

## Sibship Sex Composition: Effects on Educational Attainment

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This study decomposes the detrimental effects of increased sibship on educational attainment by the sex of the respondent and his/her siblings. Previous theories regarding the interaction of gender and sibship sex composition are reviewed and a new hypothesis is offered: a revision of the *sex minority* hypothesis, positing that an increased number of siblings of the opposite sex (regardless of the of the respondent's gender) are harmful to educational achievement since sex minority children may find their gender-specific needs unmet, may suffer from socialization by the family that conflicts with sex role expectations within the educational system, or because there may exist returns to scale for "gender-specific" goods within the household. Findings reveal that it is the number of opposite sex siblings that most hurts educational attainment efforts, marshalling support for the revised sex minority hypothesis. © 2000 Academic Press

Stratification theorists have long been interested in how the structure of one's family of origin affects an individual's life chances. In this vein, past research has shown, for example, that coming from a large family hurts the life chances of a child (Blau and Duncan, 1967; Featherman and Hauser, 1978; Blake, 1981, 1989; Heer, 1985; Powell and Steelman, 1993). Like most aspects of family background, the effect of sibship size is primarily mediated through the educational system and has been shown to manifest in dependent measures such as IQ and educational attainment (Duncan, 1968; Blake, 1986; Powell and Steelman, 1993). For instance, Featherman and Hauser (1978: pp. 242–243) find that the presence of each additional sibling decreases an individual's completed years of education by a fifth of a grade (holding other background variables constant).<sup>1</sup>

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<sup>1</sup> The entire literature on educational attainment is vast and beyond the scope of this article. For a good review see, for instance, Haveman and Wolfe (1994) or Kuo and Hauser (1997).

In explaining the reasons why sibling constellation matters in determining educational success, researchers have generated—but not come to resolution on—several competing hypotheses. These explanations have alternatively relied on economic, genetic, and social-psychological arguments to address the mechanisms by which family structure has its effects on children. Some researchers attribute the negative effect of increased sibship to a genetic dynamic (Grotevant, Scarr, and Weinberg, 1977). Those who have more children—according to the genetic paradigm—tend to have lower IQs and pass this disadvantage on to their children; thus, according to this theory, if parents' IQs were adequately controlled, the effect of sibship would disappear.<sup>2</sup> However, the extent to which IQ is heritable remains highly contested (Higgins, Reed, and Reed, 1982) and by controlling for parental education (in addition to other variables) researchers may, in fact, be partially accounting for parental intelligence (Downey, 1995).<sup>3</sup>

Among those who do believe such an effect indeed exists there are two schools of thought as to why. Some researchers have hypothesized that the negative effect of coming from a large sibling cohort on educational and socioeconomic attainment is primarily a result of the strain on parental resources that a large number of children evinces (Anastasi, 1956; Heer, 1985; Blake, 1986; Steelman and Powell, 1989). Specifically, if there are more mouths to feed and tuitions to pay and more children to help with their homework, each child receives fewer monetary and nonmonetary resources towards their intellectual development. This *resource dilution* hypothesis is the most widely accepted explanation (Steelman and Powell, 1989; Powell and Steelman, 1993) and has been lent support by studies that account for the division of educational resources and time allotment within the family (Lindert, 1978; Steelman and Powell, 1989; Powell and Steelman, 1993). The resource dilution hypothesis is also supported by the fact that the detrimental effects of sibship size are greater for individuals coming from poor families where monetary resources are already scarce than those who grow up in nonpoor families where parents may be able to provide economic advantages to each child even when there is a great number of them (Steelman and Mercy, 1980). Perhaps the single greatest support for the resource dilution model comes from the recent work of Downey (1995) who shows that a range of intervening measures of parental educational resources explain much of the effect of sibship size.<sup>4</sup>

The major alternative theory to the resource dilution model is the *confluence*

<sup>2</sup> In fact, some recent work using fixed effects (first difference) models finds no effect of a *change* in sibship size on cognitive development (Guo and Van Wey, 1999), though others question the merits of this approach (Downey, Powell, Steelman, and Pribesh, 1999).

<sup>3</sup> The current study speaks directly to this, since any effect of sibship sex composition should be immune to genetic influences to the extent that sex composition is orthogonal to parental IQ. This would support the notion that there is an effect of the sibship environment more generally.

<sup>4</sup> However, he includes nine intervening measures (four interpersonal and five economic resource indicators) which—due to multicollinearity problems—could make the coefficient for sibship size become insignificant without substantive importance. It is impossible to tell whether this is the case

*model.* This competing paradigm attributes the negative effect of sibling size to the psychological climate of the family (Zanjong, 1976). This theory suggests that a family with a lot of children or one with many spaced close together in age results in a relatively inferior intellectual climate since children dominate the environment as opposed to adults who have a greater influence on the intellectual milieu of a small family. In essence, this theory suggests that it is not the number of siblings per se that matter, but rather the age distribution in the household environment.<sup>5</sup>

## GENDER CONFIGURATION

In trying to decompose the effect of sibship size, researchers have looked at a variety of measures in the family constellation such as birth order, sibship density, and sex composition. One of the more recent and interesting additions to the literature is the separation of siblings into brothers and sisters. An effect of sibship sex composition on educational attainment may be anticipated under both the confluence and the resource dilution models.<sup>6</sup> Given the advantage on standardized tests that males enjoy (Powell and Steelman, 1984), the presence of brothers may be less disadvantageous if they pass this structural advantage onto the family unit (Powell and Steelman, 1990). This interpretation would support the confluence model. A resource dilution explanation would be suggested by the literature that documents the higher returns to education for men (Becker, 1964). Given differential returns to education by sex, parents might be more likely to invest in the educations of male children and thus a greater number of brothers should disadvantage an individual's educational efforts more than additional sisters—as Powell and Steelman (1989) hint at in their study of college financing. [That said, in another study these same authors found that parents favored female offspring slightly with respect to paying for college (Stelman and Powell, 1991).]

Powell and Steelman (1990) offer a third explanation for effects of sibling sex

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without viewing the full model to determine whether the added variables represent a significant improvement to the model (he presents only the coefficient for sibship size).

<sup>5</sup> If household resources are conceived of as largely intellectual, then the confluence model can be at least partially subsumed under the resource dilution hypothesis.

<sup>6</sup> Demographers have long found that gender on a structural—as opposed to individual—level is a significant predictor of outcomes such as marriage and divorce rates (Guttentag and Secord, 1983; Bennett, Bloom, and Craig, 1989). Even with respect to familial dynamics, the gender composition of the sibling constellation has been shown to be important. For instance, relationships have been shown between sibship sex composition and a variety of behavioral indicators such as running away from home (Johnson and Peck, 1978), criminality (Griffiths and Rundle, 1976) and male homosexuality (Suarez and Pryzbeck, 1980). However, all these studies have severe methodological limitations, most notably that respondents are sampled on the dependent variable without a corresponding control group. In the study most relevant to educational achievement, McCandless and Gigliotti find that the presence of female siblings tends to facilitate opportunities for independence, especially among male children (1988).

ratio: the *normative climate* hypothesis. According to this theory, a family with more male children will more likely have male role expectations socialized into all the children, regardless of their individual sex. Such role expectations are beneficial to children's educational achievement efforts in a society that still instills psychological advantages to males at critical educational junctures. Thus, additional brothers would prove less detrimental than additional sisters, regardless of the sex of the respondent him/herself. This effect is aside from issues of funding and intra-family resource allocation that may work in the opposite direction. However, even with such issues aside, when just conceived as a social-psychological theory of the household milieu, the normative climate hypothesis views the individuals within a family as a whole, rather than considering how each family member reacts to the entire household situation around him/her. For example, there is no reason to assume that males would pass a structural advantage in test taking onto the sibling constellation as a whole. Rather, it may be the case that a female with many brothers chooses not to compete with them in the arena of standardized tests where she is at a disadvantage by virtue of her gender. Instead, faced with stiff, intra-familial competition, she may opt to develop other skills at the expense of her academic progress. The same may be true with respect to how parents interact with their children or how they distribute educational financing within the family. Each child occupies a unique economic and psychological position within the unit by virtue of his/her gender, birth order, and number of siblings.

There is a theory of gender that does take into consideration the possibility of a differential impact of brothers and sisters by sex of the respondent: Rosenberg's "sex minority" hypothesis (1965). According to this theory, if an individual is a minority with respect to gender in his/her sibling constellation, then he/she will enjoy a special status, particularly with respect to parental attachment and expectations. This effect is posited to hold especially true for individuals who are themselves the only male/female among multiple siblings of the opposite sex. Self-esteem, parent-child ties, and adolescent perceptions of parental orientations have been shown to be stronger in certain sex minority children (see Rosenberg, 1965; Kidwell, 1981, 1982; Smith, 1984). For instance, only sons with older sisters were found to have a more failure-resistant form of self-esteem (Rosenberg, 1965). Further, female adolescents in families with a majority of male children have more accurate perceptions of their mothers' educational goals (Smith, 1984). Such psychological dynamics, combined with special economic treatment of sex minority children should—according to the paradigm—result in more successful educational outcomes among this group. According to Rosenberg's model, siblings of the opposite sex should place the respondent into a "special role" in contrast to ones of the same gender and thus should be the least disadvantageous siblings to have. Despite the theoretical appeal of this "special child" hypothesis, little empirical work has substantiated this claim with respect to achievement.

In light of the lack of support for the sex minority hypothesis, I suggest an

alternative hypothesis regarding the differential effects of brothers and sisters. This "revised sex minority hypothesis" suggests that it is more disadvantageous to have additional siblings of the opposite sex than of the same sex, regardless of the gender of the respondent him/herself. This paradigm posits that same sex siblings may stimulate a competitive, achievement-orientated environment among children while opposite sex ones may engender a more sociable, less aggressive environment. At the same time, opposite sex siblings may disadvantage individuals' educational attainment efforts by virtue of the fact that if an individual is a gender minority within the household, he/she may be socialized into gender roles that do not accord with the expectations of the educational system. In other words, there may be a mismatch between the skills that are socialized into a boy or a girl at home and the role expectations placed upon that individual by teachers and peers at school. Such role conflict may hurt his/her achievement efforts. Further, if a student comes from a household in which he/she is a minority with respect to gender, he/she may find him/herself receiving less gender-specific attention to his/her needs than in a family in which he/she forms a part of the dominant household culture. In other words, if parents are habituated to helping young women and likewise, an adolescent girl has siblings of the same sex who have gone (or are going) through the same gender-specific difficulties, then she may enjoy the advantage of their experience and expertise while a young man in the same family may receive less direct emotional support with respect to male-specific role issues (as would be true of the converse situation). Finally, it may be that there are returns to scale for gender-specific investments within the household. A dollar spent on "boys' stuff" in a household with two male children gets perhaps twice the return as the good purchased in a household with a female and male child. I am not arguing that there are inherently different sets of goods (i.e., toys or educational devices) for females and males, but if society or the family socializes the child into neglecting resources that are labeled as appropriate for the opposite gender, the child may not fully utilize the good as s/he would one that were deemed gender appropriate.

Despite such tantalizing theories, no clear relationship between sibship sex composition and educational attainment has been demonstrated as of yet. Powell and Steelman have found mixed results with respect to gender and sibship. In one study they examine high school grades and standardized test scores (verbal and mathematics). They find that there is no effect of sex composition on standardized test scores (Powell and Steelman, 1990) as would be suggested by the normative climate hypothesis. Meanwhile, they do find that additional brothers hurt grades more than additional sisters do. However, both brothers and sisters have the same sign (negative) and they provide no formal test whether the difference in these coefficients is significant (an examination of the standard errors suggests that they may be statistically indiscernible). In another study, they find that the number of brothers negatively affects parental financial contributions to college expenses while the number of sisters does not (Powell and

Steelman, 1989); however, this study is limited by its sample (from only two large, public universities) and its lack of an educational outcome variable.

Butcher and Case (1994) use data from the Panel Study of Income Dynamics (PSID), National Longitudinal Survey of Women (NLSW), and the Current Population Survey (CPS) to make the argument that women raised with more brothers (controlling for family size) do significantly better than those raised with sisters; they further assert that this effect has declined over the course of the century (perhaps in line with greater equity for female individuals). However, in the same work, Butcher and Case find no significant effect for men. There are several limitations to their study. First, they exclude blacks from their analysis. By pursuing this strategy, they eliminate a sizable portion of the low-income study population. This group may be particularly salient to the study of sibship constraints since research has shown that additional siblings demonstrate a greater effect for poor households where resources are already spread thinly (Steelman and Mercy, 1980). On their restricted sample, Butcher and Case (1994) examine means and run regression models with sibship sex composition predictor variables to mixed results. They find no effect for a percentage of female siblings term; the variable for which they do find an occasional significant effect is a dummy indicator for the presence of “any sisters” and that for “any brothers” within the sibling constellation. This finding, while interesting, is hardly a robust measure upon which one can close the book on “sibship sex composition.”

More recent work questions their findings. Kaestner (1997) uses data from the National Longitudinal Survey of Youth (NLSY) and finds no effects of sibship gender configuration on attainment or achievement among whites—“although among black adults, those who grew up with a sister, or who had relatively more sisters, had greater levels of educational attainment than black adults with no or fewer sisters” (1997: p. 250). His sample is limited by its young age (for the analysis of adult educational attainment, the mean is 33 years) and the lack of cohort variation. Hauser and Kuo (1998) analyze data from the 1973 Occupational Changes in a Generation Survey (OCG II), the 1986 to 1988 Surveys of Income and Program Participation (SIPP), and the National Survey of Families and Households (NSFH). They claim that Butcher and Case overinterpreted weak evidence and state that they find no convincing support for any hypothesis suggesting an effect of the gender composition of sibships but rather a mix of negative and positive coefficients for the presence of sisters (Hauser and Kuo, 1998). However, since they break up the sibling constellations into subgroups for detailed comparisons (i.e., those with two siblings in the various gender ratios, those with three, and so on) they may lose the power to determine a global effect. Table 1, below summarizes these studies in an easily comparable format.

## DATA AND RESEARCH STRATEGY

From the review of the literature presented above, it appears as though the book is far from closed on this issue. For my analysis, I chose to use respondents of the 1989 wave of the Panel Study of Income Dynamics (PSID) who were

TABLE 1  
Review of Previous Studies on Sibship Sex Composition and Education

Authors	Outcome	Data set	Findings	Limitations
Powell and Steelman (1989)	Parental financial assistance; reliance on other sources	Survey of two Midwestern public universities	Brothers hurt women's financial assistance from parents.	No educational outcome; nonrepresentative sample
Powell and Steelman (1990)	GPA, standardized test score	National Longitudinal Survey of High School Seniors of the Class of 1972	No effect on test scores; effect on GPA	No test for significant difference between brothers and sisters coefficients; no test of same sex versus opposite sex siblings
Butcher and Case (1994)	Years of schooling; Educational transitions	PSID NLSW CPS	Detrimental effect of sisters for women—strength depends on cohort; no effect for men.	Exclusion of African Americans; only significant term is dummy variable for "all" sisters or brothers.
Kaestner (1997)	Cognitive development; Years of schooling; educational transitions	NLSY	No effect for whites. For blacks, more sisters yields greater educational attainment	Young sample, no cohort effects tested
Kuo and Hauser (1998)	Years of schooling	OCG NSFH SIPP	No effects	No controls for social class; breaks up analysis into categories for sibship size

heads or wives (legal or nonlegal) at the time of the interview, who had at least one sibling and who were between ages 25 and 65, inclusive (see, Hill, 1992, or Duncan and Hill, 1989, for an extensive discussion of the PSID's merits). Though Butcher and Case (1994) also used the PSID, my sample and research strategy differs from theirs in several respects (see the description of their research methodology in the section above).<sup>7</sup> The strategy I follow in the analysis presented below is to use a single model to estimate main and interaction effects for both men and women so that we can know if gender composition effects are significantly different for the two groups. To this end, I include a term for the number of sisters the respondent has (controlling for the total number of siblings) and an interaction term constructed by multiplying the gender of the respondent

<sup>7</sup> They use the 1985 wave and exclude blacks; I use the 1989 sample, including all races. Their sample size is 3826 while mine is 7573. Hauser and Kuo (1998) use data sets with substantially larger samples.

and the number of sisters (along with a main effect for gender of the respondent). Thus, we can determine if effects significantly differ by gender of the respondent; that is, we can determine whether it is the gender composition of the sibship *per se* that matters or instead, whether it is the number of opposite and same sex siblings that counts. In all the models presented here, I predicted the total number of years of completed education, regardless of type of schooling (i.e., university versus postsecondary vocational training). All educational measures are coded as highest grade completed, with any postgraduate work recorded as 17 years of education, regardless of degree received. This is the formulation of the PSID. I also tested stage models: logistic regressions for the log-likelihood of graduating from high school and from college. The results were similar and are not presented here.

One additional concern relates to gender fertility preferences among parents. While overt, prenatal sex selection may be rare in the contemporary United States (Bennett, 1991), it may be the case that certain families stop having children based on having reached a desired sex composition among the group—i.e., two parents may keep having children until they finally get a boy/girl. It is possible that this type of sex selection has an association with social class. In other words, it may be possible that better educated families may be more likely to strive for an ideal of gender balance while more poorly educated ones may prefer males. Alternatively, the Trivers Willard hypothesis holds that lower class families should prefer female offspring since females are supposedly selected as mates more on physical beauty than on wealth and power. Since physical beauty is more orthogonal to social class than wealth or power, it is in the interest of lower SES families to have female offspring. While both of these dynamics are merely speculation, I nonetheless attempt to control for this possibility by including both parents' completed educations, repeatedly shown to be two of the most powerful background variables in models predicting educational attainment (Duncan, 1967; Featherman and Hauser, 1978; Sewell, Hauser, and Wolf, 1980).<sup>8</sup> There are a host of other variables that predict educational attainment that are not included in my models such as income, wealth, race/ethnicity, region, rural background, nativity and so on. Their omission is not an oversight. There is no reason to suspect that these variables should be anything but orthogonal to the effects of sibship sex composition.

A potentially important mediating variable that I have not included in my analysis is IQ. Setting aside the issue of whether IQ is a valid measure of "intelligence," some researchers have argued that the effect of sibship structure on educational attainment goes wholly through IQ; others postulate a residual (see Heer, 1985, for a review). Either way, the literature has adequately documented that the effects of sibling constellation on academic achievement are largely mediated through IQ. The PSID does not provide an intelligence measure

<sup>8</sup> I also ran orthogonal models with only number of siblings and gender composition of siblings (either percentage or number of the opposite sex), and results were the same.

TABLE 2  
 Sample Composition, 1989 respondents (heads and wives) from  
 the Panel Study of Income Dynamics (Unweighted  $N = 7573$ ).

Variable	Mean	<i>SD</i>
Respondents with all opposite sex siblings	.15	.36
Female respondents	.54	.50
Number of siblings	4.40	3.10
Number of sisters	2.14	1.87
Number of brothers	2.25	1.91
Father's education (HGC)	9.77	3.73
Mother's education (HGC)	10.36	3.33
Respondent's education	12.74	2.49
Age of respondent	39.41	10.87

for children in the sample. Thus, I cannot test whether the effects of sibship sex composition on educational attainment are also indirect through IQ. However, I do not think this undermines the importance of the research since educational attainment is an important outcome in its own right, determining to a large extent the life chances of individuals. Future researchers may want to document the extent to which the effects I present below are mediated through intelligence. Mean values and standard deviations for all variables included in the models are presented in Table 2 below.

## FINDINGS

With models specified according to the logic laid out above, I can test the importance of sibship gender composition by the gender of respondent. Turning to the multivariate analysis, we see in Model A of Table 3 that the PSID sample does demonstrate a significant sibship size effect on educational attainment: each additional sibling the respondent has (I have eliminated only children from my sample) costs him/her a little over a tenth of a year of education net of other factors. Likewise, the effects of other variables are as we should expect from previous literature: There is a significant cohort effect on education such that older individuals tend to have completed fewer years of formal schooling. Both father's and mother's education have significant, positive effects on the attainment of the respondent. Finally, women receive less formal education than their male counterparts.

Moving to Model B of Table 3, we see that merely adding a term representing the number of sisters of the respondent (still controlling for the total number of siblings) does not yield a significant coefficient. If the human capital model were at work (Becker, 1964), we should expect that this term would be significant and positive, implying that additional sisters do not hurt as much as additional brothers since boys receive a higher return to schooling and thus parents would

TABLE 3  
 OLS Regression Models Predicting Highest Grade Completed for  
 1989 PSID Respondents (Unweighted)

Variable	Model		
	A	B	C
Age of respondent	-.01***	-.01***	-.01***
Father's education	.15***	.15***	.15***
Mother's education	.15***	.15***	.15***
Female respondent	-.14**	-.14**	-.34***
Number of siblings	-.10***	-.10***	-.10***
Number of sisters (Female * No. of Sisters)		-.01	-.06*
Constant	10.74***	10.74***	10.86***
R <sup>2</sup>	.22	.22	.22
N	7573	7573	7573

\*  $p < .05$ .

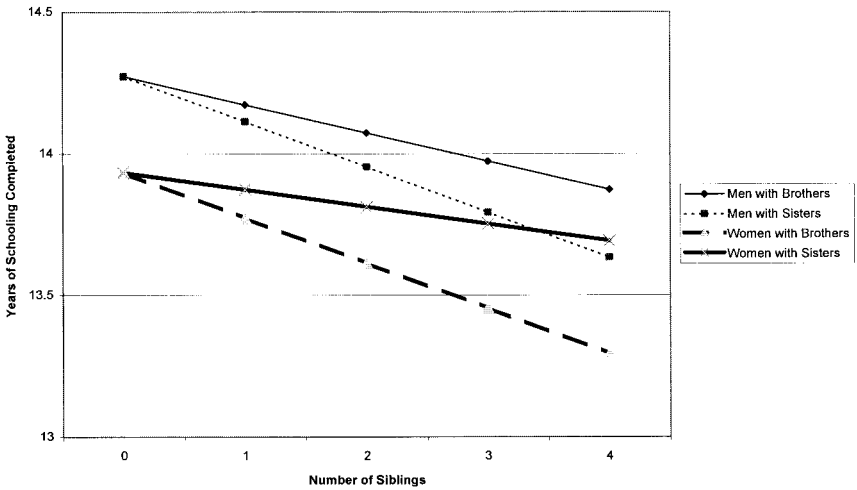
\*\*  $p < .01$ .

\*\*\*  $p < .001$ .

be likely to invest in their educations, draining the resources aimed at the respondent's schooling (regardless of his/her sex).

When we allow this effect of sisters to be transformed into an effect of opposite sex siblings by adding an interaction term that was formed by multiplying it with the gender of the respondent, we find that both terms become significant. In adding up the effects, we find that for male respondents, each additional brother costs them slightly over one-tenth a year of education (0.102) while each additional sister costs him 0.165 years, significantly more. For women, brothers cost 0.102 years of education while sisters cost significantly less, 0.061 years per sister controlling for background characteristics. I also tested an interaction effect in the basic model by multiplying number of siblings by female respondent; this term proved insignificant. Finally, results from models run separately for male and female subsamples yield similar effects with slightly higher standard errors (due to reduced sample sizes); I have presented the joint model with interactions since it provides a simple and direct statistical test of the difference between the coefficients for men and women.

These results are also depicted graphically in Fig. 1, below. Using the mean values on other variables, we can see that women demonstrate a steeper downward slope in their predicted years of schooling for the addition of brothers as compared to sisters. Meanwhile the pattern is reversed for men, where the steeper decline is with the addition of sisters. Women also start off at a disadvantage vis-à-vis men of about a third of a year of schooling in this model. However, given the gender interaction effect, there is a cross over such that a woman with four sisters is predicted to complete about the same amount of schooling as a man with four sisters.



**FIG. 1.** Effect of additional brothers and sisters on the educational attainment of men and women.

The evidence from these models directly contradicts that of Butcher and Case (1994) who concluded that sisters were more detrimental to the educational progress of women than were brothers. It seems worthy to note that in the models for educational transitions upon which Butcher and Case largely base their conclusions (1994: p. 50), the number of siblings term is not significant (without the presence of multiple interaction terms) which should lead one to question the validity of these equations on the whole since number of siblings has been one of the most consistently demonstrated effects in the sociological literature.

While the human capital model does not seem apt, the sex minority hypothesis does not seem to operate equally for both sexes. The addition of brothers costs the respondent a fixed amount of education that does not vary by gender (and approximates the strength of the effect of the classic “number of siblings” term in the base Model A) while additional sisters have a differential impact on men and women. As a further test of the sex minority hypothesis, I ran models with dummy variables indicating the presence of all opposite sex siblings, women with all opposite brothers and an interaction between the number of siblings and the dummy for all opposite sex status. These results are presented in Table 4 below.

In this form (Model A), the main all opposite sex siblings term is not significant, but that term for women is ( $t = -2.075$ ). Thus, in this model, having all opposite sex siblings is a significant detriment for women, but not for men—controlling for the total number of siblings. Next I tested Butcher’s and Case’s claim that “Women raised only with brothers have received on average significantly more education than women raised with any sisters, controlling for household size” (1994: p. 531). In Model B of Table 4, I ran a model with an

TABLE 4  
 OLS Regression Models Predicting Highest Grade Completed for 1989 PSID Respondents  
 (Unweighted)

Variable	Model			
	A	B	C	D
Age of respondent	-.01***	-.01***	-.01***	-.01***
Father's education	.15***	.15***	.15***	.15***
Mother's education	.15***	.15***	.15***	.15***
Female respondent	-.09	-.38**	-.10	-.35***
Number of siblings	-.11***	-.10***	-.10*	-.11*
Number of sisters				-.04
(Female * No. of sisters)				.04
All opposite sex siblings	.16		.23	
(Female * all opposite sex sibs)	-.28*		-.28*	
Any sisters		-.18		
(Any sisters * female)		.30*		
(All opposite sex * Number of sibs)			-.04	
(Age * Number of siblings)				-.01***
(Age * Number of sisters)				-.00
(Age * Number of siblings * female)				-.00
Constant	10.7***	10.9***	10.9***	.94***
R <sup>2</sup>	.22	.22	.22	.22
N	7573	7573	7573	7573

“any sisters” dummy variable and an interaction term constructed by multiplying this dummy by the female dummy. The main dummy term is almost significant ( $t = -1.916$ ), and the interaction is significant ( $t = 2.305$ ). However, this pattern of effects demonstrates the *opposite* dynamic that Butcher and Case describe. Namely, men who have a sister (controlling for the total number of siblings) do worse by virtue of the main effect while women who have at least one sister do better than those without [ $(-.184) + (.298) = .114$ ]. I also ran a model to determine whether the number of siblings effect varied if *all* the siblings were of the opposite gender. This interaction term proved insignificant (see Model C).

I also tested an interaction effect constructed by multiplying the gender composition of the sibship by the social class background of the family. This represented an effort to test whether resource strain led to more pronounced gender composition effects. Specifically, lower SES families may have fewer resources so that differences in allocation are more dramatic. However, the opposite dynamic may be at work as well. Namely, it could be the case that only when there are lots of resources do gender differences emerge. I would have liked to test these competing hypotheses with parental income or wealth data, but given

the retrospective nature of these data, I cannot.<sup>9</sup> Parental education was used as a proxy for the more general socio-economic conditions when growing up. This interaction effect between parental education and sibship sex composition was not significant. However, I do not take this nonsignificance as definitive proof that resource issues are not at work since they may be equally salient for all socio-economic strata, or it may be the case that the interaction effect was not significant since I was using parental education as a resource proxy.

Finally, I investigated Butcher's and Case's claim that "... the impact of sibling sex composition has changed between the cohort born 1920 to 1940 and that born 1941 to 1961, with the negative effect of having a sister declining for the younger cohort. This suggests that a change has occurred in the way households allocate educational resources (1994: p. 551). This conclusion is based on a split sample comparison that includes no statistical test for significance and has the same problem mentioned earlier: that the main effect of number of siblings is not significant in any of their six models, suggesting some problem in estimation. When I run a model (D) with added interaction terms between age and number of siblings, age, and number of sisters, and finally, age and number of sisters and female, I find that the only significant term is that of age \* number of siblings. This result suggests that the effect of number of siblings has declined over the century, while the effect of gender composition has not changed.

In all these models, the overall  $R^2$  changes hardly at all. The addition of these sex composition interaction terms does little in explaining more of the overall variance in education level. However, the more important issue is that the coefficients for these variables are significant and they affect the coefficients of other variables. That is, while the overall explained variance in educational outcomes may have not significantly increased, the allocation of the explained variance has shifted, yielding a more nuanced view.

## DISCUSSION

The findings presented here are different than those arrived at by other researchers, so some review is in order. Initial studies of the impact of sibship sex composition on educational outcomes largely conceived of the effects of gender composition as straightforward. For example, the normative climate hypothesis suggested that male advantages on standardized tests would be passed onto the entire household, making brothers less damaging than sisters. This was found not to be the case (Powell and Steelman, 1990). Alternatively, gender favoritism and greater returns to schooling are said to favor men over women so that additional brothers might siphon off parental resources to a larger extent than additional

<sup>9</sup> I do not have the income of the family when these individuals grew up. If I take advantage of the longitudinal nature of the PSID data and include only those individuals for whom I have childhood income data, my average age drops as to become ~25, not representative of the adult population; also, the sample size dips below 2000 and effects become insignificant due to large standard errors.

sisters. This hypothesis was lent support by the fact that additional brothers hurt the efforts of women to secure parental financial assistance among students in two large, Midwestern universities. However, this hypothesis has not played out in more representative samples in terms of educational attainment measures. The key to both these hypotheses is that it does not matter what the gender of the respondent is; the same dynamic should play out for men and women.

More recently, however, the literature has not assumed that the effect of brothers and sisters should be the same for men and women. These studies have arrived at a variety of effects and have not generated theories as to why we should expect different effects depending on the gender of the respondent. Butcher and Case (1994) find that additional sisters hurt women but not men. By contrast, Kaestner (1997) finds that additional sisters help educational attainment—but only for blacks and more for men than for women. Finally, Hauser and Kuo (1998) find no overall effect, but rather a mix of positive and negative coefficients.

The current study adds to this burgeoning literature by theorizing why we should expect different effects for brothers and sisters depending on the gender of the respondent. These data bear out such a claim consistently. In this data set, men are most disadvantaged by the presence of siblings when they have sisters, while women's educational attainment is hurt more by brothers. In combination, these findings suggest the importance of conceiving of gender relationally within the family. That is, there is no gender effect of brothers or sisters *per se* on educational attainment. Rather, gender effects manifest only in relation to the sex of the respondent him/herself. Such effects may be due to the fact that "sex minorities" may experience gender role conflict between how they are socialized within the family and the expectations placed upon them by the educational system, they may not receive adequate gender-specific emotional support from parents or siblings in a family climate that is dominated by the opposite sex or finally, there may exist returns to scale for gender specific household or educational goods. Such sex composition effects would imply that there is probably "true" environmental effects of other sibship constellation variables—such as size and density—over and above issues of selection bias (such as genetic differences) since gender composition is likely to be orthogonal to any source of unobserved heterogeneity.

That said, effects shown here are modest and should be interpreted with caution, particularly since they do not accord with findings from other studies. Given the fact that these findings directly contradict those of Butcher and Case (1994) and come to different results than both Kaestner (1997) and Hauser and Kuo (1998), the current study acts not as any definitive word, but as a call for further research in this domain. That said, it is not entirely clear why this study arrived at different results. As mentioned in the literature review, each research study has approached the issue differently. One of the issues at work here is the use of dummy variables versus continuous terms. Butcher and Case, for example, base their conclusions on the significance of a dummy variable for "any sisters"

that they estimate when controlling for sibship size and sibship size squared. It may be the case that this dummy variable is really picking up is the influence of a nonlinearity in the effect of number of siblings. Individuals from larger families are more likely to have at least one sister than to have “no sisters,” so it may be the case that the effect here is not about sex composition. Rather, it could be the case that the dummy variable for “no sisters” is acting as a supplement to the quadratic formulation of the sibship size variable to pick up a nonlinearity. It may be useful for researchers who prefer this dummy variable formulation to conceptualize their main term of sibship size also as a series of dummy variables. There exists a corollary issue as to whether the effect of sibship sex composition varies by family size. The dynamics of large families may be very different than those of small families. Future researchers may want to examine whether the effects of sibship sex composition are nonlinear across families of different sizes. This is particularly important for researchers—such as Butcher and Case—who want to examine cohort differences since there has been a dramatic reduction in family size over the course of the twentieth century. Finally, researchers such as Hauser and Kuo who test for differential effects by comparing means across might consider controlling for social class in some way since there may be fertility preferences that vary by class. Specifically, a family of four children that arrived at that number in search of a son after the birth of three daughters may be more likely to come from a high SES or low SES family (depending on what theory you ascribe to) when compared to a family that had four children without regard to the gender distribution.

More generally, this line of research illustrates the importance of diving into the “black hole” of the family to examine intra-familial differences in the class ascription process. Much work remains to be done to determine how social-psychological dynamics (such as the establishment of comparative advantages between siblings) interact with resource allocation within the household unit. Other researchers have already begun this work by attempting to determine, for example, whether the strength of socioeconomic status transmission between parents and children varies by gender of the child, birth order, and family size (see, e.g., Kuo and Hauser, 1995, 1996, 1997).

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