2\sigma_f^2+\beta_{Ms}^2\sigma_m^2$	(0.1278)
Fraction Unique to Mother	0.0087
$\beta_{Ms}^2\sigma_m^2 \Big/ (\beta_{Fs}+\beta_{Ms})^2\sigma_p^2+\beta_{Fs}^2\sigma_f^2+\beta_{Ms}^2\sigma_m^2$	(0.0239)
Daughters	
Fraction Common to both parents	0.5631 ***
$(\beta_{Fs}+\beta_{Ms})^2\sigma_p^2 \Big/ (\beta_{Fd}+\beta_{Md})^2\sigma_p^2+\beta_{Fd}^2\sigma_f^2+\beta_{Md}^2\sigma_m^2$	(0.1333)
Fraction Unique to Father	0.3878 ***
$\beta_{Fd}^2\sigma_f^2 \Big/ (\beta_{Fd}+\beta_{Md})^2\sigma_p^2+\beta_{Fd}^2\sigma_f^2+\beta_{Md}^2\sigma_m^2$	(0.1311)
Fraction Unique to Mother	0.0491
$\beta_{Md}^2\sigma_m^2 \Big/ (\beta_{Fd}+\beta_{Md})^2\sigma_p^2+\beta_{Fd}^2\sigma_f^2+\beta_{Md}^2\sigma_m^2$	(0.0657)
Panel B - Decomposition of Total Variance in Child's Permanent Earnings	
Fraction due to parents component only	
Sons	0.6708***
$(\beta_{Fs}+\beta_{Ms})^2\sigma_p^2+\beta_{Fs}^2\sigma_f^2+\beta_{Ms}^2\sigma_m^2 \Big/ \sigma_{Y_{psi}}^2$	(0.1763)
Daughters	0.4935***
$(\beta_{Fd}+\beta_{Md})^2\sigma_p^2+\beta_{Fd}^2\sigma_f^2+\beta_{Md}^2\sigma_m^2 \Big/ \sigma_{Y_{pdj}}^2$	(0.1102)
Bro-Sis Correlation generated by parents	0.5406***
$(\beta_{Fd}+\beta_{Md})^2\sigma_p^2+\beta_{Fd}^2\sigma_f^2+\beta_{Md}^2\sigma_m^2 \Big/ \sigma_{Y_{psi}Y_{pdj}}$	(0.1172)
Fraction due to parents and family comp	
Sons	0.8050***
$(\beta_{Fs}+\beta_{Ms})^2\sigma_p^2+\beta_{Fs}^2\sigma_f^2+\beta_{Ms}^2\sigma_m^2+\sigma_\theta^2 \Big/ \sigma_{Y_{psi}}^2$	(0.1308)
Daughters	0.5762***
$(\beta_{Fd}+\beta_{Md})^2\sigma_p^2+\beta_{Fd}^2\sigma_f^2+\beta_{Md}^2\sigma_m^2+\sigma_\theta^2 \Big/ \sigma_{Y_{pdj}}^2$	(0.0898)
Bro-Sis Correlation due to parents and common	0.6460***
$(\beta_{Fs}+\beta_{Ms})(\beta_{Fd}+\beta_{Md})\sigma_p^2+\beta_{Fs}\beta_{Fd}\sigma_f^2+\beta_{Ms}\beta_{Md}\sigma_m^2+\sigma_\theta^2 \Big/ \sigma_{Y_{psi}Y_{pdj}}$	(0.0735)

Notes: [a] Huber standard errors in ().; Signif. levels: '*' 10%; '**' 5%; '***' 1%

Table 10
MLE Estimates of Components Shared by Sons and Wives and by Daughters and Husbands

	VC+IID	VC+AR(1)	VC+ARMA(1,1)	VC+ARMA(1,2)
Sons and Wives				
σ_s	0.4743 ***	0.4307 ***	0.3370 ***	0.1837 *
	(0.0236)	(0.0330)	(0.0479)	(0.1026)
σ_w	0.7428 ***	0.4869 ***	0.3253 **	0.1140
	(0.0255)	(0.0542)	(0.1443)	(0.1127)
σ_{cs}	0.4405 ***	0.4040 ***	0.3992 ***	0.3972 ***
	(0.0249)	(0.0326)	(0.0329)	(0.0327)
ln-L s-di	-23640.10	-21870.24	-21797.68	-21786.66
Daughters and Husbands				
σ_d	0.7899 ***	0.6504 ***	0.5097 ***	0.3646 ***
	(0.0221)	(0.0311)	(0.0579)	(0.1092)
σ_h	0.4430 ***	0.3911 ***	0.2906 ***	0.0379 ***
	(0.0251)	(0.0274)	(0.0535)	(0.0126)
σ_{cd}	0.3524 ***	0.3250 ***	0.3249 ***	0.3247 ***
	(0.0277)	(0.0293)	(0.0292)	(0.0278)
ln-L	-28932.13	-26574.26	-26479.21	-26465.84

Notes: [a] Huber standard errors in ().; Significance levels: '*' 10%; '**' 5%; '***' 1%
[b] Intercept, age effects and autocorrelation not reported.
[c] Parameters jointly estimated, with no other common components, but standard errors are corrected.

Table 11
MLE Estimates of Components Shared by the Wives of Brothers and by the Husbands of Sisters

	(1) VC+IID	(2) VC+AR(1)	(3) VC+ARMA(1,1)	(4) VC+ARMA(1,2)	(5) VC+ARMA(1,2)
Wives (Daughters in-law)					
$\sigma_{\tau+\omega_s}, \sigma_{\omega_s}$	0.3710 ***	0.3512 ***	0.3507 ***	0.3476 ***	0.2366 ***
	(0.0569)	(0.0569)	(0.0579)	(0.0518)	(0.0791)
σ_{η_w}	0.7553 ***	0.4824 ***	0.3114	0.1230	
	(0.0359)	(0.0705)	(0.2114)	(0.0773)	
Husbands (Sons in-law)					
$\sigma_{\tau+\omega_d}, \sigma_{\omega_d}$	0.3073 ***	0.3158 ***	0.3208 ***	0.3161 ***	0.1805 ***
	(0.0290)	(0.0279)	(0.0273)	(0.0260)	(0.0638)
σ_{η_h}	0.4693 ***	0.3858 ***	0.2575 ***	0.0170 ***	
	(0.0257)	(0.0312)	(0.0609)	(0.0052)	
Family Component					
σ_τ					0.2596 ***
					(0.0357)
ln-L	-17513.92	-16057.33	-15994.41	-15987.2	-15981.52

Notes: [a] Huber standard errors in ().; Significance levels: '*' 10%; '**' 5%; '***' 1%
[b] Intercept, age effects and autocorrelation not reported.
[c] Models (1-4) are estimated separates with ln-L added for comparison, and (5) is jointly estimated.

Table 12
MLE Estimates of Effects of Family Components on Children's Spouses

		Coefficient on Spouse's Component
Wives of Brothers	κ_W	0.8283 ***
		(0.1277)
Husbands of Sisters	κ_H	0.5919 ***
		(0.0494)

Notes: [a] Huber standard errors in ().; Significance levels: '*' 10%; '**' 5%; '***' 1%

[b] Intercept, age effects and autocorrelation not reported.

[c] Parameters jointly estimated, with in-laws added to specification in Table 9.

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