

# THE EFFECTS OF SONS AND DAUGHTERS ON MEN'S LABOR SUPPLY AND WAGES

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*Abstract*—In this paper, we estimate the effects of children and the differential effects of sons and daughters on men's labor supply and hourly wage rates. The responses to fatherhood of two cohorts of men from the PSID sample are examined separately, and we use fixed-effects estimation to control for unobserved heterogeneity. We find that fatherhood significantly increases the hourly wage rates and annual hours of work for men from both cohorts. Most notably, men's labor supply and wage rates increase more in response to the births of sons than to the births of daughters.

## I. Introduction

THE effect of fatherhood on men's labor market outcomes has received little attention from economists, in contrast to the central role played by children in studies of women's labor supply. However, there is good reason to think that parenthood does affect men's labor supply and hourly earnings. Although child care has traditionally been viewed as the wives' responsibility, children place demands on the time and financial resources of the entire household. If the labor market decisions of husbands and wives are interdependent, we would expect parenthood to affect men's wages and labor supply. Because women's roles in the labor market and the family have changed dramatically in recent decades, we would also expect to see a shift in the relationship between children and men's labor market behavior.

In this paper, we estimate the effect of children on men's labor supply and hourly wages using data from the Panel Study of Income Dynamics (PSID). Our fixed-effects estimates indicate that, on average, a child increases a man's wage rate by 4.2% and his annual hours of work by 38 hours per year. However, the effects of children are highly non-linear and nonmonotonic, with significant positive incremental effects limited to the first two children. Comparison of OLS and fixed-effects estimates suggest that there is substantial heterogeneity bias in conventional cross-sectional estimates of the effect of fatherhood on men's outcomes. We compare the behavior of two cohorts—men born in and before 1950, and men born after 1950—and find that the relationship between children and men's labor supply and wages has shifted over time.

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Our most notable results relate to the effects of child gender on men's labor market outcomes. Sons increase men's annual hours of work and wage rates significantly more than do daughters. Fathers of both cohorts respond differently to sons and daughters, although the gender effects are more pronounced in the hours worked of the late cohort and the hourly wage rates of the early cohort. We find little evidence of an effect of child gender on the labor market outcomes of mothers, and are unable to explain our results in terms of differences in the expected pecuniary returns to boys and girls in the United States. Our results are consistent with a model in which the gender composition of a couple's offspring affects the returns to marriage, and this has implications for future research.

Section II presents the background for our analysis in terms of the theoretical underpinnings and the related empirical literature. Section III describes the data, and section IV outlines the empirical specification and econometric issues. The results are presented in section V, and section VI discusses the finding on gender differences. Section VII concludes.

## II. Background

### A. Theory

Why would children affect men's labor market outcomes? There is substantial evidence that motherhood reduces women's labor supply and wages.<sup>1</sup> The fall in mothers' labor supply is attributed to the increased value of women's home time after having a child (Becker, 1985), and the decline in wage rates to a fall in market productivity due to reduced time and effort on the job.<sup>2</sup> Given the evidence that husbands' and wives' labor market outcomes are interdependent,<sup>3</sup> we would expect this reallocation of mothers' time to be accompanied by some labor market response among fathers.

We would expect parenthood to have two effects on the value of parents' time in the household. First, consistent with Becker's work, there is the specialization effect due to the increased value of wives' time relative to that of husbands'. This generally takes the form of wives increasing their focus on home production while husbands concentrate more on the labor market. The magnitude of the

<sup>1</sup> For example, Mroz (1987), Korenman and Neumark (1992), Neumark and Korenman (1994), and Lundberg and Rose (2000a). For summaries of the literature, see Browning (1992) and Waldfogel (1998).

<sup>2</sup> Alternative explanations include discrimination against mothers and a wage penalty that compensates for more-flexible work arrangements.

<sup>3</sup> Lundberg (1988) finds evidence of interdependence in husbands' and wives' labor supplies in households with young children.

specialization effect depends on husbands' and wives' market wages and relative productivities in the household.

Second, in Lundberg and Rose (1999), we introduce an additional effect that we term the *home- (relative to market-) intensity effect*. This results from the increased value of both parents' time as inputs to child care after a child is born. This effect leads to an increase in total household resources devoted to the home in response to parenthood.

In our framework, the predicted effects of children on women's outcomes are unambiguous: both the specialization and the home-intensity effects on labor supply are negative. However, for men they are ambiguous. We would expect the specialization effect to be positive but the home-intensity effect to be negative. The greater the extent to which fathers share in parenting responsibilities, the more likely it is that the home-intensity effect will dominate the specialization effect, leading to a fall in hours worked after the birth of a child.<sup>4</sup>

The effects of children on fathers' labor market outcomes are likely to vary by parity level and by cohort. We expect the potential gains from specialization to decline with parity, as the decreases in mothers' labor supply are largest for the first two children. This implies that the effects of children on men's wages may be nonlinear or even nonmonotonic, and we allow for this in our empirical analysis.

The level of marital specialization appears to have declined for more-recent cohorts of couples, as women's and men's productivities have become more similar. However, this does not necessarily imply that the change in specialization associated with the birth of a child has fallen. If, for more-recent cohorts, households are substantially less specialized immediately following marriage, there may be a larger increase following the birth of the first child. Similarly, decreases in the level of home intensity associated with an expansion of the market for substitutes for parental time in home production do not necessarily imply that the change in home intensity in response to the birth of a child is negative. Therefore, the sign and magnitude of the cohort differences in the effects of children on men's outcomes is an empirical question.

### B. Literature

Most research on the relationship between household roles and men's labor market outcomes has focused on the effect of marriage on wages. Married men earn more than single men with the same education and experience, but it has not been clear whether marriage makes men more productive or more-productive men select into marriage. Korenman and Neumark (1991) estimate this marriage premium using fixed effects and find that married men earn approximately 6% more than do single men and that the premium accrues gradually over the course of the marriage. Their analyses of data from one firm's records on reviews,

wages, and personal characteristics of professionals and managers indicate that the effect of marriage arises through promotions rather than through a premium for married men within a job category. Taken together, their findings suggest that much of the marriage premium can be attributed to increased productivity of married men, perhaps due to returns to specialization within the household. Gray (1997) finds that the marriage wage premium has fallen over time and attributes this to declining specialization of husbands and wives.

There have been only a few attempts to measure the effect of parenthood on men's labor supply and wages. Pencavel (1986) finds that young children are associated with longer work hours for men in the 1980 U.S. Census, and Waldfogel (1998) reports that the wages of young men in 1980 and 1991 NLS samples are higher if they have two or more children. However, both of these studies use cross-sectional data and do not correct for endogeneity. To the extent that fathering children is endogenous with respect to labor market outcomes or correlated with unobservables in the wage or labor supply equations, the estimated effects of fatherhood will be subject to bias.

Angrist and Evans (1998) use instrumental variables to estimate the effect of the birth of a third child on the labor supply of men and women and find no significant effect of this birth on men's labor supply. In Lundberg and Rose (2000a), we estimate age-hours and age-wage profiles for husbands and wives with and without children under fixed effects. However, if the effects of children on men's outcomes are nonmonotonic (or even nonlinear) with respect to parity, the results of these two studies will not be generalizable to other parities.

### III. Data

We examine the effects of both marital status and parenthood on work hours and wages, using a sample of men drawn from the Panel Study of Income Dynamics (PSID). Our sample spans the entire period over which data were available to us from the PSID: 1968 through 1992. The dependent variables are annual hours of work and the (log of the) real hourly wage rate. The wage rate was computed as total annual labor income divided by annual hours of work, and deflated to 1983 dollars using the consumer price index.

Marital status was measured as a dummy variable indicating whether the individual reported having been married in a particular year.<sup>5</sup> Fertility measures were constructed

<sup>5</sup> We construct marital status and fertility variables using the Marriage History file and the Childbirth and Adoption History file, which contain retrospective fertility and marriage information beginning in 1985 and updated in each subsequent survey. Alternative indicators of marital status based on questions asked in each year can be constructed from PSID data. We have used the retrospective data for two reasons. First, for some of our analysis, we use data on length of current marriage, and this variable can be constructed only with the retrospective data. Therefore, our measure of marital status will be consistent with the data on length of marriage.

<sup>4</sup> Similarly, the effect of children on men's wages is ambiguous a priori.

from the fertility histories and include all children ever born, whether currently living with the father or not.<sup>6</sup> In addition to the total number of offspring, we calculated the number of children by gender, whether the man had at least one son or daughter, and whether the man had a first child that was a son or a daughter.

Additional regressors used as controls in all empirical models were age, education, and year of the observation, all of which are entered as a series of dummy variables to allow for nonlinearities. In some analyses, we control for the length of the marriage using values calculated from the marital history.

Our raw PSID sample comprised 26,809 observations on 2,304 white male heads of household who were born in 1943 or later, and for whom fertility and marital histories exist.<sup>7</sup> Observations were deleted for the following reasons: the man was under age 18 or over age 60 (five observations), education was missing (thirty observations), the marriage history indicates that the man was in two marriages simultaneously (44 observations), the man had a child but did not report its gender (77 observations), hours worked was missing (448 observations). The final sample consisted of 26,205 observations on 2,243 individuals.

To examine changes in household responses to children over time, we divided the sample into two cohorts: men born in or before 1950 and men born after 1950. Means and standard deviations of the variables used in the analysis are reported in table 1.

Table 2 reports the frequency distribution of children by parity for each cohort. Approximately 89% of the men in the early cohort and 66% of the men in the later cohort have had at least one child. This difference may be due to both cohort effects and age effects, as the average age is 34 for the early cohort and 28 for the later cohort. Very few men have more than four children (about 2% for the early cohort and 1% for the later cohort). Therefore, in our empirical analysis, we focus on the effects of the first few children, and include a separate dummy variable for observations with more than four children.

Table 3 reports frequency counts for number of children by gender. We note that fewer men report having any daughters than any sons in the early cohort (216 have no daughters and 195 have no sons). This is in contrast to what would be expected biologically, given that about 105 boys are born for every 100 girls, and about equal numbers of boys and girls survive until age 5 in the United States.

Undercounting can be detected by comparing the total number of boys relative to girls born. For the early cohort,

Second, the retrospective data asks about marriages per se, and the alternative measures at times categorize cohabitators as married. For a more detailed discussion of the issues involved in choosing marriage variables, see Lillard and Waite (1990).

<sup>6</sup> We used children (reported to have been) fathered rather than children living with their father because coresidence may be endogenous.

<sup>7</sup> Rendall et al. (1999) find evidence of significant underreporting of children for nonwhites but not for whites in the PSID retrospective data.

TABLE 1.—MEANS (STANDARD DEVIATIONS) OF KEY VARIABLES

	Early Cohort (Born 1950 or Earlier)	Late Cohort (Born After 1950)
Log (real hourly wage)	2.36* (0.61)	2.14** (0.63)
Annual hours worked	2248.07 (703.15)	2168.85 (717.41)
Years of education	13.93 (2.42)	13.24 (2.08)
Age	34.18 (6.69)	28.44 (5.03)
Married?	0.895	0.806
Length of marriage	9.07 (7.29)	4.85 (4.79)
Length of marriage (if married)	10.13 (6.97)	6.01 (4.64)
Number of children	1.63 (1.17)	1.15 (1.15)
Number of sons	0.87 (0.90)	0.58 (0.78)
Number of daughters	0.76 (0.86)	0.57 (0.78)
After first child born (son)	0.43	0.32
After first child born (daughter)	0.36	0.30
If at least one son	0.58	0.43
If at least one daughter	0.53	0.41
Number of observations	11,248	14,957

\* Based on 11,090 observations.

\*\* Based on 14,665 observations.

TABLE 2.—FREQUENCY DISTRIBUTION: NUMBER OF CHILDREN  
NUMBER OF OBSERVATIONS (PERCENT OF SAMPLE)

	By Individual * Time		By Individual (Maximum Number per Individual)	
	Born 1950 or Earlier	Born After 1950	Born 1950 or Earlier	Born After 1950
No children	2342 (20.82)	5749 (38.44)	70 (11.65)	560 (34.10)
One child	2501 (22.24)	3548 (23.72)	86 (14.31)	317 (19.31)
Two children	4062 (36.11)	3823 (25.56)	259 (43.09)	488 (29.72)
Three children	1761 (15.66)	1398 (9.35)	129 (21.46)	207 (12.61)
Four children	455 (4.05)	339 (2.27)	42 (6.99)	53 (3.23)
Five children	109 (0.97)	82 (0.55)	12 (2.00)	15 (0.91)
Six children	11 (0.10)	17 (0.11)	1 (0.17)	1 (0.06)
Seven children	7 (0.06)	1 (0.01)	2 (0.33)	1 (0.06)
Total	11,248 (100)	14,957 (100)	601 (100)	1,642 (100)

men report having about 110 boys for every girl (649 boys and 590 girls, in total), and, for the later cohort, the numbers are approximately equal (1,112 boys and 1,102 girls). The apparent overreporting of sons relative to daughters by the early cohort is quite striking because it is generally believed that bias in favor of male children is relatively mild in the United States and other developed countries.<sup>8</sup> We suspect

<sup>8</sup> This is in contrast to parts of Asia, where pro-male bias is believed to be more acute (Behrman, 1997). In particular, in parts of India, pro-male bias leads to excess mortality of female children relative to males, and

TABLE 3.—FREQUENCY DISTRIBUTION OF SONS AND DAUGHTERS NUMBER OF OBSERVATIONS (PERCENT OF SAMPLE)

	By Observation				
	Born 1950 or Earlier	Born After 1950	Born 1950 or Earlier	Born After 1950	
No sons	4763 (42.35)	8533 (57.05)	No daughters	5266 (46.82)	8756 (58.54)
One son	3789 (33.69)	4460 (29.82)	One daughter	3797 (33.76)	4241 (28.35)
Two sons	2131 (18.95)	1671 (11.17)	Two daughters	1819 (16.17)	1620 (10.83)
Three sons	522 (4.64)	244 (1.63)	Three daughters	311 (2.76)	312 (2.09)
Four sons	43 (0.38)	45 (0.30)	Four daughters	45 (0.40)	28 (0.19)
Five sons	0	4 (0.03)	Five daughters	9 (0.08)	0
Six sons	0	0	Six daughters	1 (0.01)	0
Total	11,248 (100)	14,957 (100)	Total	11,248 (100)	14,957 (100)
	By Individual				
	Born 1950 or Earlier	Born After 1950	Born 1950 or Earlier	Born After 1950	
No sons	195 (32)	867 (53)	No daughters	216 (36)	878 (53)
One son	216 (36)	495 (30)	One daughter	226 (38)	484 (29)
Two sons	142 (24)	232 (14)	Two daughters	123 (20)	228 (14)
Three sons	43 (7)	40 (2)	Three daughters	29 (5)	46 (3)
Four sons	5 (1)	7 (0)	Four daughters	5 (1)	6 (0.4)
Five sons	0	1 (0)	Five daughters	1 (0)	0 (0)
Six sons	0	0	Six daughters	1 (0)	0 (0)
Total	601 (100)	1,642 (100)	Total	601 (100)	1,642 (100)

that this preponderance of sons is due to systematic recall bias: men in the early cohort are more likely to recall the birth of a child if it is a son relative to a daughter, particularly if the birth is nonmarital or from a prior marriage.<sup>9</sup>

#### IV. Empirical Specification and Econometric Issues

We undertake two parallel analyses. We estimate identical sets of wage and reduced-form labor supply equations. Because the equations describing the two outcomes contain identical sets of regressors and we do not need to test

mother's reports of births of sons relative to daughters are particularly high (Rosenzweig & Schultz, 1982; Rose, 1999). Both of these factors lead to an econometric concern for the "endogeneity of gender" that is discussed in section IV.

<sup>9</sup> However, women's reports of the numbers of sons born relative to daughters do not appear to be biased. In Lundberg and Rose (2000b), we use data from the women's marital and fertility histories to estimate a hazard model of the likelihood a woman marries subsequent to a non-marital birth, and find that women who have sons marry sooner than do women who have daughters. This is consistent with the hypothesis that fathers underreport daughters because they are less likely to have contact with daughters born nonmaritally.

cross-equation restrictions, the equations can be estimated separately.

The base specification is

$$Y_{it} = \alpha + \beta_{MARR} MARR_{it} + \sum_{Age} \beta_{Age} D_{Age_{it}} + \sum_{Year} \beta_{Year} D_{Year_{it}} + \sum_{Educ} \beta_{Educ} D_{Educ_{it}} + u_{it}, \quad (1)$$

where the subscript "i" indicates individual and "t" indicates time,

$Y$  is the outcome of interest (the log of the real hourly wage rate, or annual hours of work),

$MARR$  is a dummy variable indicating whether the individual is married,

$D_{Age}$  is a series of dummy variables for each year of age of the individual,

$D_{Year}$  is a series of dummy variables representing the year of the observation, and

$D_{Educ}$  is a series of dummy variables indicating the number of years of education.<sup>10</sup>

Because both age and education are included as regressors, an estimate of Mincerian experience is implicitly included in these estimates. We do not include actual experience or controls for occupation or industry, as these variables are endogenous in the theoretical framework underlying our estimating equations. In these respects, our estimates of the effect of the marriage are not comparable with those reported by Korenman and Neumark (1991) and Gray (1997), and our estimates of the male "family gap" are not analogous to those in Waldfogel (1998).

We introduce children into the analysis in two ways. In a linear specification, we include the variable  $NKID04$ , which is the number of children if the man has four children or less and zero otherwise, and a dummy variable for five or more children ( $DKID5$ ); that is,

$$Y_{it} = \alpha + \beta_{MARR}MARR_{it} + \beta_{NKID04}NKID04_{it} + \beta_{DKID5}DKID5_{it} + \sum_{Age} \beta_{Age}D_{Age_{it}} + \sum_{Year} \beta_{Year}D_{Year_{it}} + \sum_{Educ} \beta_{Educ}D_{Educ_{it}} + u_{it}. \quad (2)$$

In a nonlinear specification, we include instead a series of dummy variables  $DKID1$  through  $DKID4$  indicating whether the man has exactly that number of children; that is,

$$Y_{it} = \alpha + \beta_{MARR}MARR_{it} + \sum_{NKID=1}^{NKID=4} \beta_{NNKID}D_{NKID_{it}} + \beta_{DKID5}DKID5_{it} + \sum_{Age} \beta_{Age}D_{Age_{it}} + \sum_{Year} \beta_{Year}D_{Year_{it}} + \sum_{Educ} \beta_{Educ}D_{Educ_{it}} + u_{it}. \quad (3)$$

We examine the effects for only the first four children because there are so few observations for men with five or more children. (See table 2.)<sup>11</sup>

These models are estimated two ways. First, we estimate OLS<sup>12</sup> equations to obtain estimates that are more comparable to what would be found in a conventional cross-sectional analysis. OLS estimation of these models may yield substantially biased coefficients due to heterogeneity; that is, a man's fertility may be correlated with unobserv-

ables in the estimating equations. There are essentially three approaches for dealing with this problem. The first is using an instrumental variables procedure, such as two-stage least squares. However, this procedure would require data on some variable that is correlated with the measures of fertility, but uncorrelated with the error terms. It is in practice very difficult to find such an instrument. For instance, Angrist and Evans (1998) use the sex composition of the first two children in a family to instrument for whether a third child is born. This is appropriate given the evidence that parents' preference for balanced families leads them to be more likely to have a third child if the first two children are the same sex. However, because this approach can be used to examine the effect of only the third child on outcomes, it will not be useful for our problem.

The other two approaches involve some form of fixed effects. Under sibling fixed effects, data on brothers would be used. Here, the subscript "i" would refer to family, "t" would refer to brother, and the intercept  $\alpha$  would be allowed to vary by family. This approach assumes that the portion of the unobservables that is correlated with the regressors is constant within family. Biases would arise if, say, more-attractive brothers tend to have more-favorable labor market outcomes and are also more likely to marry or father children.

The third approach is individual fixed effects. In this case,  $\alpha$  varies by individual, and, as already noted, the subscript "i" refers to individual and "t" refers to time.<sup>13</sup> This approach is commonly used in this literature (for instance, Korenman and Neumark (1992) and Waldfogel (1997) on the effect of children on women's wages, and Korenman and Neumark (1991) on the marriage premium). This is the strategy we follow.

Individual fixed-effects estimates may still exhibit endogeneity or omitted-variable bias, for two reasons. First, timing of marriage and parenthood may be caused by, or correlated with, actual or expected shocks to the outcome variables. For instance, men may choose marriage or parenthood at a time when they expect to receive a promotion and a raise. Second, men with higher growth rates of wages may be more likely to get married or have more children. Because hours tend to be more stable over time than wages, we believe this is less likely to be a problem in the hours equations.

#### A. *The Effects of Sons versus Daughters*

To estimate the effects of sons relative to daughters on wages and hours worked, we estimate several variants of equations (2) and (3) under fixed effects.

First, we examine the differential effect of the number of boys and girls. We measure the number of boys and girls as  $NBOY03$  and  $NGIRL03$ , which refer to the number of boys

<sup>10</sup> The few observations with seventeen or more years of education are grouped together.

<sup>11</sup> We estimated the effects of children without separating out the highest parities and found that the coefficients for these parities were unstable, imprecisely estimated, and implausibly large, but that including them did not have much impact on the coefficients for lower parities. These results are reported in Appendix Tables A1 and A2.

<sup>12</sup> With Huberized standard errors in order to allow for the fact that we have repeated observations by individual (Huber, 1967).

<sup>13</sup> In our specification, it is necessary to eliminate the year dummies from the fixed-effects specification because they are perfectly collinear with the fixed effects and the age dummies.

and girls if there are fewer than three. Observations in which there are more than three boys or girls are dummied out with the variable *GIRBOYG3*. The first specification of the model used to estimate gender-specific effects, then, is

$$\begin{aligned}
 Y_{it} = & \alpha_i + \beta_{MARR}MARR_{it} + \beta_{NBOY}NBOY03_{it} \\
 & + \beta_{NGIRL}NGIRL03_{it} \\
 & + \beta_{GIRBOYG3}GIRBOYG3_{it} + \sum_{Age} \beta_{Age}D_{Age_{it}} \\
 & + \sum_{Educ} \beta_{Educ}D_{Educ_{it}} + u_{it}.
 \end{aligned} \quad (4)$$

Second, we note that Morgan, Lye, and Condrón's (1988) finding on the effect of sons relative to daughters on marital survival probabilities pertained to whether there was at least one son or at least one daughter, and Butcher and Case's (1994) finding on the effect of brothers on girls' education relates to the presence of at least one brother. Therefore, in the second specification, we include the variables *IFBOY* and *IFGIRL* indicating whether the man has at least one son or daughter; that is,

$$\begin{aligned}
 Y_{it} = & \alpha_i + \beta_{MARR}MARR_{it} + \beta_{IFBOY}IFBOY_{it} \\
 & + \beta_{IFGIRL}IFGIRL_{it} + \sum_{Age} \beta_{Age}D_{Age_{it}} \\
 & + \sum_{Educ} \beta_{Educ}D_{Educ_{it}} + u_{it}.
 \end{aligned} \quad (5)$$

Third, we include the dummy variables *FIRBOY* and *FIRGIRL* indicating that the man has had at least one child and the first child was a boy or girl, respectively:

$$\begin{aligned}
 Y_{it} = & \alpha_i + \beta_{MARR}MARR_{it} + \beta_{FIRBOY}FIRBOY_{it} \\
 & + \beta_{FIRGIRL}FIRGIRL_{it} + \sum_{Age} \beta_{Age}D_{Age_{it}} \\
 & + \sum_{Educ} \beta_{Educ}D_{Educ_{it}} + u_{it}.
 \end{aligned} \quad (6)$$

Finally, in the nonlinear specification, we include two sets of dummy variables corresponding the gender-specific parities:

$$\begin{aligned}
 Y_{it} = & \alpha_i + \beta_{MARR}MARR_{it} + \sum_{NBOY=1}^{NBOY=3} \beta_{NBOY}D_{NBOY_{it}} \\
 & + \sum_{NGIRL=1}^{NGIRL=3} \beta_{NGIRL}D_{NGIRL_{it}} \\
 & + \beta_{GIRBOYG3}GIRBOYG3_{it} + \sum_{Age} \beta_{Age}D_{Age_{it}} \\
 & + \sum_{Educ} \beta_{Educ}D_{Educ_{it}} + u_{it}.
 \end{aligned} \quad (7)$$

All of these equations are estimated under individual fixed effects. To the extent that the gender composition of a man's offspring is random, the issues of endogeneity and heterogeneity with respect to actual or expected shocks to hours or wages are not of concern. However, the sex ratios reported in section III suggest that births of girls are underreported for the cohort of men born before 1950. This means that gender is potentially endogenous; that is, the probability that a son is reported to have been born, or survive, relative to a daughter, may be correlated with unobservables in regressions of the effects of a child's gender on individual- or household-level outcomes. If the underreporting is systematic with respect to shocks to earnings or hours, then the difference in the effects of sons and daughters will be biased. This seems unlikely. Alternatively, if men in the early cohort who have high growth rates of hours or wages are more likely to underreport daughters, then the effects of sons versus daughters will be biased upward. This possibility cannot be eliminated, but we do note that it's unlikely to be an issue with the hours equations, or for the later cohort.<sup>14</sup>

## IV. Results

### A. The Effects of Children on Wages and Hours

Table 4 presents the results regarding the effects of marriage and children on hourly wage rates. Table 4a reports results for the entire sample, and table 4b reports the results by cohorts. Columns (1) through (3) contain the OLS estimates, and columns (4) through (6) contain the fixed-effects estimates. Columns (1) and (4) present the base specifications without children, columns (2) and (5) are the linear child specifications, and columns (3) and (6) are the nonlinear specifications.

The fixed-effects results for the base specification reported in column (4) indicate that married men earn approximately 6.1% more than do single men, holding constant age, education, race, and year of observation. Adding *NKID04* and *DKID5* into the regression in column (5) reduces the estimate of the marriage premium slightly to 5.7%. The coefficient on *NKID4* is 0.042 and statistically significant. This means that each additional child is associated with an increase in wages of approximately 4.2%. The coefficient on the dummy variable *DKID5* is also positive and significant. The results in column (6) indicate that the relationship between number of children and hourly wages is highly nonlinear. The first child increases wages by 7.1% ( $t = 5.9$ ), the second by an additional 6% ( $t = 5.5$ ), and the incremental effects of the third and fourth child are small and insignificant.

The OLS results in columns (1) through (3) indicate a somewhat larger marriage premium (10% rather than 6%)

<sup>14</sup> For further discussion of the econometric implications of endogenous gender, see Rose (2000).

TABLE 4A.—THE EFFECT OF MARRIAGE AND CHILDREN ON (LOG REAL HOURLY) WAGE (ENTIRE SAMPLE) ( $N = 25755$ )

	(1) OLS	(2) OLS	(3) OLS	(4) FE	(5) FE	(6) FE
Married	0.10 (0.023)	0.086 (0.023)	0.078 (0.023)	0.061 (0.013)	0.057 (0.013)	0.050 (0.013)
Number of children (0 if none or >4)		0.017 (0.010)			0.042 (0.006)	
(Exactly) one child			0.020 (0.021)			0.071 (0.012)
(Exactly) two children			0.070 (0.026)			0.131 (0.014)
(Exactly) three children			0.073 (0.033)			0.125 (0.019)
(Exactly) four children			-0.04 (0.065)			0.114 (0.028)
More than four children		-0.157 (0.138)	-0.141 (0.137)		0.088 (0.050)	0.087 (0.050)
<i>Two children – one child</i>			0.05 (0.022)			0.060 (0.011)
<i>Three children – two children</i>			0.003 (0.03)			-0.006 (0.015)
<i>Four children – three children</i>			-0.113 (0.062)			-0.011 (0.025)
$R^2$	0.16	0.17	0.17	0.59	0.59	0.59

Additional regressors include dummy variables for year of observation, years of education, and age. Standard errors in parentheses.

and a substantially smaller effect of children (1.7% per child rather than 4.2%). The fall in the marriage coefficient when we move from OLS to fixed-effect estimates indicates that one reason that married men earn more than single men is positive selection: men with higher levels of the unobservables affecting wages are more likely to get married. This positive selection effect in terms of marriage is consistent with the findings of Korenman and Neumark (1991) and Gray (1997). However, the implied selection into fatherhood is negative. The estimated effects of children are higher under fixed effects relative to OLS in both the linear specification in column (5) and for each parity in the nonlinear specification in column (6). This means that, although fatherhood itself increases wages, having children is associated with lower levels of unobservables in the wage equation.

The effect of heterogeneity can be seen graphically in figure 1a, which plots the OLS coefficients (solid line) and the fixed-effects coefficients (dashed line) against the number of children. A diamond ( $\diamond$ ) indicates that the respective coefficient is significantly different from zero (at the 10% level). A square ( $\square$ ) indicates that the coefficient is significantly different from the coefficient for the previous parity.

Figure 1 shows that, for each parity, the fixed-effects coefficient is greater than the respective OLS coefficient. The difference at parity 4 is particularly striking: the OLS estimates suggest that having a fourth child relative to a third reduces wages substantially, but the fixed-effect estimate indicates that this drop is due entirely to heterogeneity.

The analyses reported in table 4a are repeated by cohort and presented in table 4b. For both cohorts, we find positive marriage premia and evidence of positive selection into marriage. We find, as does Gray, that the marriage premium

has fallen over time: our fixed-effects estimates indicate that it has been reduced by half. For both cohorts, there is evidence that fatherhood increases wages and that negative selection into fatherhood is present. In the linear specification for the early cohort, the selection effect apparently nearly outweighs the true effect, and the estimated OLS relationship between the number of children and wages is small and insignificant.

The effects of children on men's wages appear to have changed over time. The incremental effects of the first two children are about half as large for the later cohort (5.7% versus 9.7% for the first child, and 4.2% versus 8.4% for the second child). The incremental effect of the third child is significantly negative for the early cohort and positive but not highly significant for the later cohort. For the early cohort, the effects of children are highly nonlinear and nonmonotonic; for the later cohort, the effects are monotonic and approximately linear. (See figures 1b and 1c.)

The analysis of the determinants of wages reported in table 4 is repeated for total hours of work in table 5. The formats of the tables and figures are identical. The results for the entire sample reported in table 5a indicate that men work more hours per year after marriage, in addition to earning more per hour. The OLS estimates indicate that married men work approximately 201 hours per year more than do single men; the comparable fixed-effects estimate is 115 hours per year. In hours as well as hourly wages, there is evidence of positive selection into marriage, as the fixed-effects estimates are approximately half the magnitudes of the OLS estimates for the entire sample, and for each cohort individually. Comparing the estimates for the two cohorts indicates that the marriage "premium" in terms of hours of work has increased somewhat over time.

TABLE 4B.—THE EFFECT OF MARRIAGE AND CHILDREN ON (LOG REAL HOURLY) WAGE (BY COHORT)

Cohort ( <i>N</i> )		(1) OLS	(2) OLS	(3) OLS	(4) FE	(5) FE	(6) FE	
Born 1950 or earlier (11090)	Married	0.153 (0.049)	0.146 (0.047)	0.134 (0.047)	0.084 (0.020)	0.076 (0.020)	0.067 (0.020)	
	Number of children (0 if none or >4)		0.008 (0.018)			0.043 (0.008)		
	(Exactly) one child			0.019 (0.043)			0.097 (0.019)	
	(Exactly) two children			0.076 (0.048)			0.181 (0.021)	
	(Exactly) three children			0.064 (0.057)			0.136 (0.029)	
	(Exactly) four children			-0.105 (-0.102)			0.085 (0.040)	
	More than four children		0.040 (0.136)	0.072 (0.137)		0.127 (0.068)	0.137 (0.068)	
	<i>Two children – one child</i>			0.057 (0.036)			0.084 (0.016)	
	<i>Three children – two children</i>			-0.012 (0.045)			-0.045 (0.020)	
	<i>Four children – three children</i>			-0.169 (0.091)			-0.051 (0.032)	
	<i>R</i> <sup>2</sup>	0.13	0.13	0.13	0.55	0.56	0.56	
	Born after 1950 (14665)	Married	0.070 (0.025)	0.048 (0.025)	0.044 (0.026)	0.048 (0.016)	0.045 (0.016)	0.042 (0.017)
		Number of children (0 if none or >4)		0.028 (0.011)			0.044 (0.008)	
		(Exactly) one child			0.030 (0.023)			0.057 (0.015)
(Exactly) two children				0.075 (0.029)			0.099 (0.018)	
(Exactly) three children				0.089 (0.040)			0.127 (0.026)	
(Exactly) four children				0.057 (0.073)			0.173 (0.041)	
More than four children			-0.438 (0.189)	-0.431 (0.188)		0.050 (0.073)	0.052 (0.073)	
<i>Two children – one child</i>				0.045 (0.025)			0.042 (0.014)	
<i>Three children – two children</i>				0.014 (0.035)			0.028 (0.019)	
<i>Four children – three children</i>				-0.032 (0.073)			0.046 (0.036)	
<i>R</i> <sup>2</sup>		0.16	0.16	0.16	0.60	0.60	0.60	

Additional regressors include dummy variables for year of observation, years of education, and age. Standard errors in parentheses.

Having children significantly increases men's annual hours of work. For the sample as a whole, the linear OLS estimate of the effect of children is 46 hours per year per child and the comparable fixed-effects estimate is 38 hours per child. The nonlinear fixed-effects estimates reported in column (6) indicate that men work approximately 82 hours per year more ( $t = 5.5$ ) after the birth of the first child and 26 hours per year more ( $t = 1.9$ ) after the second child. The incremental effects of subsequent children are not statistically significant, nor is the effect of having more than four children.

Interpretation of the nonlinear estimates by cohort is facilitated by examining figures 2b and 2c. For the early cohort, the fixed-effects coefficients are less than the OLS coefficients for each parity, and they indicate a step-function relationship between children and men's labor supply. The effect of the first child is positive and significant, but the effects of subsequent children are all small. For the later

cohort, however, the effects of each child on hours of work are positive and significant.

In summary, men work more hours and earn more per hour after becoming fathers, although the incremental effects of children are nonlinear. For the early cohort, the relationship is nonmonotonic. The first two children increase wages, but subsequent children reduce them. For hours of work, the relationship is a step function, with the first child leading to higher labor supply and no effect of children at higher parities. In terms of the framework in Lundberg and Rose (1999) and discussed in section II, the specialization effect outweighs the market-intensity effect for the first one or two children, but the market-intensity effect dominates or cancels out the specialization effect for higher parities. For the late cohort, in contrast, the positive effect of the first four children on hours and wages is approximately linear.



FIGURE 1.—THE EFFECT OF CHILDREN ON WAGES

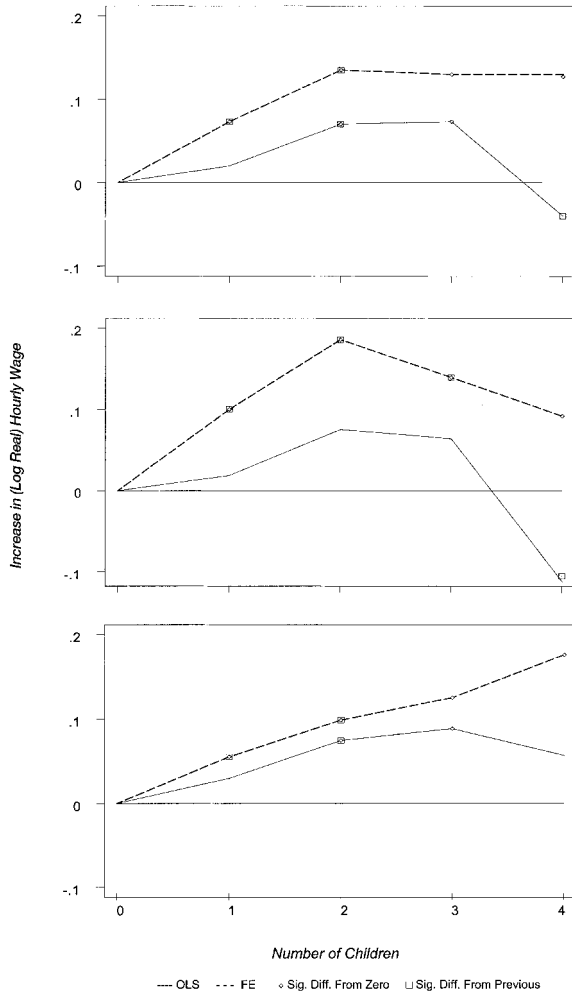
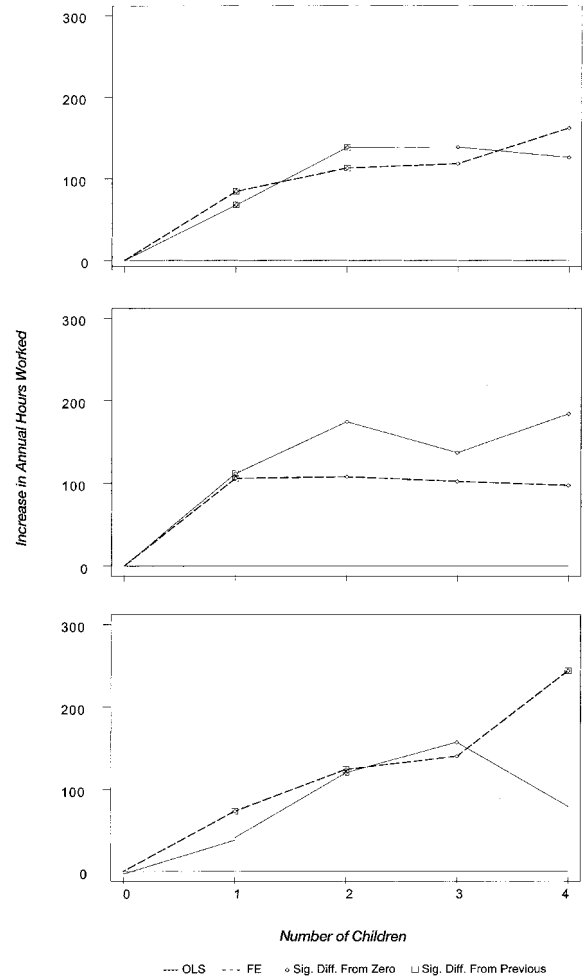


FIGURE 2.—THE EFFECT OF CHILDREN ON LABOR SUPPLY



*B. The Effects of Boys versus Girls on Wages and Hours*

The results for the gender-specific effects on hourly wage rates and hours worked (equations (4) through (7)) are reported in tables 6 and 7, respectively. In each, the results for the entire sample are reported in column (1), for men born in or before 1950 in column (2), and for men born subsequent to 1950 in column (3).

For the sample as a whole, the gender of the man's offspring does not significantly affect his wage rate. However, when we disaggregate by cohort, more-striking patterns emerge.

For men in the early cohort, we find significantly higher wages for fathers of sons relative to daughters in most of the specifications. Each son raises wages by approximately 3% more than each daughter, and this difference is significant ( $t = 1.9$ ). Men with at least one son earn 2.9% more than men with at least one daughter, although this effect is not significant. However, men whose first child was a son earn approximately 5.3% more per hour than do men whose first child was a daughter, and this is statistically significant ( $t = 1.8$ ). The nonlinear specification at the bottom of column

(2) indicates that, for each gender-specific parity, men earn more after having sons relative to daughters, but these results are statistically significant only for the third boy or girl. There are no significant gender-specific effects on wages for men born after 1950.

The gender-specific effects on men's hours of work reported in table 7 are striking. For the full sample, we find that men work significantly more if they have at least one son versus at least one daughter (53 hours per year,  $t = 2.5$ ) or if their first child were a boy rather than a girl (65 hours per year,  $t = 2.7$ ). In the nonlinear estimates, we again find hours are significantly higher if the first child is a boy rather than a girl (63 hours per year,  $t = 3.0$ ), but find no significant effects for subsequent children.

We find some significant effects of child gender on labor supply for both cohorts, although only the effects for the later cohort are substantial and pervasive. For the early cohort, the only significant difference is in the effect of the first child in the nonlinear specification: sixty hours more if the first child is a son relative to a daughter. For men born after 1950, we find statistically and quantitatively significant positive effects of sons relative to daughters in every

TABLE 5A.—THE EFFECT OF MARRIAGE AND CHILDREN ON ANNUAL HOURS WORKED (ENTIRE SAMPLE) ( $N = 26205$ )

	(1) OLS	(2) OLS	(3) OLS	(4) FE	(5) FE	(6) FE
Married	200.679 (24.560)	160.945 (24.645)	148.516 (24.892)	115.325 (16.327)	111.264 (16.335)	103.686 (16.470)
Number of children (0 if none or >4)		45.86 (10.245)			38.416 (7.266)	
(Exactly) one child			68.297 (22.983)			82.023 (14.849)
(Exactly) two children			138.562 (25.595)			108.165 (17.729)
(Exactly) three children			138.922 (34.375)			113.230 (24.544)
(Exactly) four children			126.268 (66.625)			152.212 (36.551)
More than four children		-57.497 (133.137)	-34.916 (132.643)		38.074 (62.147)	49.624 (62.319)
<i>Two children – one child</i>			70.265 (24.215)			26.142 (13.554)
<i>Three children – two children</i>			0.360 (30)			5.065 (17.907)
<i>Four children – three children</i>			-12.654 (63.27)			38.982 (31.111)
$R^2$	0.04	0.04	0.04	0.45	0.45	0.45

Additional regressors include dummy variables for year of observation, years of education, and age. Standard errors in parentheses.

TABLE 5B.—THE EFFECT OF MARRIAGE AND CHILDREN ON ANNUAL HOURS WORKED (BY COHORT)

Cohort ( $N$ )		(1) OLS	(2) OLS	(3) OLS	(4) FE	(5) FE	(6) FE
Born 1950 or earlier (11248)	Married	173.946 (38.702)	132.761 (39.310)	110.868 (39.260)	89.157 (26.179)	84.924 (26.249)	75.778 (26.351)
	Number of children		45.183 (16.578)			25.850 (10.955)	
	One child			111.941 (39.98)			102.453 (24.218)
	Two children			174.566 (41.668)			102.874 (27.633)
	Three children			137.205 (52.801)			100.369 (37.350)
	Four children			184.275 (102.62)			91.639 (51.857)
	More than four children		19.678 (186.82)	70.617 (185.85)		8.746 (86.607)	32.131 (86.864)
	<i>Two children – one child</i>			62.625 (39.141)			0.421 (21.2)
	<i>Three children – two children</i>			-37.361 (45.644)			-2.505 (25.05)
	<i>Four children – three children</i>			47.07 (98.148)			-8.73 (43.65)
	$R^2$		0.03	0.03	0.04	0.41	0.42
Born After 1950 (14957)	Married	219.089 (31.169)	179.695 (30.968)	175.617 (31.743)	132.115 (21.002)	128.610 (20.991)	124.346 (21.247)
	Number of children		46.971 (12.842)			52.556 (9.776)	
	One child			41.381 (27.63)			72.455 (18.821)
	Two children			120.189 (31.699)			121.436 (23.201)
	Three children			157.128 (45.437)			138.084 (32.851)
	Four children			78.916 (78.028)			240.877 (52.599)
	More than four children		-184.61 (205.32)	-177.16 (205.05)		73.246 (90.024)	82.482 (90.374)
	<i>Two children – one child</i>			78.808 (29.431)			48.981 (17.732)
	<i>Three children – two children</i>			36.939 (39.603)			16.648 (24.284)
	<i>Four children – three children</i>			-78.212 (77.065)			102.793 (46.109)
	$R^2$		0.04	0.05	0.05	0.48	0.48

Additional regressors include dummy variables for year of observation, years of education, and age. Standard errors in parentheses.

TABLE 6.—THE EFFECT OF SONS VERSUS DAUGHTERS ON (LOG REAL HOURLY) WAGE

Equation Number		(1) Full Sample	(2) Born 1950 or Earlier	(3) Born After 1950
(4)	Number of boys (0 if none, or >3)	0.037 (0.008)	0.048 (0.011)	0.027 (0.010)
	Number of girls (0 if none, or >3)	0.030 (0.008)	0.018 (0.011)	0.044 (0.010)
	<i>Number of boys – number of girls</i>	0.007 (0.011)	0.030 (0.016)	–0.017 (0.014)
	If more than three boys or more than three girls	–0.035 (0.051)	0.091 (0.072)	–0.175 (0.073)
(5)	If at least one boy (0 if no sons yet)	0.051 (0.011)	0.084 (0.018)	0.030 (0.015)
	If at least one (0 if no daughter yet)	0.056 (0.011)	0.055 (0.018)	0.059 (0.015)
	<i>If at least one boy – if at least one girl</i>	–0.005 (0.016)	0.029 (0.026)	–0.029 (0.022)
(6)	After first child, boy (0 if no child, or first child girl)	0.091 (0.014)	0.151 (0.023)	0.052 (0.018)
	After first child, girl (0 if no child, or first child boy)	0.080 (0.015)	0.098 (0.024)	0.074 (0.019)
	<i>After first child boy – after first child girl</i>	0.011 (0.019)	0.053 (0.030)	–0.022 (0.024)
(7)	(Exactly) one boy	0.050 (0.011)	0.075 (0.018)	0.033 (0.015)
	(Exactly) one girl	0.050 (0.012)	0.053 (0.018)	0.052 (0.015)
	<i>One boy – one girl</i>	–0.002 (0.011)	0.022 (0.027)	–0.019 (0.022)
	(Exactly) two boys	0.10 (0.017)	0.120 (0.025)	0.085 (0.023)
	(Exactly) two girls	0.088 (0.017)	0.075 (0.026)	0.105 (0.023)
	<i>Two boys – two girls</i>	0.012 (0.022)	0.045 (0.035)	–0.02 (0.032)
	(Exactly) three boys	0.115 (0.030)	0.103 (0.040)	0.136 (0.045)
	(Exactly) three girls	0.024 (0.030)	–0.039 (0.043)	0.111 (0.042)
	<i>Three boys – three girls</i>	0.091 (0.040)	0.142 (0.056)	0.025 (0.059)
	If more than three boys or more than three girls	0.031 (0.052)	0.146 (0.073)	–0.10 (0.074)

Additional regressors include dummy variables for marital status, years of education, and age. Fixed-effects estimates, standard errors in parentheses.

specification. The linear specification indicates that each son increases his father's labor supply by forty hours per year more than (or about 2.5 times as much as) each daughter ( $t = 2.2$ ). Having at least one son leads to about 73 more hours of work per year than having at least one daughter ( $t = 2.7$ ), and having a son as a first child leads to an increase in labor supply of about 69 hours per year more than a daughter ( $t = 2.2$ ). Thus, the incremental effect of having a son rather than a daughter amounts to more than 3% of total male labor supply. In the nonlinear specification, we find increases in labor supply for each of the gender-specific parities.

In summary, having sons versus daughters leads to higher hourly wages and higher labor supply for fathers. The labor supply effect is particularly striking, as we find significant effects for both the early and late cohorts and for a variety

of specifications of the gender composition of a man's offspring.

## V. Discussion: Why Do Men's Outcomes Depend on Children's Gender?

Our results indicate that men work more and/or harder after having sons relative to daughters. Furthermore, when we estimated the same specifications reported in tables 6 and 7 for women as well as men,<sup>15</sup> we found virtually no evidence that children's gender affects women's hourly wages and no evidence of an effect on labor supply.

What economic factors could explain these findings? First, we consider how having sons relative to daughters

<sup>15</sup> These results are available from the authors upon request.

TABLE 7.—THE EFFECT OF SONS VERSUS DAUGHTERS ON ANNUAL HOURS WORKED

Equation Number		(1) Full Sample	(2) Born 1950 or Earlier	(3) Born After 1950
(4)	Number of boys (0 if none, or >3)	36.477 (9.663)	4.101 (14.513)	66.013 (12.997)
	Number of girls (0 if none, or >3)	25.063 (9.773)	30.121 (14.691)	26.010 (13.148)
	<i>Number of boys – number of girls</i>	<i>11.414</i> (13.452)	<i>-26.02</i> (20.380)	<i>40.003</i> (18.016)
	If more than three boys or more than three girls	-41.658 (64.389)	-93.327 (91.693)	12.815 (91.304)
(5)	If at least one boy (0 if no sons yet)	81.451 (14.76)	67.973 (23.360)	95.462 (18.928)
	If at least one (0 if no daughter yet)	28.570 (14.704)	43.127 (23.360)	22.140 (18.975)
	<i>If at least one boy – if at least one girl</i>	<i>52.881</i> (21.481)	<i>24.846</i> (34.791)	<i>73.322</i> (27.383)
(6)	After first child, boy (0 if no child, or first child girl)	118.405 (18.543)	129.375 (29.975)	111.754 (23.599)
	After first child, girl (0 if no child, or first child boy)	53.650 (19.193)	75.206 (31.078)	42.832 (24.429)
	<i>After first child boy – after first child girl</i>	<i>64.755</i> (24.354)	<i>54.169</i> (39.402)	<i>68.922</i> (31.009)
(7)	(Exactly) one boy	85.591 (14.806)	85.125 (23.832)	93.356 (18.991)
	(Exactly) one girl	22.517 (14.851)	25.020 (23.760)	25.172 (19.123)
	<i>One boy – one girl</i>	<i>63.074</i> (21.634)	<i>60.105</i> (35.114)	<i>68.184</i> (27.562)
	(Exactly) two boys	81.582 (21.414)	52.194 (31.985)	114.162 (29.168)
	(Exactly) two girls	54.743 (22.042)	67.999 (33.196)	51.885 (29.612)
	<i>Two boys – two girls</i>	<i>26.839</i> (29.460)	<i>-15.805</i> (45.625)	<i>62.277</i> (39.466)
	(Exactly) three boys	99.830 (37.997)	21.480 (52.158)	206.652 (57.288)
	(Exactly) three girls	65.839 (38.530)	65.223 (56.197)	89.574 (53.255)
	<i>Three boys – three girls</i>	<i>33.991</i> (51.243)	<i>-43.743</i> (71.913)	<i>117.078</i> (74.952)
	If more than three boys or more than three girls	21.163 (65.424)	-82.059 (92.80)	136.443 (93.361)

Additional regressors include dummy variables for marital status, years of education, and age. Fixed-effects estimates, standard errors in parentheses.

might shift parents' constraints. If the returns to educating sons are greater than the returns to educating daughters, parents may work more if they have sons relative to daughters in order to finance their education. Although there is limited evidence to suggest that parents spend more on sons' education than they do on daughters' education, the magnitudes would be too small to explain the difference in wages and labor supply of parents of boys relative to girls (Taubman, 1990).

Parents' lifetime constraint sets may also differ by child gender if they expect more old-age support from daughters relative to sons. It is often observed that women are more likely to care for elderly parents than are men, perhaps because the opportunity cost of women's time at the age at which parents need care is lower than the opportunity cost of men's time. However, McGarry (1998) finds that men are less likely to care for elderly parents only if

they have sisters, and that men with only male siblings are no less likely to care for parents than are women from women-only families. This implies that the labor supply effects of "at least one son" versus "at least one daughter" would not be due to anticipated differences in old-age support.

Moreover, if the effects of children's gender are due only to pecuniary factors such as differential costs or old-age support from sons and daughters, we would expect to find some effects on women's outcomes, as well. This would be particularly true for an old-age support motive, as women are more likely to outlive their husbands and require care in old age.

One additional way that children may affect parents' constraints is through demonstration effects. Fathers or families may believe it is more important to model the traditional male role in society for sons than for daughters.

TABLE 8.—THE EFFECTS OF SONS VERSUS DAUGHTERS ON WAGES AND HOURS MARRIED MEN VERSUS UNMARRIED MEN

Dependent Variable	Eq. No.	Difference in Coefficients	Married			Not Married		
			Full Sample	Early Cohort	Late Cohort	Full Sample	Early Cohort	Late Cohort
Log Real Wage Rate	(4)	Number of boy – number of girls	0.021 (0.011)	0.025 (0.016)	0.012 (0.015)	-0.22 (0.071)	-0.064 (0.129)	-0.335 (0.089)
	(5)	If at least one boy – if at least one girl	0.024 (0.018)	0.040 (0.028)	0.012 (0.021)	-0.024 (0.097)	-0.143 (0.174)	-0.362 (0.12)
	(6)	After first child boy – after first child girl	0.062 (0.021)	0.062 (0.033)	0.054 (0.026)	-0.25 (0.091)	-0.066 (0.16)	-0.40 (0.115)
	(7)	One boy – one girl	0.030 (0.017)	0.042 (0.028)	0.019 (0.023)	-0.180 (0.101)	-0.124 (0.185)	-0.224 (0.125)
		Two boys – two girls	0.049 (0.024)	0.050 (0.035)	0.042 (0.032)	-0.734 (0.17)	-0.388 (0.412)	-0.722 (0.21)
	Three boys – three girls	0.129 (0.041)	0.139 (0.056)	0.095 (0.060)	-0.420 (0.35)	-0.180 (0.619)	-1.17 (0.58)	
	Sample size ( <i>N</i> )		21803	9927	11876	3952	1163	2789
Annual Hours of Work	(4)	Number of boy – number of girls	17.7 (13.9)	-8.71 (21.1)	39.1 (18.5)	33.3 (97.5)	96.3 (165)	7.09 (129)
	(5)	If at least one boy – if at least one girl	58.1 (22.2)	42.6 (36.1)	72.5 (28.1)	103.05 (134)	238.4 (221)	58.6 (172)
	(6)	After first child boy – after first child girl	63.3 (26.2)	70.4 (42.5)	57.1 (33.2)	71.2 (127)	258.6 (205)	-36.9 (167)
	(7)	One boy – one girl	64.8 (22.2)	69.9 (36.3)	65.5 (28.2)	139.2 (140)	456 (236)	45.4 (181)
		Two boys – two girls	37.1 (30.3)	15.3 (46.3)	56.4 (40.3)	23.55 (228)	-45 (531)	-66.5 (301)
	Three boys – three girls	47.5 (51.9)	-8.42 (84.4)	125.9 (74.5)	204.2 (484)	929 (802)	400 (799)	
	Sample size ( <i>N</i> )		22140	10072	12068	4065	1176	2889

Additional regressors include dummy variables for years of education and age. Fixed-effects estimates; standard errors in parentheses.

The alternative to a constraint explanation for fathers' responses to child gender is a preference explanation. If men prefer sons to daughters or value the time spent with sons more highly, then the value of marriage (or at least coresidence) with the child's mother will be higher for fathers of sons. Morgan et al. (1988) find that the birth of a son relative to a daughter increases the likelihood that a marriage will survive by approximately 7% points using data from the U.S. Census.<sup>16</sup> Reduced probability of marital dissolution will increase the returns to marriage-specific investments, and we would expect this to lead to greater specialization within the marriage. This is consistent with our finding that husbands work more in the labor market after a son is born relative to a daughter, but not with our finding of no differential increase in home production by mothers of sons.

We can also analyze the effects of child gender in the context of a bargaining model with a divorce threat point in which husbands and wives each allocate their resources to the production of household public goods and to private goods. If men prefer sons and divorce causes a reduction in the child services that fathers receive, they will contribute more to household public goods and less to their private consumption of leisure in a marriage with sons. Our labor

supply results are consistent with this story, but the bargaining framework implies that child gender should affect the intrahousehold distribution of goods and time more generally. Yeung et al. (1999) (and others) find that boys spend more time with fathers than do girls. This suggests that the increased work intensity of men with sons is not at the expense of their contribution to the child care component of household production, and is also consistent with the bargaining model.<sup>17</sup>

The theoretical models underlying the last two explanations are relevant only for two-parent families. We therefore have rerun the analyses for married and unmarried men, separately. These results are summarized in table 8. We find that the boy versus girl effects are larger and generally more

<sup>16</sup> Their findings are supported by those of Mott (1994) and Katzev, Warner, and Acock (1994), who use data from the NLSY and National Survey of Families and Households, respectively. Teachman and Schollaert (1989) find that women are likely to have a second child sooner when the first child is a son rather than a daughter, but this is attributed entirely to the reduced likelihood of marital dissolution due to the birth of the son.

<sup>17</sup> The dependence of other family outcomes, including divorce, on the gender of children suggests a couple of ways in which the relationship between children's gender and labor supply and wages might be spurious. First, Korenman and Neumark (1991) show that the marriage premium increases with the duration of the marriage. If having sons relative to daughters increases the duration of a marriage, the gender effects may be proxying the effects of marriage duration. In appendix tables A3 and A4, we report the results of the analyses reported in tables 6 and 7 when length of marriage, and its square, are included in the regressions. The findings on the gender effects change little. Second, Teachman and Schollaert's finding that having a son as a first child speeds the transition to having a second child would suggest that the effect of a first boy on labor market outcomes may be due to the fact that families with first sons are, on average, larger than families with first daughters. However, we found that including total number of children in the specifications including *FIRBOY/FIRGIRL* and *IFBOY/IFGIRL* did not affect the magnitude or significance of the results.

significant for married men. However, for unmarried men, we find that the coefficients on the “boys” variables tend to be smaller than the coefficients on the “girls” variables. This suggests to us that selection bias is an issue when analyzing the data by fathers’ marital status. In particular, because parents of boys are less likely to divorce than are parents of girls, if men with less favorable unobservables are more likely to divorce, then divorced fathers of boys are a more “negatively selected” pool than are divorced fathers of girls.

## VI. Conclusion

In this paper, we have estimated the effects of children, both total and by gender, on men’s labor supply and hourly wages. We find that fatherhood results in significantly higher wages and labor supply. We find that the relationship between children and labor market outcomes for fathers has changed: men born after 1950 have larger labor supply responses to children than do men from earlier cohorts. Also, the child effects are nonlinear, with positive incremental effects on men’s hours and wages limited to the first two children.

Most strikingly, we find that men’s outcomes respond differently to the births of sons rather than daughters. For the earlier cohort, there is some evidence that both wages and hours are higher after having sons relative to daughters; for the later cohort, there are very strong and highly significant effects of sons versus daughters on hours worked.

Our findings have several implications. First, although the role of children is typically ignored in studies of male labor supply and wage determination, fatherhood has quantitatively and statistically significant effects on both outcomes. Second, because we observe increases in both hourly wages and annual hours of work for fathers, increased specialization of husbands and wives in response to parenthood is the dominant pattern for both early and late cohorts. Third, the increase in men’s hourly wage rates suggests that additional research into the source of this “fatherhood premium” and its relationship to human capital investments, job changes, or promotions is warranted.

Finally, the increased commitment to the labor market that men demonstrate after having sons relative to daughters provides surprising evidence of the significance of child gender for families in the United States. Because we did not find evidence of gender effects on mother’s labor supply, it appears that the “first round” effects on household outcomes arise through the behavior of fathers, not mothers.<sup>18</sup> In conjunction with other research on the effects of child gender on divorce and father’s time with children, our results suggest that sons increase the value of marriage and family life for men.

<sup>18</sup> This echoes the findings in the child development literature summarized by Maccoby (1998) that mothers’ behavior towards sons and daughters tends to be more similar than that of fathers.

## REFERENCES

- Angrist, Joshua, and William Evans, “Children and Their Parents’ Labor Supply: Evidence from Exogenous Variation in Family Size,” *American Economic Review* 88:3 (1998), 450–477.
- Becker, Gary S., “Human Capital, Effort, and the Sexual Division of Labor,” *Journal of Labor Economics* 3:1 (1985), S33–58.
- Behrman, Jere, “Intrahousehold Distribution and the Family” (pp. 125–187), in Mark Rosenzweig and Oded Stark (Eds.), *Handbook of Population and Family Economics* (New York: Elsevier, 1997).
- Browning, Martin, “Children and Household Economic Behavior,” *Journal of Economic Literature* 30:3 (1992), 1434–1475.
- Butcher, Kristen, and Anne Case, “The Effect of Sibling Sex Composition on Women’s Education and Earnings,” *Quarterly Journal of Economics* 109:3 (1994), 531–563.
- Gray, Jeffrey S., “The Fall in Men’s Return to Marriage,” *Journal of Human Resources* 32:3 (1997), 481–504.
- Huber, P. J., “The Behavior of Maximum Likelihood Estimates Under Non-Standard Conditions” (pp. 221–233), in *Proceedings of the Fifth Berkeley Symposium in Mathematical Statistics and Probability* (Berkeley: University of California Press, 1967).
- Katzev, A. R., R. L. Warner, and A. C. Acock, “Girls or Boys—Relationship of Child Gender to Marital Instability,” *Journal of Marriage and the Family* 56:1 (1994), 89–100.
- Korenman, Sanders and David Neumark, “Does Marriage Really Make Men More Productive?” *Journal of Human Resources* 26:2 (1991), 282–307.
- , “Marriage, Motherhood and Wages,” *Journal of Human Resources* 27:2 (1992), 233–255.
- Lillard, Lee, and Linda Waite, “Panel vs. Retrospective Data on Marital Histories: Lessons from the PSID” (pp. 243–253), in H. V. Beaton et al. (Eds.), *Individuals and Families in Transition: Understanding Change Through Longitudinal Data* (Washington, DC: U.S. Bureau of Census, 1990).
- Lundberg, Shelly, “Labor Supply of Husbands and Wives: A Simultaneous Equations Approach,” this REVIEW 70:2 (1988), 224–235.
- Lundberg, Shelly, and Elaina Rose, “The Determinants of Specialization within Marriage,” University of Washington mimeograph (March 1999).
- , “Parenthood and the Earnings of Married Men and Women,” *Labour Economics* (July 2000a), 689–710.
- , “Child Gender and the Transition to Marriage From Single Motherhood,” University of Washington mimeograph (October 2000b).
- Maccoby, Eleanor E., *The Two Sexes: Growing Up Apart, Coming Together* (Cambridge, MA: Harvard University Press, 1998).
- McGarry, Kathleen, “Caring for the Elderly: The Role of Adult Children” (pp. 133–163), in David A. Wise (Ed.), *Inquiries in the Economics of Aging* (Chicago: University of Chicago Press, 1998).
- Morgan, S. Philip, Diane Lye, and Gretchen Condron, “Sons, Daughters and the Risk of Marital Disruption,” *American Journal of Sociology* 94:1 (1988), 110–129.
- Mott, Frank L., “Sons, Daughters and Father’s Absence—Differentials in Father-Leaving Probabilities and in-Home Environments,” *Journal of Family Issues* 15:1 (1994), 97–128.
- Mroz, Thomas A., “The Sensitivity of an Empirical Model of Married Women’s Hours of Work to Economic and Statistical Assumptions,” *Econometrica* 55:3 (1987), 765–799.
- Neumark, David, and Sanders Korenman, “Sources of Bias in Women’s Wage Equations: Results Using Sibling Data,” *Journal of Human Resources* 29:2 (1994), 379–405.
- Parish, William L., and Robert J. Willis, “Daughters, Education and Family Budgets: Taiwan Experiences,” *Journal of Human Resources* 28:4 (1993), 863–898.
- Pencavel, John, “Labor Supply of Men: A Survey” (pp. 3–102), in Orley Ashenfelter and Richard Layard (Eds.), *Handbook of Labor Economics*, Volume I (New York: Elsevier, 1986).
- Rendall, M. S., L. Clarke, H. E. Peters, and G. Verropoulou, “Incomplete Reporting of Men’s Fertility in the U.S. and Britain: A Research Note,” *Demography* 36:1 (1999), 135–144.
- Rose, Elaina, “Consumption Smoothing and Excess Female Mortality in Rural India,” this REVIEW 81:1 (1999), 41–49.
- , “Gender Bias, Credit Constraints and Time Allocation in Rural India,” *The Economic Journal* 110:465 (2000), 738–758.

- Rosenzweig, Mark, and T. Paul Schultz, "Market Opportunities, Genetic Endowments, and Intrafamily Resource Distribution: Child Survival in Rural India," *American Economic Review* 72:4 (1982), 803–815.
- Taubman, Paul, "Discrimination within the Family: The Treatment of Daughters and Sons" (pp. 25–42), in Emily P. Hoffman (Ed.), *Essays on the Economics of Discrimination* (Kalamazoo, MI: W.E. Upjohn Institute for Employment Research, 1990).
- Teachman, Jay D., and Paul T. Schollaert, "Gender of Children and Birth Timing," *Demography* 26:3 (1989), 411–423.
- Waldfogel, Jane, "The Effects of Children on Women's Wages," *American Sociological Review* 62 (1997), 209–217.
- , "Understanding the 'Family Gap' in Pay for Women with Children," *Journal of Economic Perspectives* 12:1 (1998), 137–156.
- Yeung, W. Jean, et al., "Children's Time with Fathers in Intact Families," University of Michigan mimeograph (March 1999).

## APPENDIX

TABLE A1.—THE EFFECT OF CHILDREN ON (LOG REAL HOURLY) WAGE

Cohort (N)		(1) OLS	(2) OLS	(3) FE	(4) FE
All (25,755)	Number of children:	0.01 (0.01)		0.037 (0.005)	
	1		0.020 (0.021)		0.071 (0.012)
	2		0.070 (0.026)		0.131 (0.014)
	3		0.073 (0.033)		0.126 (0.019)
	4		−0.040 (0.065)		0.114 (0.028)
	5		−0.071 (0.125)		0.167 (0.053)
	6		−0.484 (0.511)		−0.221 (0.109)
	7		−0.685 (0.375)		−0.434 (0.197)
Early (11,090)	Number of children:	0.007 (0.017)		0.037 (0.008)	
	1		0.019 (0.043)		0.097 (0.019)
	2		0.076 (0.048)		0.182 (0.021)
	3		0.064 (0.057)		0.138 (0.029)
	4		−0.105 (0.102)		0.088 (0.040)
	5		0.123 (0.138)		0.196 (0.073)
	6		0.014 (0.227)		0.048 (0.157)
	7		−0.687 (0.379)		−0.374 (0.198)
Late (14,665)	Number of children:	0.014 (0.013)		0.039 (0.008)	
	1		0.030 (0.024)		0.057 (0.015)
	2		0.074 (0.029)		0.098 (0.018)
	3		0.088 (0.040)		0.127 (0.026)
	4		0.056 (0.073)		0.167 (0.041)
	5		−0.354 (0.136)		0.151 (0.079)
	6		−0.798 (0.710)		−0.40 (0.152)
	7		0.0 (0.0)		0.0 (0.0)

Additional regressors include dummy variables for year of observation, years of education, age, and if married. Standard errors in parentheses.

TABLE A2.—THE EFFECT OF CHILDREN ON ANNUAL HOURS WORKED

Cohort ( <i>N</i> )		(1) OLS	(2) OLS	(3) FE	(4) FE
All (26,205)	Number of children:	37.321 (10.557)		32.869 (7.055)	
	1		68.431 (22.983)		82.014 (14.849)
	2		138.784 (25.596)		108.044 (17.729)
	3		139.198 (34.375)		113.505 (24.545)
	4		126.569 (66.627)		151.424 (36.558)
	5		-28.354 (131.40)		96.996 (66.782)
	6		-241.498 (391.595)		-168.659 (140.288)
	7		542.48 (443.952)		-111.059 (225.275)
Early (11,248)	Number of children:	39.084 (16.405)		21.429 (10.486)	
	1		111.625 (39.975)		102.335 (24.223)
	2		174.402 (41.648)		102.776 (27.637)
	3		136.768 (52.799)		99.997 (37.364)
	4		184.436 (102.632)		90.991 (51.881)
	5		-11.553 (184.471)		21.903 (93.366)
	6		320.331 (345.975)		30.671 (206.745)
	7		927.751 (108.740)		141.281 (247.532)
Late (14,957)	Number of children:	35.494 (13.709)		46.496 (9.606)	
	1		41.198 (27.631)		71.735 (18.815)
	2		119.703 (31.685)		120.177 (23.195)
	3		156.065 (45.410)		136.872 (32.841)
	4		78.182 (78.217)		233.055 (52.635)
	5		-80.628 (216.475)		179.564 (96.554)
	6		-565.50 (449.038)		-361.981 (194.292)
	7		-1903.692 (119.201)		-1514.531 (582.496)

Additional regressors include dummy variables for year of observation, years of education, age, and if married. Standard errors in parentheses.



TABLE A3.—THE EFFECT OF SONS VERSUS DAUGHTERS ON (LOG REAL HOURLY) WAGE

Cohort ( <i>N</i> )		(1) FE	(2) FE	(3) FE	(4) FE
All (25,755)	Length of marriage	0.012 (0.002)	0.012 (0.002)	0.012 (0.002)	0.010 (0.002)
	(Length of marriage) <sup>2</sup>	-0.001 (0.000)	-0.001 (0.000)	-0.001 (0.000)	-0.001 (0.000)
	Number of boys – number of girls	0.008 (0.011)			
	If at least one boy – if at least one girl		-0.004 (0.016)		
	After first child boy – after first child girl			0.011 (0.018)	
	One boy – one girl				0.001 (0.017)
	Two boys – two girls				0.011 (0.022)
	Three boys – three girls				0.096 (0.040)
Early (11,090)	Length of marriage	0.013 (0.003)	0.013 (0.003)	0.012 (0.003)	0.013 (0.003)
	(Length of marriage) <sup>2a</sup>	-0.001 (0.000)	-0.001 (0.000)	-0.001 (0.000)	-0.001 (0.000)
	Number of boys – number of girls	0.032 (0.016)			
	If at least one boy – if at least one girl		0.032 (0.026)		
	After first child boy – after first child girl			0.054 (0.030)	
	One boy – one girl				0.024 (0.027)
	Two boys – two girls				0.043 (0.034)
	Three boys – three girls				0.152 (0.055)
Late (14,665)	Length of marriage	0.016 (0.004)	0.017 (0.004)	0.018 (0.004)	0.014 (0.004)
	(Length of marriage) <sup>2</sup>	-0.001 (0.000)	-0.001 (0.000)	-0.001 (0.000)	-0.001 (0.000)
	Number of boys – number of girls	-0.016 (0.014)			
	If at least one boy – if at least one girl		-0.028 (0.021)		
	After first child boy – after first child girl			-0.023 (0.024)	
	One boy – one girl				-0.019 (0.022)
	Two boys – two girls				-0.014 (0.029)
	Three boys – three girls				0.024 (0.058)

Additional regressors include dummy variables for years of education, age, and if married. Fixed-effects estimates, standard errors in parentheses.

TABLE A4.—THE EFFECT OF SONS VERSUS DAUGHTERS ON ANNUAL HOURS OF WORK

Cohort ( <i>N</i> )		(1) FE	(2) FE	(3) FE	(4) FE
All (26,205)	Length of marriage	3.222 (2.627)	2.999 (2.581)	3.209 (2.545)	2.558 (2.642)
	(Length of marriage) <sup>2</sup>	-0.173 (0.111)	-0.149 (0.111)	-0.143 (0.110)	-0.137 (0.112)
	Number of boys – number of girls	11.552 (13.521)			
	If at least one boy – if at least one girl		53.047 (21.478)		
	After first child boy – after first child girl			64.489 (24.375)	
	One boy – one girl				63.257 (21.633)
	Two boys – two girls				26.465 (29.589)
	Three boys – three girls				35.048 (51.695)
Early (11,248)	Length of marriage	4.873 (3.414)	3.492 (3.350)	3.267 (3.312)	3.772 (3.424)
	(Length of marriage) <sup>2</sup>	-0.239 (0.131)	-0.183 (0.130)	-0.167 (0.129)	-0.192 (0.132)
	Number of boys – number of girls	-25.261 (20.192)			
	If at least one boy – if at least one girl		25.821 (34.817)		
	After first child boy – after first child girl			54.91 (39.423)	
	One boy – one girl				60.885 (35.094)
	Two boys – two girls				-16.404 (45.497)
	Three boys – three girls				-40.125 (72.067)
Late (14,957)	Length of marriage	3.049 (4.721)	4.372 (4.666)	4.847 (4.629)	2.912 (4.768)
	(Length of marriage) <sup>2</sup>	-0.125 (0.260)	-0.145 (0.261)	-0.124 (0.262)	-0.112 (0.263)
	Number of boys – number of girls	39.793 (18.032)			
	If at least one boy – if at least one girl		73.107 (27.379)		
	After first child boy – after first child girl			67.831 (30.993)	
	One boy – one girl				68.214 (27.574)
	Two boys – two girls				61.8 (39.483)
	Three boys – three girls				116.277 (74.901)

Additional regressors include dummy variables for years of education, age, and if married. Fixed-effects estimates, standard errors in parentheses.