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LABOR AND POPULATION

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Abstract

This study examines the educational effects of sibship sex composition using data from the 2002 and 2007 Taiwan Social Change Survey. The results show that men with older siblings, especially older sisters, have higher educational attainment, while women with both younger sisters and younger brothers have lower educational attainment. Moreover, the positive effect of having an additional older sibling on men's educational attainment only exists in large families but not small families. We interpret the findings as consistent with an indirect parental effect of intra-family transfer of resources, reflecting parents' son preference in educational investment in their offspring; and that such a son preference is only present when the family is under budget constraints. Implications of these findings for trends in declining fertility and diminishing gender gap in educational attainment are discussed.

1. Introduction

It is well documented in stratification and social mobility research that not all siblings are raised equal. Only 25 percent of the variation in educational attainment is attributable to between-family differences, suggesting that siblings may acquire a highly uneven share of family resources invested in their education (Conley 2004). Parents often have preferences for certain siblings over others based on their sex, birth order, as well as other characteristics. Thus, sibship configuration may influence how much parents invest in each of their child's education and thus contribute to educational inequality within the family. The mechanisms through which parents exhibit their preference for a specific child may be either allocation of family resources among siblings or a subtle form of economic transfers among the siblings. Most prior studies have focused on the *direct* parental effect of allocation of family resources, and few studies have examined the *indirect* parental effect of inter-sibling transfer of family resources.

In this study, we seek to contribute to the literature on the intra-family educational inequality in Taiwan. We are particularly interested in how inter-sibling transfer of family resources explains the educational effects of sibship configuration. Compared to parents in the Western societies, Taiwanese parents tend to have greater power to exert indirect parental effect on their offspring's educational attainment. While previous studies have shared similar motivations related to the indirect parental effect, they each have a specific focus on sibship configuration. Parish and Willis (1993) found that having older sisters is associated with a higher level of educational attainment of younger siblings of both sexes; however, only having same-sexed younger siblings, but not opposite-sexed younger siblings, is associated with a lower level of educational attainment of older siblings. Chu *et al.* (2007) found that having siblings who are spaced apart has a negative effect on women's, but not men's, educational attainment, regardless of her birth order. Yu and Su (2006) focused on first-borns and their results partially supported the hypothesis that younger siblings attain a higher level

of education at the expense of their oldest sister. What these studies have in common is the focus on sex and birth order of (or more accurately in the Asian context, “seniority among siblings”) sibship configuration, but it remains to be clarified whether intra-family transfer of resources flows from older siblings to younger siblings or the other way around, and how sex preference among siblings of the parents influences such a transfer.

To address these research questions, we systematically identify the effects for the full range of sibship configurations, and pay particular attention to the possible moderating effects of son preference in Taiwan. Moreover, we examine the extent to which parents exercise son preference in investment in their offspring’s education under budget constraints.

2. Theoretical Background

2.1. Sibship Configuration and Educational Attainment

The confluence theory, the resource dilution model, and the rational choice model of parental investment are dominant theories that motivate empirical studies of the effects of sibship configuration on educational attainment.

The confluence theory (Zajonc and Markus 1975) suggests that the intellectual environment of the family, defined as the average intelligence of all household members, is an important factor to explain the differences in children’s cognitive development by sibship size and birth order. Given intelligence is positively associated with age, the higher number of young children in the household, the lower intellectual climate of the family, and the less developed a child’s intelligence will be. Hence, children growing in up in a larger family tend to be less smart than children growing up in a smaller family. However, the negative effect of sibship size on intelligence is stronger for later-borns than earlier-borns because, compared to their younger siblings, early-born children grow up in a smaller family with better intellectual environment and they benefit from the opportunity to tutor their younger siblings. Despite its novelty and elegance, the confluence theory has received little empirical support (Retherford

and Swell 1991), and Parish and Willis (1993) have argued that this theory may bear little relevance to understanding the family dynamics of cognitive development in Asian cultures.

The resource dilution model (Blake 1981; 1989) posits that family resources are a major determinant of children's educational outcomes and the allocation of family resources depends on the sibship size. As sibship size increases, each child receives fewer resources from their parents and thus achieves a lower level of education. This model also predicts that family resources are diluted among siblings who are spaced closely together so that children with more siblings of similar ages will have lower educational attainment. Empirical studies have supported this prediction (Powell and Steelman 1993). Because family resources also tend to expand as young parents grow older, early-borns will share a smaller pot of resources for their education and enter labor market at a younger age than their younger siblings (Steelman and Powell 1991).

The original version of the resource dilution model implicitly assumes that each sibling gets an equal share of their parents' resources. Thus, it provides little insight on what may explain intra-family inequality in educational attainment. Modifications to the original version have looked at how sibship sex composition affects the allocation of family resources. Powell and Steelman (1989) found that brothers receive more resources than sisters so that adding one brother will lower a child's educational attainment, whereas Butcher and Case (1994) found that women raised only with brothers have higher education than women raised with only sisters. Conley (2000) found that siblings raised with siblings of the opposite sex have a lower level of educational attainment. Kaestner (1997) and Hauser and Kuo (1998) reported null findings regarding the relationship between sibship sex composition and educational attainment.

The rational-choice model of parental investment provides another important insight into the mechanisms of educational stratification among siblings. This model suggests that parents are motivated to maximize their yields from their investment in the next generation.

Thus, parents tend to invest more resources in the education of the child who is likely to generate a higher value in the labor market and to presumably provide more support when they are retired than that of another child who is less likely to be valued in the labor market (Becker 1981; Kaestner 1997; Buchmann 2000). The fact that the economic return to education for women is lower than for men will reduce parents' incentive to invest in their daughters' education (Parish and Willis 1993). Consistent with this prediction, Powell and Steelman (1989) find that the number of brothers is negatively associated with the amount of fund parents allocate for a child's college education. Kaestner (1997) finds that blacks, but not whites, have a higher level of educational attainment when they have an additional sister relative to an additional brother.

2.2. Son Preference in Parental Investment in Education

Extending the rational choice model, we argue that son preference in educational investment will be stronger in societies with a greater gender disparity in the labor-market returns to education—such as Taiwan—than in societies with a smaller gender disparity. Beyond consideration of the labor-market returns, parents in patriarchal cultures have an additional set of incentives to exhibit son preference in how they invest family resources. Family norms in patriarchal societies expect a married couple to live with and financially support the husband's parents. The son also carries the family name and inherits the family properties in these societies (Chu and Yu 2010). In those societies with a strong Confucian influence, filial piety stipulates that children (especially the sons) should maintain and glorify the fame and reputation of a family (Yeh and Bedford 2003). These economic and cultural incentives provide an even stronger motivation for parents in these societies to invest a greater amount of resources in their sons than their daughters (Greenhalgh 1985).

Family processes are not static. Intergenerational transfer from offspring to parents does not have to begin after parents retire from the labor market. Parents may exercise son preference in a dynamic way of allocating their resources by exploiting various possibilities.

For example, the available family resources may change over time. Chu *et al.* (2007) pointed out that an older sibling (especially an older sister) may enter the labor market at a young age to help support her younger siblings.

Finally, the resource dilution model emphasizes the role of budget constraints. Under budget constraints, siblings need to compete for the limited amount of family resources. Following Parish and Willis (1993), we argue that son preference in educational investment will be stronger when there are more budget constraints than less budget constraints.

2.3. Son Preference in Educational Investment in Taiwan

The foregoing literature review suggests that son preference in educational investment may be particularly strong in Taiwan—the focus of this present paper. Three studies have investigated such son preference in Taiwan by examining the effects of sibship sex composition on educational attainment. Parish and Willis (1993), using data from the 1989 Taiwan Women and Family Survey, found that the educational effect of family size is negative only in low-income families. Siblings in high income families have similar levels of educational attainment. They interpreted this finding as Taiwanese parents will only play preference in their children's educational investment when they face budget constraints. Parish and Willis also found that having an additional older sister (but not older brother) increases educational attainment for both male and female siblings. In other words, son preference is expressed in such a way that Taiwanese parents may have acquired family resources from their earlier-born daughters and invested them in the younger children. Yu and Su (2006) extended the Parish and Willis argument to the study of educational differences between first-borns (of both sexes) and children of higher birth orders. They hypothesized that, while the oldest sister may benefit their younger siblings' education at their own expense, the oldest son may enjoy a greater amount of parental resources for their education. Their analysis of data from the Panel Study of Family Dynamics (PSFD) supported the hypotheses. Chu *et al.* (2007) focused on child spacing. Using data also from the PSFD, they found that

women, but not men, attain a lower level of educational attainment when siblings are spaced further apart. They also found that child spacing moderates the effects of sibship sex composition: older sisters attain a lower level of education only when their younger siblings are spaced apart. This finding is inconsistent with that reported in Parish and Willis (1993).

An overarching theme for these three studies is how family resources are allocated among siblings of different sex and birth order. They differ in how sibship sex composition is parameterized. While Yu and Su's (2006) decision to single out first-borns yields the most straightforward and appealing interpretation, it may be an oversimplified story. In contrast, Chu *et al.*'s (2007) preferred parameterization involves a large number of interactions with the child-spacing variables and may be too complicated. In the present study, we thus choose to more closely follow Parish and Willis's (1993) analysis. We first decompose the effects of older siblings versus younger siblings. We then distinguish the effects further by the sex of the siblings into four categories: namely, older brothers, older sister, younger brothers, and younger sisters. Parallel results are reported for male and female. Finally, we examine whether the effects of sibship sex composition are contingent on budget constraints using family size as a proxy for how strained the family resources are.

We pool data from the 2002 and 2007 Taiwan Social Change Surveys that are much more recent than the 1989 survey data analyzed by Parish and Willis (1993). Thus, our study may be viewed as an update of a seminal study on son preference in educational investment in the Taiwanese context. We are also able to replicate a part of the PSFD analysis reported in Chu *et al.* (2007), which provides a bridge to reconcile certain inconsistent findings between Parish and Willis (1993) and Chu *et al.* (2007). Moreover, our study will seek to identify the gendered direction (either from older siblings to younger siblings or the other way around) of intra-family resource transfer under budget constraints.

3. Data and Method

3.1. Taiwan Social Change Survey

Data come from two waves of the Taiwan Social Change Survey (TSCS). Each wave of TSCS includes a multistage stratified probability sample of the adult population in Taiwan. There were 1,992 and 2,040 respondents interviewed, with 64% and 45% response rates, respectively, in 2002 and 2007.¹

We choose the 2002 and 2007 TSCS because they included information about age, sex, and education for the five oldest siblings and the youngest sibling of the respondent, whereas other waves of the TSCS included very limited information about the respondent's siblings. To make our analysis comparable to previous studies (Chu *et al.* 2007; Yu and Su 2006), we use data for all siblings reported by the respondents (except those 89 individuals who were the only child). Following Chu *et al.* (2007), we include only families in which all siblings were age 25 years or older² at the time of the interview to ensure most individuals in the analytic sample to have completed schooling.³ After listwise deletion of individuals with missing data on any of the variables, the analytic sample includes 11,781 individuals (including both respondents and their siblings) based on 2,524 respondents' reports.

3.2. Measures

Following Parish and Willis (1993), Yu and Su (2006), and Chu *et al.* (2007), we use years of schooling for the dependent measure of educational attainment. To operationalize sibship configuration, we first decompose the total number of siblings into the number of

¹ Despite the difference in response rates, the results (available upon request) are qualitatively the same if we run separate analyses on the 2002 and 2007 waves of data. Furthermore, our being able to replicate some main findings reported in Chu *et al.*'s (2007) analysis using the PSFD data strengthens our confidence in the findings, even though we are also concerned about the relative low rate of response in the 2007 survey.

² Parish and Willis (1993) required at least 20 years of age to be included in their analytic sample. While this decision might be sensible for data collected in 1989, the same age truncation may be inadequate for data collected in 2002 and 2007—in light of the massive educational expansion in the 1980s (Tsai 2004). Thus, we require at least 25 years of age in the sample selection.

³ Yu and Su (2006) used a slightly different criterion in their sample selection. They did not require all siblings to be at least 25 years of age. Instead, they included any siblings in the data who were at least 25 years of age in their analytic sample. Thus, only some families included in Yu and Su's (2006) analysis comprise all siblings in a family in the survey, whereas all families included in Chu *et al.*'s (2007) analysis comprise all siblings.

older siblings and the number of younger siblings. We then further decompose the configuration by seniority among siblings—a concept that more accurately capture the effects of sibship configuration than birth order in the Asian context. This operationalization includes four variables, respectively, for the numbers of older sisters, older brothers, younger sisters and younger brothers. Control variables include mother’s and father’s years of schooling, the respondent’s ethnic background (including four categories, Fukien, Hakka, Mainlander, and Aborigine) and his/her birth cohort (including the following dummy variables for those born in 1935 and before, 1936-1945, 1946-1955, 1956-1965, and in 1966 and later). We do not include an additional control variable of family size because this information is embedded in our sibship configuration specification. To operationalize budget constraints imposed by family size, we divide the sample into large families (more than five siblings, oneself included) and small families (with four or fewer siblings) using the median of sibsize.

3.3. Statistical Models

Following Parish and Willis (1993) and Chu *et al.* (2007), we estimate ordinary least squares (OLS) regressions to predict an individual’s years of schooling; and use the Huber-White method to adjust for biases in standard errors due to the clustered data structure. We do not apply the hierarchical linear models as Yu and Su (2006). Thus, we assume that between-family differences are uncorrelated with sibship configurations. Because Yu and Su did not specify any cross-level interactions involving the error term, our assumption is similar to theirs. We do not include sibling fixed effects for concerns over measurement errors in these data and related identification issues (see Chu *et al.* 2007 for a detailed discussion).

4. Analyses and Results

We begin with a description of the sample (summary statistics in Table A-1). Taiwanese women in our sample, on average, have 8.96 years of schooling (roughly equivalent to a junior-high-school diploma) whereas men have 1.35 more years of schooling than women.

This gender difference suggests that parents may have invested more resources in their sons' education than in their daughters' education. Women in our sample have a larger family size than men, and this difference appears to result from a slight son preference in childbearing behaviors so that parents of daughters were more likely to continue to have children than parents of sons. Consistent with this conjecture, we see that women have about .30 $(= (1.34 - 1.17) + (1.31 - 1.17))$ more younger-siblings than men.

As stated earlier, a major discrepancy in existing findings is between Parish and Willis (1993) and Chu *et al.* (2007). As we choose to follow Parish and Willis's parameterization, we want to make sure that our analysis is also comparable to that of Chu *et al.* (2007). If so, then our results may to a certain extent be viewed as an attempt to reconcile, if not adjudicate, this discrepancy. Thus, our first analysis attempts to replicate the basic models reported in Chu *et al.* (2007) based on the PSFD data to make sure that any difference between our findings and their findings are not due to differences in the choice of data. Table 1 shows that our regression results lead us to reach the same conclusion as theirs: Having an additional sibling decreases women's, but not men's, educational attainment. This successful replication makes us more confident that our results are building on a solid empirical ground of prior studies, especially as results reported in Chu *et al.* (2007) differ from those reported in Parish and Willis (1993). Such a discrepancy is unlikely the result of any idiosyncratic feature of the data analyzed by Chu *et al.*, and may possibly reflect substantive differences related to social change. Moreover, because Yu and Su (2006), another important study on the same topic, used the same PSFD data, despite a slightly different sample selection, our being able to replicate Chu *et al.* (2007) also bridges our analysis and the literature with Yu and Su (2006).

[Table 1 about here]

Building on these findings, we look closely at the effects of sibship configurations on educational attainment for men and women in Taiwan. In Table 2, we decompose sibship by seniority among siblings. The first two columns (Models 1 and 2) are for the entire sample,

and the next four columns (Model 3 – Model 6) further divide the sample by the number of siblings to examine the effects of seniority by family size. Model 1 shows that adding a younger sibling will reduce one's schooling by .137 years while having an older sibling neither increases nor decreases one's schooling ($b = .033, z = 1.06, n.s.$). Model 2 further shows that the effects of seniority differ by gender (and these gender interactions are all statistically significant): adding younger siblings only reduces women's, but not men's, educational attainment ($b = -.270, z = 7.11, p < .001$), whereas only men, not women, benefit from having an additional older sibling ($b = .086, z = 2.32, p < .05$). These findings are consistent with our hypotheses that the intra-family resources tend to transfer from older siblings to younger siblings, and this transfer is gender asymmetric, usually from older sisters to younger brothers, expressing parents' son preference.

[Table 2 about here]

When we further divide the sample by family size, we find that the above pattern only runs in families with five or more children. In those families with no more than four children, the effects of having an additional sibling are always negative and the gender interaction is statistically insignificant. These findings are consistent with our argument that parents only need to exercise intra-family resource transfer when they face budget constraints. In small families, the effects of older siblings and younger siblings are similar for men but different for women. Women's educational attainment is much lower when they have younger siblings than when they have older siblings. These results suggest that there is still some evidence that older sisters are disadvantaged in small families. In general, the above findings imply that (1) the most advantageous sibship position for men is growing up in large families where they receive more resources from older siblings and not be affected by having additional younger siblings, whereas (2) the most disadvantageous sibship position for women is growing up in large families where they may transfer resources to their younger siblings and do not benefit from having any older siblings.

We then examine whether the effect of having an elder sibling and the effect of having a younger sibling vary by the sex of the sibling. Results in Table 3 show that the educational effect of having an additional sibling depends on whether the sibling is a brother or a sister. Model 1 of Table 3 suggests that individuals have a higher level of educational attainment if s/he has more older-sisters or fewer younger-sisters. Having brothers (particularly younger brothers) is in general negatively associated with one's educational attainment, but the effects are statistically insignificant. Model 2 in Table 3 shows different patterns for men and women. Men's educational attainment is not affected by having additional siblings with one exception: men with each additional older sister have .133 more years of schooling. In contrast, having additional siblings in general decreases women's educational attainment (except a null finding about having older sisters). The next four models of Table 3 show that the above findings only hold in families with at least five children. In families with four or fewer children, we observe negative but (by and large) statistically insignificant effects of sibsize.

[Table 3 about here]

In sum, our findings indicate a clear son preference with regard to parental investment in education in Taiwan. Men acquire more resources and have higher educational attainment than women, and their educational attainment does not vary much by sibship configuration of their families than women's educational attainment. Moreover, our findings support the hypothesis that the transfer of family resources flows from older siblings to younger siblings, especially in large families where family resources are under more severe budget constraints.

5. Conclusion and Discussion

Motivated by the theoretical interest in indirect parental effect of intra-family transfer of resources and the substantive focus on gender inequality in an Asian context, we examine the educational effects of sibship sex composition using data from the 2002 and 2007 Taiwan Social Change Survey. The results show that having an additional older sister increases men's,

but not women's, educational attainment; and having an additional younger sibling reduces women's, but not men's, educational attainment. Furthermore, these asymmetric transfers of family resources by the gender and seniority among siblings only exist in large families. In general, in terms of educational attainment, the youngest son with all older sisters in a family fare the best, whereas the daughters tend to fare worse than their male siblings.

This study confirms a unique feature of intra-family transfer in Taiwan such that parents scrounge family resources from older siblings (especially older sisters) and invest them in the education of the younger siblings. As suggested by prior studies (e.g., Parish and Willis 1993; Yu and Su 2006; Chu *et al.* 2007), the early-born children may sacrifice their educational opportunities by either marrying or entering the labor market before they completely fulfill their scholastic potentials. Their earnings (or their saved opportunity costs) may then be used to subsidize their younger siblings' education. The implication of our finding is that children in Taiwan benefit not only from direct investment from their parents in their education, but they also receive indirect investment from their older siblings.

These findings may be, on the one hand, viewed as an extension of the resource dilution model with an emphasis on son preference. On the other hand, they stand in marked contrast with findings based on data collected in the United States. For example, Steelman and Powell (1991) stated that younger children will receive more resources than their older siblings because they are born into the family when parents are economically better off than when their older siblings are born—a pure effect of birth order. However, the allocation of greater family resources to the younger siblings in Taiwan is driven not just by birth order. Instead, only younger brothers, but not younger sisters, attain a higher level of educational attainment; and the benefit of being a later-born son comes from having older sisters rather than older brothers. In other words, while the effects of sibship structure are neutral with respect to the child's gender in the United States, the effects strongly depend on the genders of the child and his/her siblings in Taiwan.

These findings may also be viewed as a unique “pecking order” of intra-family stratification that is not based on the resource dilution rationale as discussed in Conley (2004), but more in line with the cultural influence of the Asian/Confucian patriarchy that emphasizes on gender and seniority among siblings: Parents accrue family resources from the early-borns (especially the older daughters) and redistribute them to the later-borns. In fact, opposite to the prediction of resource dilution model, women with younger siblings spaced further apart have a lower level of educational attainment (Chu *et al.* 2007) because the intra-family stratification mechanism in Taiwan is not siblings’ concurrent (and static) competition for the same pot of resources, but a dynamic process of a sequential investment in the offspring.

Our study not only updates the earlier finding reported in Parish and Willis (1993), but also in some sense reconciles the discrepancy between their study and Chu *et al.* (2007) by showing that the difference likely reflects substantive social change, rather than differences in data and methodology. In other words, son preference documented in Parish and Willis (1993) prior to the late 1980s may have become restricted only to those women with younger siblings who are spaced apart during subsequent decades as documented in Chu *et al.* (2007). Our analysis provides a more direct test of the budget constraints hypothesis proposed by Parish and Willis (1993), by showing that the gendered flow of intra-family resources transfer only exists in large families where family resources are stretched thinner than in small families. Thus, our findings imply that parents’ son preference in educational investment among Taiwanese parents will disappear once their financial conditions improve.

Despite being a more direct test of the budget constraints hypothesis, our analysis does not and cannot address the endogeneity issue. Those parents who exhibit no son preference in the educational investment may embrace less traditional values and choose to have fewer children. Thus, an alternative explanation of our finding that son preference only exists in large families may be a hypothesis of modernization (Goode 1982). While our data do not allow us to adjudicate these two hypotheses (and we simply follow the better-articulated

hypothesis of budget constraints in this literature), both theories will lead us to predict that son preference will decrease and gender equity in educational attainment will diminish along with recent trends in declining fertility and educational expansion in Taiwan (Tsai and Kanomata 2012). In fact, we have also explored the cohort effects and found an overall trend toward diminishing son preference (results not shown). As also noted by Parish and Willis (1993), however, details of these results are not as stable as those other findings reported in this paper, presumably because birth cohort captures a number of mechanisms all at once. We will address those issues in another paper.

A key message we draw from the findings is that women in Taiwan attain a lower level of education in large families due to redistribution of family resources among siblings. To the extent such a causal interpretation holds, our study provides another way to understand recent trends of declining fertility and diminishing gender gap in educational attainment (Tsai and Kanomata 2012). While current academic and policy discourses on demographic trends in Taiwan have emphasized on how highly educated women have delayed and retreated from marriage and childbearing (e.g., Chang and Li 2011), our study raises the possibility the causal relationship may run the opposite direction. Women may indeed attain a higher level of education (say, comparable to her brothers) because she was born into a family with fewer siblings and received a greater amount of family resources from her parents. If this argument holds, we believe that gender inequality in educational attainment will continue to decline. As some demographers argue that improving gender equity may increase fertility in developed countries (McDonald 2000), we have reasons to be optimistic about future trends in fertility based on the gender-equal prospects of intra-family stratification we document in this paper. We hope that our optimism will gain empirical support in future studies.

Table A1. Summary Statistics for Men and Women (All Siblings) in the 2002 and 2007 Taiwan Social Change Surveys

	Male (n=5,938)		Female (n=5,843)		Total (n=11,781)	
Individual Level	mean	sd	mean	sd	mean	sd
Years of Schooling	10.288	(4.420)	8.957	(4.776)	9.628	(4.648)
Number of Elder Brothers	1.006	(1.134)	1.021	(1.163)	1.013	(1.149)
Number of Elder Sisters	1.130	(1.265)	1.100	(1.219)	1.115	(1.243)
Number of Younger Brothers	1.174	(1.294)	1.340	(1.311)	1.256	(1.305)
Number of Younger Sisters	1.174	(1.334)	1.311	(1.415)	1.242	(1.377)
Birth Cohort						
≤ 1935	.112		.106		.109	
1936~1945	.134		.135		.135	
1946~1955	.225		.233		.229	
1956~1965	.290		.297		.294	
1966~1981	.238		.228		.233	
Family Level						
Father's Schooling	4.873	(4.540)	4.852	(4.563)	4.862	(4.551)
Mother's Schooling	3.015	(3.691)	2.996	(3.644)	3.006	(3.667)
Father's Ethnic						
Fukkien	.770		.767		.768	
Hakka	.125		.130		.127	
Mainlander	.091		.088		.090	
Aborigine	.014		.015		.015	
Family size	5.483	(2.037)	5.771	(1.998)	5.626	(2.023)

Note: N=11,781 individuals from 2,524 families.

Table 1. Replication of the Basic Models in Chu, Xie and Yu (2007) Using Data from the Taiwan Social Change Survey

	Chu, Xie and Yu(2007)'s Paper				Sibling Data in TSCS			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Sibship Size	-.089**				-.059 ⁺ (.031)			
Male×SibshipSize		.032				.050 (.037)		
Female×SibshipSize		-.217***				-.172*** (.034)		
Brothers			-.081 [*]				-.048 (.044)	
Male×Brothers				.007				.053 (.052)
Male×Sisters				.051				.047 (.043)
Sisters			-.093**				-.067 ⁺ (.035)	
Female×Brothers				-.182***				-.162*** (.049)
Female×Sisters				-.237***				-.178*** (.040)
R ²	.452	.453	.452	.453	.509	.512	.509	.511
Number of Families	2,591	2,591	2,591	2,591	2,524	2,524	2,524	2,524
Number of Observations	10,654	10,654	10,654	10,654	11,781	11,781	11,781	11,781

Standard errors in parentheses

⁺ $p < .10$, ^{*} $p < .05$, ^{**} $p < .01$, ^{***} $p < .001$

Control variables include gender, ethnicity, birth cohort, father's years of schooling, and mother's years of schooling.

Table2. Coefficients (and Standard Errors) of Older and Younger Siblings by Family Size for Regressions Predicting Years of Schooling

	Total		Gender	Small Families ^a		Gender	Large Families		Gender
	Model 1	Model 2	Difference	Model 3	Model 4	Difference	Model 5	Model 6	Difference
Female	-1.279*** (.067)	-.363* (.160)		-.786*** (.098)	-1.005* (.415)		-1.495*** (.085)	-.340 (.314)	
Sibship Configurations									
Older Siblings	.033 (.031)			-.203+ (.110)			.083+ (.046)		
Male×Older Siblings		.086* (.037)	† ^b		-.279* (.135)			.151** (.057)	†
Female×Older Siblings		-.027 (.038)			-.087 (.142)			.023 (.055)	
Younger Siblings	-.137*** (.034)			-.258* (.113)			-.119* (.048)		
Male×Younger Siblings		.0003 (.041)	†		-.247+ (.136)			.024 (.059)	†
Female×Younger Siblings		-.270*** (.038)			-.262+ (.147)			-.245*** (.053)	
Intercept	4.969*** (.247)	4.505*** (.256)		4.512*** (.451)	4.593*** (.490)		5.041*** (.353)	4.412*** (.389)	
Number of Families	2,524	2,524		1,130	1,130		1,394	1,394	
Number of Observations	11,781	11,781		3,778	3,778		8,003	8,003	
R ²	.513	.516		.506	.506		.461	.463	

⁺ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

a. Small Family indicates the number of siblings (self included) is less than or equal to four.

b. This sign means that the gender difference in sibship effects is statistically significant.

Table 3. Coefficients (and Standard Errors) of Older Brothers, Older Sisters, Younger Brothers, and Younger Sisters by Family Size for Regressions Predicting Years of Schooling

	Total		Gender Difference	Small Families		Gender Difference	Large Families		Gender Difference
	Model 1	Model 2		Model 3	Model 4		Model 5	Model 6	
Female	-1.279*** (.068)	-.365* (.162)		-.795*** (.110)	-1.051* (.420)		-1.492*** (.085)	-.343 (.314)	
Sibship Configurations									
Older Brothers	-.026 (.047)			-.231+ (.124)			.014 (.059)		
Male×Older Brothers		.030 (.054)	†		-.360* (.155)			.098 (.069)	†
Female×Older Brothers		-.104+ (.058)			-.066 (.164)			-.070 (.073)	
Older Sister	.084* (.039)			-.174 (.119)			.143** (.055)		
Male×Older Sisters		.133** (.048)	†		-.214 (.143)			.195** (.069)	
Female×Older Sisters		.043 (.046)			-.097 (.155)			.106+ (.063)	
Younger Brothers	-.073 (.050)			-.203 (.133)			-.063 (.062)		
Male×Younger Brothers		.055 (.060)	†		-.239 (.162)			.083 (.077)	†
Female×Younger Brothers		-.208*** (.058)			-.138 (.170)			-.197** (.071)	
Younger Sisters	-.203*** (.041)			-.332** (.125)			-.176** (.055)		

Male×Younger Sisters		-0.056	†			-0.270 ⁺	†			-0.037	†
		(.055)				(.148)				(.073)	
Female×Younger Sisters		-.336 ^{***}				-.435 [*]				-.296 ^{***}	
		(.045)				(.171)				(.060)	
Intercept	4.972 ^{***}	4.516 ^{***}		4.513 ^{***}	4.604 ^{***}			5.053 ^{***}	4.429 ^{***}		
	(.249)	(.258)		(.451)	(.491)			(.354)	(.392)		
Number of Families	2,524	2,524		1,130	1,130			1,394	1,394		
Number of Observations	11,781	11,781		3,778	3,778			8,003	8,003		
R ²	.513	.516		.506	.507			.461	.464		

⁺ $p < 0.10$, ^{*} $p < 0.05$, ^{**} $p < 0.01$, ^{***} $p < 0.001$

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