The Effect of Family Size on Educational Attainment in China: Cohort Variations*

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Abstract

In industrialized nations family size generally depresses educational attainment—the larger the number of siblings, the lower the educational attainment, presumably because of the reduction of family resources (both material and intellectual) available to each child. However, this association is much less consistent in developing nations, and there is some evidence of substantial change over time. In this paper, we study the effect of number of siblings on educational attainment in China, a nation that has experienced sharp vacillations between policies designed to promote equality (between urban and rural residents and between men and women) and policies designed to promote economic development. The implementation of these policies in the educational arena has alternately reduced and increased competition for educational resources and, we show, has correspondingly reduced and increased the effect of the number of children in a family on their educational attainment.

Introduction

Studies conducted in the U.S. and Western industrialized societies show a clear negative effect of the number of siblings on children's educational attainment, even controlling for family socioeconomic background (Blau and Duncan 1967; Featherman and Hauser 1978; Blake 1981, 1989; Mare and Chen 1986; Downey 1995); each additional sibling reduces schooling by as much as one fifth of a year (Featherman and Hauser 1978; Mare and Chen 1986). This is a strong effect, exceeding that of other family origin variables (Blake 1989). The inverse relationship between number of siblings and educational attainment is often explained by a "resource-dilution" hypothesis—finite parental resources are distributed among siblings, which means that each additional sibling reduces the family resources available to each child (Blake 1981).

However, there is increasing evidence that the negative effect of the number of siblings (sibship size) is neither universal nor inevitable, particularly in developing countries, but depends on demographic, socioeconomic, and political factors external to the family, which influence both the availability of resources to the family and their internal allocation within the family in ways that affect children's education.

Given that the effect of sibship size is importantly affected by societal-level changes and state policies, research focusing on as yet unstudied developing nations can be informative. China provides a particularly interesting case in which to explore the effect of sibship size on educational attainment. The past 60 years have seen remarkable changes in China: dramatic socioeconomic development, especially since 1978; state educational policies that vacillated between "red" and "expert;" and concerted state intervention with respect to fertility control beginning in the 1970s. All of these changes may influence the effect of sibship size on educational attainment, for reasons discussed in greater detail below.

Using data from the study of "Life Histories and Social Change in Contemporary China," a national probability sample of Chinese adults age 20-69 surveyed in 1996, we investigate the association between sibship size and educational attainment in China over four historical periods

characterized by differing socioeconomic conditions and differing educational and other state policies.

Sibship Size and Educational Attainment

The effect of sibship size on educational attainment has been studied in the last two decades as an aspect of educational stratification. Initially a no-effect hypothesis prevailed: the seeming effect of number of siblings was spurious, a consequence of the fact that socio-economically disadvantaged families tended to bear more children. However, as noted above, subsequent studies conducted in the U.S. and other Western societies demonstrated that there is a clear negative effect of number of siblings on children's educational attainment, each additional sibling reducing years of schooling by about one fifth of a grade net of family socioeconomic status.

The most widespread explanation for the sibset size effect is the "resource-dilution" hypothesis, which posits that finite parental material and nonmaterial resources are allocated among siblings and therefore each additional sibling results in a reduction of familial resources available to each child (Blake 1981; Downey 1995). "Resources" include nonmaterial assets such as parental time, attention, and emotional support, as well as material assets such as financial investments in children's education and study environments. These resources are less effective as sibship size increases since in large families resources tend to be distributed more thinly over each child. In a study that explicitly tested the resource-dilution theory, Downey (1995) found strong support for the hypothesis that parental resources account for the inverse relationship between sibship size and educational outcomes. However, he also found that material resources such as money saved for college and computers in the home decreased more rapidly with sibship size than did non-material resources.

Sibship Size and Cognitive Development

Numerous studies in psychology have established links between the home environment, especially the quantity and quality of parent-child interaction, and children's cognitive development, even controlling for the effects of maternal IQ and family SES (Gottfried and Gottfried 1984). Marjoribanks, Walberg, and Bargen (1975) theorized that a child's intellectual ability depends crucially on the amount of parental attention. That is, young children's cognitive development is facilitated by the time and attention provided by their parents in the form of parent-child interactions characterized by parental stimulation, engagement, and positive affect (Bakeman and Brown 1980; Field 1987; Clarke-Stewart 1988).

However, the amount of parental attention available to a given child depends on the number of children in the family. In settings with more than one child, adults necessarily must give less attention to any given child, all else equal, thereby reducing the amount of cognitive and language stimulation. Less overall parental attention might impede development, as shown in studies comparing cognitive and language stimulation and outcomes among singletons and twins of the same age (Bornstein and Ruddy 1984; Tomasello, Mantle, and Kruger 1986), and in a review of 110 studies of the relationship between family size and intelligence (Anastasi 1956). Children with more siblings receive less speech and fewer utterances directed specifically to them, have fewer and shorter conversations with parents, and participate in fewer and shorter period of parental attention. They are thus penalized by the limited attention they receive, in terms of the quantity and possibly the quality of parent-child interaction, which results in their slower rate of early development.

In sum, most studies show a negative relation between family size and cognitive development—the larger the number of children in the family, the lower their intellectual level

(Anastasi 1956; Nisbet and Entwistle 1967; Belmont and Marolla 1973; Breland 1974; Zajonc et al 1979). The detrimental impact of sibsize on intellectual capacity is attributable to the fact that phenotypic intelligence depends upon the amount of attention provided by parents, which is affected by the number of siblings present in the family who also require parental attention. As family size increases, parenting styles may change in ways that negatively affect those aspects of children's cognitive development that require intense and high-quality interactions with parents. This is especially the case for children in their early childhood, for whom interactions mainly take place within families. Once the children are older, the nature of family interactions may be less vulnerable to the birth of a sibling. The reduction in parental non-material resources is particularly damaging to verbal growth (Steelman and Doby1983; Steelman 1985) because verbal development requires sustained interactions with parents due to the fact that language is learned in a social context.

In sum, it is clear that per capita familial non-material resources contingent on family size (eg, parental attention) influence children's intellectual development and thus indirectly affect educational attainment, whereas material resources (e.g, financial support for school) affect educational attainment directly.

The Effect of Sibship Size in Developing Nations

While a negative effect of sibship size is widely observed in Western societies, and sibship size has become a standard variable in studies of educational attainment, emerging evidence in the developing world indicates that the negative association is not universal (Lloyd 1994; Maralani 2004; Shavit and Pierce 1991). Instead, as noted earlier, the effect often varies across contexts and population subgroups, which suggests the need for attention to conditions and institutions external to the family that influence within-family resource availability and distribution.

Sibship size may interact with the level of socioeconomic development and other societal level factors. At very low levels of development, sibset size is unlikely to affect educational outcomes because few children get more than minimal schooling (Lloyd 1994). In such settings, parents may be unable or unwilling to invest family resources in their children's education. Even where education is available, it may be expensive and beyond the reach of most people. Indeed, especially in Africa, educational attainment may be *positively* related to sibset size due to a positive association between income and fertility (Mueller 1984). The same positive relationship between income and fertility has been observed in pre-transitional China (Lamson 1935; Barclay *et al.* 1976; Campbell, Wang, and Lee 2002). A negative association between sibship size and children's educational attainment may arise only at a later stage of socioeconomic development since development level affects the availability and importance of education, and hence the significance families place on education. As education becomes more widely available, families may begin to regard schooling as an important vehicle for socioeconomic attainment and thus initiate resource-distribution strategies to maximize their children's educational attainment (Hermalin, Seltzer, and Lin 1982; Mueller 1984; Sudha 1997). As a result, the amount of resources available to each child begins to matter. Sibship size may then negatively affect educational attainment by reducing the resources available to each child at any given level of family income.

Societal-level demographic changes such as changing fertility levels also may modify the sibset size-education relationship. In Hungary, where the modernization process was accompanied by fertility declines and educational expansion, the negative sibship size effect increased over cohorts (Van Eijck and De Graaf 1995). As the proportion of large families decreased over time, the remaining large families became increasingly disadvantaged with respect to education; that is, children from smaller families benefited more from modernization, especially educational expansion, than did those from larger families.

The sibsize-education association is not only likely to be different depending on the importance of education, but also is likely to depend on whether the costs of schooling fall solely on the parents or are shared by extended families. In industrialized societies relationships of obligation

are generally restricted to the nuclear family and are centered on exchanges between parents and children. In these circumstances sibship size almost always negatively affects educational attainment. However, in some cultures, especially in developing countries, responsibilities for supporting children include extended family members and older siblings (Gomes 1984; Shavit and Pierce 1991). Among Moslems in Israel, where extended families are an important source of child support, the number of children in the nuclear family does not have an impact on educational attainment since families can and do draw on support from extended family members. In contrast, among Jews a negative sibsize effect is evident since relationships of obligation and support are largely restricted to the nuclear family (Shavit and Pierce 1991). Similarly, in sub-Saharan African the number of siblings has little effect on educational attainment since educational costs tend to be spread among a wide circle of relatives (Caldwell and Caldwell 1987). For example, in Kenya sibship size is *positively* related to the educational chances of children because older siblings are a source of support for younger siblings (Gomes 1984). The way the process works in Kenya is that since parents expect to receive direct income returns from the educational investments they make in their children, they tend to provide older children with educational resources to obtain early returns whatever the ultimate family size. But then older siblings provide remittances to supplement family resources, permitting the education of younger siblings.

Moreover, the extent to which sibship size matters may depend in part on specific public policies. For example, government subsidies reduce the direct costs of schooling, thus weakening the negative effect of sibship size on educational attainment (Behrman, Pollak, and Taubman 1989; Pong 1997; Sudha 1997). However, such benefits may be differentially available. For example, in Malaysia most state subsidies are reserved for ethnic Malays. This affirmative action policy neutralizes the detrimental impact of sibship size among Malays. By contrast, a clear negative relationship is observed among Chinese and Indians, for whom state subsidies are scarce (Pong 1997; Sudha 1997). Similarly, Behrman *et al*. (1989) found a negative relationship between sibship size and educational attainment in the U.S. except for special situations that equalized access to financial resources to pay for education, such as the G.I. Bill and loan programs operating in the late 1980s. In

sum, if the state subsidizes children's education, parental resources matter less, and so does sibship size. Finally, the state may influence family size purposefully by discouraging high fertility and compensating low-fertility families, as in China, which in turn shapes opportunities for children and modifies how sibsize matters (Steelman *et al*. 2002).

Gender and place may also mediate the effect of sibship size. In societies with strong son-preference norms, such as China, parents may choose to invest in the education of sons rather than daughters when their resources are inadequate to do both. This implies that the effect of sibship size on the education of females should be stronger than the effect on males, at least when parental resources are stretched thin (Lloyd 1994; Sudha 1997). A similar argument would lead us to expect a greater impact of sibship size on educational attainment in rural areas. Since rural families tend to be poorer than urban families, and since in China educational subsidies are less readily available in rural areas, we would expect sibship size to have a stronger effect on educational attainment in rural than in urban areas.

Educational Policies and Educational Stratification in Contemporary China

Since 1949, the Chinese government has pursued the twin goals of economic development and of promoting equality. However, given the limited resources of the new government, and the need to create incentives for individuals to act in ways that promoted economic development, these two goals were substantially incompatible (Hannum and Xie 1994). Although China experienced strong educational expansion throughout the 20th century, both before and after the communist government took power (Deng and Treiman 1997), during the communist period there was great tension between the two goals and as a result there have been periodic shifts in educational policy between an ideological socialist egalitarian agenda and a practical competitive agenda (Hannum 1999; Tsang 2000). The socialist egalitarian agenda emphasized equal opportunities (mass education) and socialist ideals ("redness") under a uniform curriculum for children in all social groups, with the goal of promoting social equality and reducing status differences. Such policies dominated the period before

1978 and reached their apex during the 1966-77 Cultural Revolution. In contrast, the practical competitive agenda focused on education for economic efficiency (expertise) and emphasized personal advancement as a device for producing experts who could promote economic development; an important goal of this strategy was to maximize economic returns to governmental investments in education. This agenda was ascendant during Liu Shaoqi's dominance in the early 1960s and, most importantly, during the post-Mao economic reform era that began in 1978.

In China, whether one lives in an urban or a rural area is crucial in determining one's life chances—both economic opportunities and educational outcomes (Knight and Shi 1996; Wu and Treiman 2004). The rural-urban gap in educational attainment results from differences in the level of public funding and the quality and availability of schools; differences in the ability of rural and urban families to pay for schooling; and differences in the level of cultural capital of urban and rural people. Such disparities currently are regarded by the Chinese state as a serious problem because of their negative implications for social equality. Although little is being done at the moment to improve rural schools, efforts are being made to improve the standard of living of the rural population, which presumably will enable peasants to devote more resources to the education of their children. For example, in early 2004 the price paid by the government for grain was raised and taxes on the rural population were reduced with the goal of improving the standard of living of the rural population (China Daily 2004)). Nonetheless, the urban-rural gap is very large, because of the sustained emphasis on economic development over the past quarter century, which focused on urban areas. As we will see below, the egalitarian agenda places great importance in eliminating the rural-urban gap while the competitive agenda tends to favor the more developed urban areas (Hannum 1999).

Despite efforts made by the government to raise women's status, there is persistent son preference in China (Bauer *et al*. 1992; Hannum and Xie 1994). Decisions regarding schooling for sons and daughters reflect both parents' perceptions of gender roles and their understanding of gender differences in labor market returns to investments in education. Traditional Chinese marriage and kinship patterns are strongly patrilocal and patrilineal, with women expected to care for their husbands' parents rather than their own. Therefore, parents anticipate much greater old-age support

from their sons than from their daughters, which means that they have a much stronger incentive to educate their sons than their daughters. A second such incentive comes from the greater earning power of men than of women and the greater access of men to jobs requiring educational credentials (Summerfield 1994). In a manner similar to changing rural-urban differentials, gender differences in educational attainment reflect the vacillation of educational policies between egalitarianism and competitive growth. Periods with a strong emphasis on equality are characterized by decreases in gender inequality in education, whereas periods focusing on economic development are characterized by increases in gender educational stratification (Hannum and Xie 1994).

The vacillation between an emphasis on equality and an emphasis on development can be reasonably well captured by distinguishing four periods in recent Chinese history, each with distinctive socioeconomic conditions and educational policies, which lead us to posit different expectations regarding educational stratification and specifically differences in the effect of sibship size on educational attainment.

Period 1: Pre-Liberation (before 1950). Before the 1949 Liberation, China's economy suffered from nearly two decades of war (the Anti-Japanese War and the Civil War). The economy had collapsed during this period and the level of socioeconomic development was extremely low. The formal educational system, which was not very extensive in the pre-war era, with schools very unequally distributed across regions, was badly disrupted, and government policies put little emphasis on either elite or mass education. The result was that more than 80 per cent of the urban population and nearly 95 per cent of the rural population was functionally illiterate (Ministry of Education. 1981).

Period 2: The Early Years after Liberation (1950-65). Since the establishment of the People's Republic of China, China has undergone numerous changes. The period from 1950, when the Communist government firmly established its control of the country, until 1959 was a time of economic recovery in which the primary goal was to promote rapid economic development (Zhou, Moen, and Tuma 1998). Because of the increasing demand for educated labor needed for national economic development, educational opportunities expanded. The educational policies during this period emphasized both economic development and social equality (Hannum and Xie 1994). Besides

building a national education system, efforts to expand mass education focused on the early years of schooling, with an emphasis on establishing universal primary education and reducing illiteracy (Tsang 2000). However, under conditions of scarce societal-level resources and emphasis on economic development as a first priority, education did not, in fact, expand to a degree that significantly reduced educational inequality. Hence, educational policies in this period have mixed implications for educational inequality.

In response to Mao's idea of accelerating the movement towards true communism, the Great Leap Forward period from 1958 to 1960 promoted educational equality through a substantial expansion of access to education, especially for peasant and working-class children (Tsang 2000). Education expanded at all levels and new schools proliferated for children from peasant households. However, at the same time, the attempt to promote rapid economic development failed, which led to an economic collapse and a nationwide Great Famine (Hannum and Xie 1994). As a result, even though education became more available, many parents kept their children out of school to contribute to the economic support of the family and to reduce family expenses. This was especially true of rural families, which suffered the brunt of the economic collapse, and also for girls because traditional son preferences made girls more vulnerable to economic hardship of any kind (Hannum and Xie 1994). In short, during the Great Leap Forward and its aftermath educational policies promoting were greatly undermined by the economic collapse and Great Famine.

After three years of sharp economic decline (1958-1960), Liu and Deng took control of national affairs in 1961, and among other things revamped educational policies (Tsang 2000). They held the view that limited resources should be spent where they were most effective, with an emphasis on expertise. In order to produce technically trained personnel needed for economic development, Liu and Deng introduced a competitive educational agenda and abruptly reversed the previous egalitarian policy, building new urban "key-point" (academic elite) schools and closing low-quality schools, especially in rural areas. Generally, policy makers tended to invest in education in urban areas by building on the existing school systems of relatively high quality, where they could expect faster

economic returns, rather than implementing policies of educational expansion in rural areas designed to equalize educational opportunities (Hannum 1999).

Overall, despite expansion of the educational system relative to the pre-Liberation period, educational inequalities remained strong from 1949-65 due to great economic constraints and the competitive educational agenda implemented for part of this period. Also, rural-urban and gender specific education inequalities are evident in this period, with rural children and girls relatively disadvantaged.[1]

Period 3: Cultural Revolution (1966-76). Unsatisfied with Liu and Deng's policies, Mao again seized control of the party in 1966. He returned to the earlier emphasis on ideological egalitarianism and collectivist production (Tsang 2000). Specifically, policies promoting educational equality and ideological purity ("redness") regained priority. Almost all secondary and tertiary educational institutions were closed during the early years of Cultural Revolution (secondary schools from 1966-68 and tertiary institutions from 1966-72). When they reopened they concentrated on political indoctrination and instituted policies and practices designed to narrow the gap between manual and non-manual workers, between urban and rural people, and between workers and peasants (Hannum 1999). There was also an ideological emphasis on gender equality during those years (Bauer *et al*. 1992). Politically oriented and class background admission criteria prevailed, which accomplished the purpose of increasing enrollments of worker and peasant children. Since an essential goal of the Cultural Revolution was to reduce differences between the peasantry and the remainder of the population (Deng and Treiman 1997), tracking systems, key-point schools, vocational education, and entrance examinations were abolished. At the same time, many new primary and especially secondary schools were opened in villages, although typically with a low academic standard (Unger 1982). Colleges were closed to high school graduates, and only a limited number of students were allowed to enter college, on the basis of political and family background (low

[1] We conducted exploratory analysis in which we divided the 1950-1965 years into two periods: 1950-1957 and 1958-1965. However, the results for the two periods were substantially similar. Thus, in the interest of parsimony we combined them and analyzed four rather than five birth cohorts.

SES) selection criteria (Zhou *et al*. 1998). Urban students and other urban workers, especially the "intelligentsia," were sent down to the countryside to work as peasants. One important result of these policies was to reduce the quality of education for children who were in school, or should have been in school, during the Cultural Revolution period. Treiman (2002) shows that the "cost" of the Cultural Revolution in terms of knowledge of vocabulary was about the equivalent of one year of schooling, net of years of schooling and other factors.

The deliberate reversal of previous policies during this period led to a major expansion of the education system, increasing educational opportunities for children of peasants in particular at the expense of urban worker's children. Hence, due to state interventions that explicitly promoted educational equality and a reduction of class differences, educational attainment in this period became less dependent on social origins (Deng and Treiman 1997). Further, the egalitarian political climate of this period had an equalizing effect on educational disparities between men and women (Hannum and Xie 1994).

Period 4: Post-Mao Economic Reform (1977-1996). With the repudiation of the Cultural Revolution following the death of Mao, Deng geared the development of the educational system to the advancement of economic modernization and a competitive merit-based educational agenda was re-emphasized. The educational system prevailing during the Cultural Revolution was gradually re-structured. The rapid expansion of education during the Cultural Revolution was blamed for the low quality of many schools and as a remedy schools regarded as of low quality were closed down. At the same time, key-point schools and vocational schools proliferated. Moreover, after 1978 the foundations of education financing were changed from a centralized system with a narrow revenue base to a decentralized system with a more diversified revenue base (Tsang 2000), which had the effect of exacerbating quality differences between schools, particularly between rural and urban schools. Although there have been subsequent efforts to further reduce illiteracy as well as to improve the quality of schools, the overall consequence of the post-Mao reforms was to increase inequality in educational opportunities and attainment (Rong and Shi 2001).

The decentralization of educational investment is embodied in the system of "local responsibility and administration by levels," according to which lower levels of local governments are responsible for the provision of primary and secondary education, whereas before the reform period funds were allocated by the central government directly to schools (Tsang 1996). Since investment in education does not produce short-term profits that boost local revenues, there has been a strong incentive for local governments in poor areas to invest in profitable ventures instead of in education (Tsui 1997). Decentralization generally has led to an increase in educational fees, which particularly affects children in poor areas least able to subsidize schools. Also, higher fees increase the opportunity costs associated with educating children. Finally, with the introduction of the "household responsibility system" (in which collective land was allocated to individual families, who were allowed to sell on the open market for profit any grain remaining after they paid the in-kind grain tax and also all other agricultural products), parents were more likely to keep children out of school due to the increasing economic value of child labor (Summerfield 1994). All of these factors contributed to an increase in educational inequality, and to the curtailment of access to education for rural children in particular (Hannum 1999). These same factors also exacerbated differentials in the willingness of families to invest in their male and female children (Summerfield 1994). During the reform period, female participation in schooling declined at all levels of education and the gender gap increased (Rong and Shi 2001).

Hypotheses

Because of the marked volatility of Chinese state policies over the past half century, the Chinese experience is invaluable for studying the impact of the political environment on individual outcomes, specifically the sibship size effect studied here. As we have noted, political changes may alter both access to education and the ability and incentives of families to keep their children in school. We thus expect sharp differences in the impact of the number of siblings on educational attainment across the four periods identified above. We formalize these expectations by specifying seven hypotheses.

Hypothesis 1: During periods emphasizing educational egalitarianism (Period 3: the Cultural Revolution Period), the effect of sibship size is negligible. By contrast during periods characterized by a competitive agenda and educational inequality (Period 2: the Early Years after Liberation; and Period 4: the Economic Reform Period), the larger the number of siblings, the lower the level of education attained, all else equal. (For a prediction regarding Period 1, see Hypothesis 3.)

As noted, educational policies in China after 1949 have fluctuated between an egalitarian emphasis and an emphasis on meritocratic competition. These two impulses have been accompanied by quite different practices. Although the Chinese education system has expanded more or less continuously since Liberation, only during egalitarian periods has this expansion been both extensive and relatively equally distributed. During periods of meritocratic emphasis, increases in the availability of schooling tended to be concentrated on the already-advantaged sectors of Chinese society, with most of the population left almost untouched. Similarly, during egalitarian periods schools were provided greater subsidies from the state and school fees paid by parents were reduced. The expansion in the availability of schooling and the reduction in school fees was accompanied by a campaign of encouragement of parents, especially rural and laboring parents, to send their children to school. Finally, during egalitarian periods affirmative action policies were emphasized in which admission standards were relaxed for the children of workers and peasants. Meritocratic periods, by contrast, tended to require higher school fees and also emphasized examination performance as the basis for admission to each level.

The result of these policy differences was that during meritocratic periods, family differences in material and cultural capital were much more important than during egalitarian periods, and so the dilution of these resources in families with many children was far more consequential in meritocratic than in egalitarian periods.

Hypothesis 2: During periods when educational inequality is large, the effect of sibship size is especially detrimental for the educationally disadvantaged---girls and rural children.

Hypothesis 2.1: The sibship size effect varies by sex. It is weak for boys in all periods but is strong for girls during meritocratic periods.

Son preference is persistently observed in China and girls are always disadvantaged relative to boys, due to different perceptions of gender roles and expected returns to family investments. Parents tend to allocate resources disproportionately to the children they expect to bring the highest returns—that is, their sons in preference to their daughters. There are two reasons for expecting greater returns from investment in sons. First, China is strongly patrilocal and patrilineal. When they married, women traditionally moved to their husband's family compound or at least to his village, and they were expected subsequently to care for his parents, not their own. Such practices are still prevalent in rural China today, and the attendant norms persist even in the urban population. Second, the greater earning power of men relative to women, which is more or less universal across societies (Treiman and Roos 1983) and in China as well,[2] means that even under circumstances in which old-age-support obligations extend to daughters as well as to sons, it still is more rational to maximize one's son's earning power.

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Particularly when family size is large and boys and girls are competing for limited resources within a family, girls tend to experience more gender inequality in education. Thus, high fertility tends to reinforce the gender gap by generating greater inequality between siblings by sex in educational attainment, which means large sibsize is more likely to affect girls rather than boys. This is especially the case during periods when competitive educational agenda prevail. Under these conditions, family resources are a significant part of the financing of education and there are little external-family resources to promote educational equality. Also, the government policies with a strong emphasis on economic development provide incentives to favor male children who are perceived to bring higher economic returns, and hence increase the opportunity costs for educating girls. Sibship size thereby has significant consequences for girls' schooling under unequal-access conditions where both son

[2] In our data, among those with individual incomes, women on average earned 77% of what men earned.

preference and competition among siblings for resources exist. However, during egalitarian periods emphasizing educational equality, on one hand, gender inequality in education decreases due to the direct consequences of equalizing policies to reduce family resource constraints which lead parents to make selective investment among their children; on the other hand, the relevant socioeconomic and demographic incentives influence parental decisions to educate their children and encourage equal treatment for male and female children. Therefore, we argue that sibsize effect for girls is largely weakened during the egalitarian periods.

Hypothesis 2.2: Sibship size depends on rural/urban residence.

The most important factor influencing a person's educational attainment in China is whether he lives in a rural or an urban area, which reflects the institutional, administrative and economic differences, and affects both educational resources and access to educational institutions (Knight and Shi 1996).

Hypothesis 2.2.1: During the unequal-access period (Early Years after Liberation), sibship size effect tends to be larger in rural areas than in urban areas. During the equalizing period (Cultural Revolution Period), sibship size effect tends to be larger in urban areas than in rural areas due to the deliberate educational goals to promote rural education.

Sibship size is likely to compound whatever hardships a family may face, particularly in periods characterized by unequal-access policies. In rural areas where government provision is weak and schools are less available, educational expenses is high relative to family resources; and thus competition for limited family resources is extremely high among rural families. Therefore, we expect a stronger sibsize effect during early years after liberation for rural families. In contrast, during the Cultural Revolution period with a priority of improving education for peasant children, by building a large number of rural schools and resetting admission criteria largely favoring peasant background, rural children's education is less dependent on familial-level resources. Under the egalitarian environment, rural parents place more value on education and for all children as a response to the mass education expansion in rural areas. Hence, rural children suffer less from within-family resource dilution, and sibship size effect tends to be small. However, dissimilar to the reduction in gender gap during this period which improve girls educational positions without eliminating sons' superiority,

educational policies seek to reduce rural-urban gap by explicitly enhancing the educational levels in rural areas while decreasing educational opportunities for urban children, and a large number of urban students were even sent down to countryside. Thus, the declining access to education aggravates the competition among urban siblings, and the negative sibsize effect tends to be larger in urban areas.

Hypothesis 2.2.2: During the Economic Reform Period, sibsize effect in rural areas is mixed due to offsetting effects of the resource-dilution process and the introduction of responsibility system. In urban areas, this effect increases as a result of declining fertility through policies advocating small family size.

After the implementation of birth control policies since 1971 which peaked to one-child policy in 1979, number of large families decreases dramatically, whereas number of one and two-child families where family resources are less thinly distributed increases remarkably. These policies are especially thorough in urban areas. To further encourage having fewer children, the government even provides subsidies for eligible small families. This act further enlarges the gap in family resources on each child between small and large sibsize families. Therefore, as the proportion of large families decreasing over time, the remaining large families are increasingly disadvantaged in allocating resources to educate their children. As a result, sibship size effect increases for urban children during this period.

Along with the deepening decentralization, the household becomes a major financial unit for education in China, especially in rural areas where local government provision is scarce. These policies raise the direct costs of schooling to families, which tends to increase the competition of limited resources among rural siblings. A large sibsize effect is thus expected. At the same time, the rural decollectivization and introduction of the household responsibility system emphasizing agricultural returns to productive units increase the economic value of child labor. Also, since rural parents are generally aware of the limited educational opportunities for their children during this period, they perceive little use in having their children attend school. Together with the establishment of responsibility system, parents may keep or even take their children out of schools because they prefer that their children work to increase family income. Under this situation, the presence of siblings

may be beneficial and increase the likelihood of enrollment. Children benefit from having siblings because siblings can increase the possibility of educational investments by substituting for each other's labor contributions to the households, which is considered to diversify risks of familial investments and economize on family resources. Hence, sibship size may have positive effect on children's education. Overall, during this period, the sibsize effect is mixed due to the two offsetting mechanisms.

Hypothesis 3: Certain level of development needs to be achieved before sibship size can have an impact on education in China. Before the state liberation in 1949, there tends to be no evident sibship size effect on educational attainment for all population due to the floor effect.

Sibship size effect is closely associated with level of socioeconomic development (Sudha 1997; Hermalin *et al*. 1982). Before liberation in 1949, China was in the early stage of socioeconomic development. The educational opportunities and facilities were extremely limited, and education was not attached great importance because labor largely depended on manpower than human capital. As observed in many other developing societies, we expect no sibsize effect under this traditional socioeconomic structure, since the low availability and importance of education made parents very unlikely to carry out resource-allocation process on children's education. Thus, there tends to be a floor effect that parents are least likely to invest on children's education, no matter how many children they have.

Data, Variables, and Methods

Data

The data used here are from the survey of *Life Histories and Social Change in Contemporary China* (Treiman and Walder 1996), a multi-stage stratified national probability sample of 6,090 adults aged 20-69 from all regions of China except Tibet (Treiman 1998; Treiman

and Walder 1996).[3] The sample was stratified by dividing each county into rural and urban portions, with the urban population sampled at three times the rate of the rural population. Within the rural sample, counties were divided into 25 strata on the basis of the proportion of the rural population with at least a middle school education. Two counties (*xian*) were chosen from each stratum with probability proportionate to the size of the rural adult population (PPS); within each county, one township (*xiang*) was chosen PPS; within townships, two villages (*cun*) were chosen PPS; within villages, 30 households were chosen from the permanent and temporary *hukou* lists; and within households, one adult (age 20-69) was chosen at random; this procedure yielded 3,003 cases. The urban sample was selected in the similar way, with the stages comprised of counties or county-level units (county-level cities and districts of larger cities), "street committees," and "neighborhood committees," yielding 3,087 cases (see Treiman [1998: Appendix D] for details). This is effectively a national probability sample of the Chinese population, since the population of Tibet is so small that it is extremely unlikely that any Tibetan counties would have been selected even if Tibet had been included in the population from which the sample was drawn.

Given the sample design, respondents were selected from households with different numbers of adults; moreover, the current urban and rural populations were sampled at different rates. Thus, to render our data representative of the adult population of China, we apply case weight methods both for the descriptive statistics and for the model estimation. Also, because the sample is clustered, we utilize survey estimation procedures to get correct standard errors (StataCorp 2003).

The survey gathered extensive information on respondents' life histories, especially education histories and family socioeconomic background. This is a high quality survey with little missing data.

[3] The data and documentation can be downloaded from [http://www.sscnet.ucla.edu/issr/da/].

After constructing a missing variable indicator for father's occupational status[4] and eliminating 32 cases with missing data on the other variables considered here, the analysis is based on 6,058 cases. Our basic strategy is to estimate a series of OLS regression models predicting years of schooling from the number of siblings and other explanatory variables. To highlight the impact of political shifts over time and to account for persistent rural-urban and gender differences, we also estimate separate models for cohorts corresponding to each of the four periods identified above (see below for details), and for rural and urban residents and males and females.

Variables

The *dependent variable* is the total years of completed schooling, ranging from 0 to 18. A potential problem with this specification of educational attainment is some respondents may still be in school. However, it turns out that this is true of less than one per cent of the sample, the bulk of whom were age 20 or 21 at the time of the survey. Thus, it is of little practical importance.

Explanatory variables include basic background variables. *Gender* is coded as a dichotomous variable (male=1, female=0). *Rural/urban residence* is defined based on the place of residence at age 14, with villages coded as rural (=0) and other residential status categories[5] coded as urban (=1). Residential status at age 14 is a better predictor of adult life chances than is residential status at birth or current residential status, which may be a result rather than a determinant of education.

We control for *parental education,* which is known to be an important determinant of offspring's education. In Chinese families, father's education is often considered to be more important, but the relative unimportance of mother's education may be largely due to the low educational level of women (who average nearly two years less schooling than men—5.4 years vs. 7.2 years). Since parents generally attempt to maximize the positive effects of their education, we expect that in

[4] Father's occupation is the only variable in the analysis that has missing data on more than a handful of cases. To maximize the number of cases for analysis, we construct a missing data indicator for father's occupational status rather than omitting these missing cases.

[5] Other categories include townships or towns, county seats, county-level cities, prefecture-level cities, provincial capitals and provincial-level cities.

families in which mothers are better educated than fathers their education tends to be more influential. Thus, parental education is measured by the years of schooling completed by the parent with the higher level of education. Also, in the handful of cases where information was available for only one parent, that information was used.

We include *father's occupational status (ISEI)*[6] when the respondent was age 14 as one aspect of family origin. More than 10 per cent of the data (N=731) have missing data on father's occupation and this information is not likely to be missing at random. Rather, poorly educated people are less likely to know about their parental characteristics, which means that the omission of such cases would substantially bias the sample.[7] In particular, the number of siblings is correlated with whether father's occupation is known.[8] Thus, we included a dichotomous variable, scores 1 if father's occupation was missing and scored 0 otherwise, and assigned the mean *ISEI* score to all cases missing information on father's occupation. This procedure yields appropriate estimates of the effect of each of the other variables in the model, as well as of father's ISEI. The coefficient associated with the "missing value" dichotomy shows the difference in the average years of schooling for those who are missing information on father's occupational status and those who are not.[9]

The key independent variable in the analysis is *sibship size*. We use the total number of siblings at age 14 as an indicator of sibship size. This variable ranges from 0 to 14 in our data. However, we truncate it at seven and treat it as a continuous variable in order to reduce the leverage of the small number of respondents with a very large number of siblings (less than one per cent of our sample reports eight or more siblings).

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[6] Father's occupational status is measured by the *I*nternational *S*ocio*e*conomic *I*ndex of Occupations *(ISEI)* (Ganzeboom, De Graaf, and Treiman 1992), which was added to the data by the original investigators. This scale has a metric ranging from 10 to 90 and is constructed on principles similar to those used to construct the well-known Duncan (1961) *SEI*.

[7] In our data, about 15 per cent of those with a primary education or less are missing information on father's occupation, compared to about seven per cent of those with at least a middle school education.

[8] In our data, those missing information on father's occupation have about one half sibling less (2.9 compared to 3.4) than those who reported their fathers' occupations.

[9] In contrast with our treatment of parental education, we did not code the higher of father's and mother's ISEI because this information is missing for a large fraction of mothers (about one-third), which would leave us with a substantial amount of missing data even if we used whatever information was available.

Although the data set includes abundant information on the life histories of individuals, it contains no information on the composition of sibsets with respect to birth order, gender, or spacing. Birth order is likely to be unimportant since there is evidence, at least for developed nations, that birth order has little or no impact on educational attainment (Olneck and Bills 1979; Steelman and Powell 1985). Similarly, in developed nations the effect of sex composition is much smaller than the effects of sibship size or spacing (Steelman *et al*. 2002). To examine how sibship size effect operates depending on sex, it would be informative to know the sex composition of the respondent; that is, whether girls are more sensitive to sibsize because they have male siblings. Since we do not have such information, we can only estimate models on sibsize separately for girls and boys without accounting for sibship sex composition. However, since there is clear evidence in China that parents tend to continue to bear children if earlier children are daughters in order to have at least one son, we expect that girls are more likely than boys to have brothers. Thus, even without information on sex composition, we can reasonably assume that girls suffer more from sibsize because they have more brothers.

To incorporate a historical perspective, we collapse the population into four cohorts with each experiencing distinctive educational policies and level of socioeconomic development, rather than the conventional 10-year birth cohort. Studying the effect of historical events is difficult because it is unclear where in the life process the impact will be greatest (Deng and Treiman 1997). In the present study, we use age 7—the modal school entrance age according to the current data and many other studies—as the age point at which people's education tend to be most affected. It is because the school starting age is the age at which parental decisions regarding children's education are most decisive, and parents tend to plan children's education at the outset of school years. Thus, parental decisions which are closely related to children's educational outcomes are most affected by policy-related factors during children's earliest school years. Also, since parents' influence tends to decline along with the school progression due to individual selectivity (Mare 1981), the early selection turns out to be critical. We thus define four cohorts, based on the year of birth corresponding to the year the respondent turned age 7 during certain historical period: the Pre-Liberation (before 1949) cohort

includes people born before 1942; the Early Years after Liberation (1950-65) cohort includes people born between 1943 and 1959; the Cultural Revolution (1966-76) cohort includes people born between 1960 and 1969; and the Post-Mao Economic Reform (after 1977) cohort includes people born after 1970.

Another limitation of the present study is that we cannot account for the endogeneity problem of sibsize effect on education. That is, there might be reciprocal causality between the demand for children and the demand for education within families, also called the quantity-quality tradeoff. Parents may choose to have fewer children in order to provide each of them with better educational resources before they start building families. In this case, the effect of sibship size on education would be attenuated. An appropriate solution is to include instrumental variables. However, without longitudinal data on how family planning decisions are made and how subsequent resources are invested in children, we cannot determine the extent to which the observed effect is real or artificial, so do numerous other studies on this topic. Nevertheless, our main concerns are to study how the sibsize-education relationship has changed across contexts over time, rather than focusing only on the magnitude of this effect. Therefore, the endogeneity problem does not affect our analysis to a large degree.

Results

Descriptive statistics

Table 1 presents sample means and percentages for each cohort, and by rural/urban residence and sex. The general trends are expected. From the top panel, we see that the family size has declined from almost 5 children (no. of siblings plus one) to around 3 children, especially for the latest cohort who undergo a series of birth-control policies. At the same time, average level of schooling has increased from four and half years before liberation to eight and half years during the post-Mao economic reform period. The results mostly reflect the changes in governmental educational policies. For pre-liberation cohort who suffered from low levels of socioeconomic development, mean

educational level is low and there is a relatively large dispersion from the mean. After-liberation, along with education expansions which culminate to the Cultural Revolution, the mean years of schooling increases while the dispersion from the mean decreases. Also, the overall education for the third cohort distinguished by egalitarianism is greatly improved compared to the second cohort where educational inequalities prevailed. Results for the fourth cohort are mixed and not distinguishable from the third cohort, presumably resulting from both educational inequalities for this cohort and the fact that a number of respondents are still in school.

The middle panel of Table 1 shows the rural-urban disparities across cohort. For almost every cohort, fertility is higher in rural areas whereas the level of education is lower. Similar to the overall trend, fertility decreases while education increases over time for both rural and urban people. Also, it is clear that rural-urban different is more than 0.5 year higher for the second and fourth cohort characterized by educational inequality than for the egalitarian Cultural Revolution cohort. Although results for the youngest cohort may be mixed, it seems that rural-urban difference has enlarged because mean years of schooling decreases for rural children while it increases for urban children. From the lowest panel, the changes in sex difference in education across cohort are mostly consistent with shifting educational policies, except for the latest cohort of whom the results are mixed. Also, there is clear evidence of persistent son preference in China; that is, for each cohort boys are better educated than girls and there is less dispersion for boys. Moreover, although the number of siblings for boys and girls are both declining consistent with the declining fertility, over time girls tend to have more siblings than boys due to the persistent son preference in China that parents tend to continue bearing children to secure they have sons.

Overall sibship size effect

To study the overall sibship size effect in China, we first estimate a model of years of schooling on sibsize only (results are not shown in tables). Results show that each additional sibling decreases individual's education by almost one fifth of a year (β = -.18, p-value=.000).

Consistent with findings in most of other societies, sibsize exerts a negative effect on children's education. The negative effect of sibship size holds even when we control for other background variables (control variables include parental education, father's ISEI, sex, rural/urban residence and cohort), although smaller in magnitude (β = -.09, p-value=.018). Overall, sibship size exhibits a significant effect on children's education, in the expected direction. In order to explain the negative consequences of large sibship size, we further test the resource-dilution hypothesis by studying the relationship between sibship size and familial resources. There are five familial resource variables in the data: number of books in home at age 14, home atlas at age 14, children's magazines at age 14, family study desk at age 14 and own study desk at age 14. Since it is better to trace the resource-dilution process by studying individual-level and low-shareability resources, we restrict this test only to "own study desk at age 14". Logistic regression of the presence of own desk by sibsize shows that the availability of own study desk at age 14 declines as sibship size increases, net of other background controls (β = -.110, p-value=.004). Resource-dilution theory thereby tends to be supported that each additional sibling reduces the availability of familial resources for each child.

Sibship size effect by cohort

Since the gross relationship may hide substantial variation by cohort, we estimate separate models by cohort each with distinctive level of socioeconomic development and educational policies. Results shown in Table 2 appear to support Hypothesis 1. For early years after liberation and economic reform cohort under unequal-access conditions, there are large and significant sibship size effects, with one additional sibling costing almost 0.2 year of education. In contrast, for the Cultural Revolution cohort who experience a major education expansion and benefit from egalitarian policies, the resource dilution process hardly affects children's education due to the support from the state that modifies within-family education stratification. The sibship size effect for this cohort is extremely

small (-.03) and insignificant. Also, it is evident from the table that during this egalitarian period, effects of other social origin variables are relatively small as well, particular parental education and occupation. This finding tends to support our proposition that when effects of social origin decrease sibship size effect also declines. Moreover, for the first cohort before liberation, sibship size does not exhibit an impact on children's education. This is consistent with Hypothesis 3 that there tends to be a floor effect at early stage of socioeconomic development of a society, when both the availability and importance of education are so low that sibsize is irrelevant to educational outcomes.

Sibsize effect across cohort by rural/urban residence

Table 3 presents the historical relationship between sibship size and educational attainment separately for rural and urban residence, an important dimension of educational stratification in China. All results clearly suggest that sibsize effect differ by rural/urban residence, supporting Hypothesis 2.2. We note that for the first cohort, there is no sibship size effect for both rural and urban children, with sibsize-education association in urban areas even showing a positive trend. This finding is consistent with Hypothesis 3. Moreover, we suspect that the slightly positive effect may be attributable to the fact that at early stage of development, fertility and income tend to be positively associated (Mueller 1984). Since we do not have information on detailed family wealth or income, we test this argument by regressing number of siblings on father's source of income—a dummy variable with income from sources of manager, wage worker or cadre being coded 1 as an indicator of high income—that is closely related to family income. Appendix Table A tends to support this argument particularly in urban China, with high-income families having .3 more siblings than low-income families.

By examining the next four columns, we find that Hypothesis 2.2.1 is supported. For cohort 2 characterized by educational inequality, rural-urban inequality is evidently an important aspect of this inequality. Sibsize hardly exhibits any effect for urban children, whereas it has detrimental effect for rural children with each additional sibling costing one fifth of a grade. However, for the Cultural

Revolution cohort, the rural-urban differential in sibsize effect is reversed. While education expansions mostly concentrate in rural areas and state policies deliberately emphasize increasing admission of peasant children at all levels, sibsize is associated with rural children's educational outcomes. In contrast, since the narrowing rural-urban education gap largely results from increasing rural admission at the expense of urban enrollment, there is an evident detrimental sibsize effect of negative .2 for urban children.

The last two columns of Table 3 exhibit a rural-urban difference in sibship size effect during the Economic Reform period. For urban children, the sibsize effect is more than doubled, with one additional sibling decreasing education by almost half a year. This may be attributed to the intensified birth-control policies during this period, especially in urban areas where governmental control is more rigid. As the overall fertility is declining, the remaining large families in urban areas become increasingly disadvantaged, particularly when government encourages low fertility by providing subsidy for small families which enlarges the existing individual-level resource differences between large families and small families. For rural children, whether there is a sibsize effect is less clear because the coefficient is neither large nor significant. Two offsetting mechanisms may be the possible explanation: on one hand, fiscal decentralization greatly reduces the local government provision with respect to education in rural areas, which tends to aggravate familial resource constraints and result in a negative sibsize effect; on the other hand, the introduction of decollectivization increases the value of child labor for families involving in agricultural production and small family business, and parents are more likely to keep children out of school for purpose of increasing family income, thus, the presence of siblings may increase the possibility of being educated since siblings can substitute for each other in labor work to reduce risks in family investment, which predicts a positive sibsize effect. We explicitly test this argument by regressing education on sibsize separately for children whose families involve in agriculture production and small business and those who do not (Appendix Table B). Results show that for other kind of families sibsize clearly exhibits a substantial negative effect (-.4), whereas for families doing agriculture and small business there is no effect. Therefore, the above results are consistent with Hypothesis 2.2.2.

Sibsize effect across cohort by sex

Results from Table 4 support Hypothesis 2.1 that sibsize effect depends on sex. While for the earliest cohort, there is no sibsize effect for both boys and girls due to the floor effect (Hypothesis 3), for all the other cohorts no sibsize effect presents for boys which reflect the persistent son preference in China. Boys in small families are about as likely to go to school as boys in larger families. However, for girls, this effect clearly shows a historical variation. While for the second and fourth cohort under educational inequalities large sibsize is certainly a cost for girls' education, for the egalitarian cohort there is no such detrimental effect. This is consistent with our proposition that during periods with educational inequalities, girls, as a disadvantaged population, are more affected by sibship size; while during egalitarian period gender disparities in sibsize effect tend to be small.

Summary and Discussion

In China, sibship size effect is neither universally observed nor negative. Rather, it exhibits a clear cohort-specific pattern dependent on level of socioeconomic development and state policies. A negative sibsize effect began to emerge only at later stage after the state liberation, when familial resource-dilution process was initiated because education expanded and parents attached more value on children's education. After a certain level of development was achieved, however, the sibsize effect was mediated by shifting state policies between egalitarian and competitive agenda. When competitive agenda prevailed during the early years after liberation and post-Mao economic reform, there was a clear negative sibship size effect. In contrast, when the government advocated social equality during the Cultural Revolution, the negative sibsize effect disappeared since state interventions modified both the societal stratification mechanism and familial resource availability and allocation decisions.

Importantly, sibsize effect in China also depends on rural/urban residence and sex of children. The son preference proves to be persistent. In almost any context, sibsize tends to have little bearing on male education. However, large sibsize reinforces girls' existing disadvantages in schooling under

contexts characterized by educational inequality. When the state advocates egalitarianism such as during the Cultural Revolution period, gender equality is emphasized and parental education decisions are less dependent on limited family resources, thus, sibship size effect is largely weakened and barely exists. Nonetheless, urban children are not persistently free from the negative sibsize effect. While sibship size had relatively little impact on urban children during early years after liberation, their advantage was largely eliminated during the Cultural Revolution era. During this period when educational policies especially emphasized peasant children enrollment, urban educational opportunities decreased and a large number of urban adolescents had their schoolint disrupted and were sent down to the countryside. Hence, during this period there was no sibsize effect for rural children but it emerged for urban children.

While the economic reform to boost the economy and birth control policies to reduce fertility are a blessing for China's socioeconomic development, they lead to an emerging aspect of inequality with respect to sibship size. In urban areas, the existing individual-level resource differences between large and small families are enlarged due to the introduction of government subsidy for small families. In rural areas, the decentralization increases the constraints of family educational resources, which tends to increase the sibsize effect. However, the decollectivization system tends to prefer large sibsize to increase rural enrollment, which predicts a positive sibsize effect. The two mechanisms are offsetting each other, and the present evidence is still premature to determine whose impact would be larger. Moreover, while the penetrating birth-control policies in rural areas are a way to reduce within-family resource dilution to increase rural educational level, it may in fact reduce rural educational attainment contrary to the original intention under the decollectivization system.

In China, it is evident that individual life chances under state socialism are extremely sensitive to political processes, and changes in state policies can dramatically alter opportunity structures. The Chinese experience contributes to our understanding of the effect of sibship size by explicitly taking the level of development and state policies of a society into account. The evidence for China clearly illustrates how changes in the wider contexts characterized by different macro-level of socioeconomic development and state institutions affect the relationship on the micro-level. Examining rural/urban

and sex differentials in corresponding settings further illustrate the mechanism under which changing macro-societal contexts influence intra-familial resource distribution and educational decision making processes. A further research potential in China is to examine the sibsize-education association under changing sociocultural contexts by studying the extent to which extra-parental resources assist in the financing of children's education, that is, to what extent the extended family network and large-spacing siblings help to eliminating family resource constraints.

A caveat. Before concluding, we need to dispose of two potential problems with our analysis: the possibility that we have the causal order wrong, because fertility decisions depend on parents' calculations as to how many children the can afford given their educational aspirations for their children; and the possibility that the observed sibsize effect is spurious because it simply reflects other aspects of family composition, in particular, birth order effects.

Consider first the causal order, or endogeneity, problem. It is evident that the relationship between sibship size and educational outcomes may arise in part from the fact that parents make fertility decisions based on their expectations regarding the cost of children, particularly the cost of educating them. The question is whether such reverse causality is important or only a minor problem. We find the evidence unpersuasive that endogeneity is a major problem. Several studies account for the endogeneity problem by using exogenous fertility events such as the birth of twins, implemented via an instrumental variable approach, and find little or no sibship size effect (Rosenzweig and Wolpin 1980; Black, Devereux, and Salvanes 2004). However, as demonstrated by Conley and Glauber (2004), the twin birth instrument is unconvincing because the presence of twins is an unusual event which may have effects on the sibsize-education association not present for single births. "It is difficult to know whether any observed effects on attainment are the result of the unexpected extra child present in the family or the presence of twins. Another way of putting this is that families with twins may not be generalizable to the population as a whole"

(p.10). Guo and Van Wey (1999) use a longitudinal analysis of sibling models rather than a cross-sectional analysis without sibling pairs to account for endogeneity and find no sibsize effect. Although their analysis is clever and thoughtful, this sample on which they base their analysis is highly restrictive (for detailed critiques see Philips 1999 and Downey *et al.* 1999). As Philips (1999) and a series of other studies suggest, sibship size still affects familial resources, which in turn affect children's outcomes.

Because of the lack of suitable data, we cannot take into account the possibility of tradeoffs between the quality and quantity of children. However, we regard such tradeoffs as relatively important for our analysis because there is considerable evidence that family size was far from perfectly planned for most families under study. Moreover, we argue that quality-quantity calculations were relatively uncommon in China until quite recently, and then only in the urban population, because children have long been valued in China as a source of labor and a resource for old age support. This was especially the case during the 1950s and 1960s when there was a substantial increase in fertility rates to support the mass production advocated by Mao: for these cohorts, for which quality-quantity tradeoff s were unlikely, we find an overall negative family size effect, which contradicts the claim that sibship size effect essentially results from endogenous quality-quantity calculations. The endogeneity problem is also likely to be less important for rural families due to their need for child labor in agricultural production.

Further, our analytical strategy was to assess variations in the sibship size effect across different cohorts rather than to examine the absolute family size effect at a single point of time. If the quality-quantity tradeoff is the story, we should expect a gradual change in the sibsize effect as quality-quantity calculations became more prevalent rather than the abrupt shifts between the presence and absence of such effect that we observed. Still, we must acknowledge that the large

and significant family size effect for the most recent urban cohort may partly reflect the endogenous quality-quantity tradeoff.

While the sibship size effect mainly focuses on between-family inequality, other studies of sibling configurations stress within-family inequality by assuming that parental resources are not divided equally between all children within a family. There has been increasing interest in the effects of sibling configurations other than sibship size, although such effects often have been shown to be negligible; there is little reliable evidence documenting such effects and the explanations for them vary enormously. Observed effects are not even consistently in the same direction, rather, they tend to depend on the specific situation studied. In addition, unlike the evidence with respect to family size effects, it is far from clear why various studies of other aspects of sibling configuration arrive at different results although this presumably is due to the fact that within-family processes tend to be entangled with individual values and beliefs that are diverse and difficult to generalize about.

Consider birth order effects. A variety of plausible, but contradictory, hypotheses regarding the influence of birth order on children's outcomes have been advanced; some predict that earlier-borns will be higher achievers, some predict that later-borns will do better, while still others predict a curvilinear advantage for both the oldest and youngest siblings. Overall, the effects of birth order are ambiguous, and claims of unequal parental treatment to children of specific birth order do not seem to have strong theoretical support.qq

Some studies find no effect of birth order and gender composition on educational attainment after controlling for family size (Kuo and Hauser 1997; Hauser and Sewell 1985; Kessler 1991). Even in situation where an effect of sibling configuration is observed (Van Eijck and de Graaf 1995), studies often fail to account for their strong relation with family size: being

early in the birth order is sometimes found to be advantageous, but this effect may be due to the higher probability of being in a small family; similarly, being in sibships with long intervals between births is advantageous, presumably due to the fact that as birth intervals increase, family size decreases. Hence, various measures of sibling configuration such as birth order, birth spacing and sex composition (in societies with strong male preference, such as China) largely reflect their interactive effect with family size.

A few studies even claim that the effect of sibship size has been exaggerated and is actually spurious due to the confounding effect of other sibling configurations such as birth order (Black *et al.* 2004). A problem involving studies of this kind is the multicolinearity between type of sibling configuration and sibship size that results from including both measures in a single model (correlations of .7 between such measures are not uncommon). But if both types of variables are regarded as potentially influential, leaving one out results in the model being underspecified. A preferred way to study the effects of both factors is to decompose the family size effect into birth order, birth spacing, and sex composition effects. This strategy can be implemented by separating the number of siblings into the number of older siblings vs. younger siblings, the number of brothers vs. sisters, and the number of closely-spaced siblings vs. sparsely-spaced siblings, or combinations of these factors (Chu, Yu, and Tsay 2004).

Unfortunately, our data do not permit doing this. Yet, as we have shown above, the family size effect is far from artifactual. Hence, our results on between-family inequality with respect to family size can be considered informative with respect to public policy implications, to which within-family inequalities are not pertinent. Further, all of the research conducted so far on the impact of sibling configuration on child outcomes has been from data sets collected for other

purposes, making the analysis of sibling configurations somewhat problematic. Clearly, data should be collected that will permit the direct investigation of such effects.

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Table 1.1. Sample Means and Percentages by Cohort (standard deviations in parentheses), LHSC 1996 (N=6,058).

	Cohort 1 (Pre-Liberation)	Cohort 2 (Early years after Liberation)	Cohort 3 (Cultural Revolution)	Cohort 4 (Economic Reform)	Total
No. of siblings	3.1 (1.8)	3.7 (1.8)	3.6 (1.6)	2.6 (1.6)	3.4 (1.8)
Parental years of schooling	1.9 (2.9)	2.7 (3.6)	4.7 (4.2)	6.6 (4.3)	3.6 (4.1)
Father's ISEI	24.6 (13.2)	25.9 (15.3)	29.6 (18.4)	29.8 (18.2)	27.2 (16.4)
Children's years of schooling	4.4 (4.5)	6.8 (4.1)	8.6 (3.5)	8.6 (3.3)	7.1 (4.2)
Urban	31.43	32.41	33.30	35.48	32.87
Male	52.78	51.61	48.41	50.38	50.76
Missing on fr.'s ISEI	24.13	11.83	5.61	5.93	11.80
N	1,260	2,240	1,766	792	6,058

Table 1.2. Sample Means and Percentages by Cohort and Rural/Urban Residence (standard deviations in parentheses), LHSC 1996 (N=6,058).

	Cohort 1 (Pre-Liberation)		Cohort 2 (Early years after Liberation)		Cohort 3 (Cultural Revolution)		Cohort 4 (Economic Reform)		All Sample	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
No. of siblings	3.0 (1.9)	3.1 (1.8)	3.6 (1.9)	3.7 (1.8)	3.2 (1.6)	3.8 (1.6)	2.2 (1.4)	2.9 (1.6)	3.2 (1.8)	3.5 (1.8)
Parental years of sch.	2.8 (3.7)	1.5 (2.4)	4.4 (4.3)	2.0 (2.9)	6.6 (4.5)	3.7 (3.7)	9.3 (4.0)	5.1 (3.6)	5.4 (4.7)	2.7 (3.4)
Father's ISEI	31.5 (15.6)	21.5 (10.6)	35.2 (17.6)	21.4 (11.8)	40.5 (14.5)	24.1 (15.7)	43.4 (18.2)	22.3 (13.3)	37.2 (18.0)	22.3 (13.1)
Children's years of sch.	6.5 (4.7)	3.5 (4.0)	9.0 (3.2)	5.7 (4.0)	10.3 (2.6)	7.7 (3.6)	10.7 (2.5)	7.5 (3.1)	9.1 (3.6)	6.0 (4.1)
Male	52.02	53.13	51.24	51.78	48.64	48.30	49.11	51.08	50.33	50.97
Missing on fa's ISEI	25.25	23.61	11.43	12.02	6.80	5.01	5.34	6.26	11.95	11.73
Rural/Urban difference in education	3.0		3.3		2.6		3.2		3.1	
N	396	864	726	1,514	588	1,178	281	511	1,991	4,067

Table 1.3. Sample Means and Percentages by Cohort and Sex (standard deviations in parentheses), LHSC 1996 (N=6,058).

	Cohort 1 (Pre-Liberation)		Cohort 2 (Early years after Liberation)		Cohort 3 (Cultural Revolution)		Cohort 4 (Economic Reform)		All Sample	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
No. of siblings	3.0 (1.8)	3.2 (1.9)	3.7 (1.9)	3.7 (1.8)	3.5 (1.7)	3.7 (1.6)	2.5 (1.4)	2.8 (1.7)	3.3 (1.8)	3.5 (1.8)
Parental years of sch	1.8 (2.8)	1.9 (3.0)	2.8 (3.7)	2.7 (3.5)	4.8 (4.3)	4.5 (4.2)	6.4 (4.3)	6.7 (4.3)	3.6 (4.1)	3.6 (4.0)
Father's ISEI	24.3 (12.7)	25.1 (13.8)	25.7 (15.2)	26.1 (15.5)	29.8 (18.5)	29.3 (18.3)	29.5 (18.2)	30.2 (18.2)	27.0 (16.3)	27.4 (16.6)
Children's years of sch	5.6 (4.4)	3.1 (4.1)	7.7 (3.6)	5.8 (4.3)	9.3 (3.2)	7.9 (3.7)	8.9 (3.1)	8.3 (3.5)	7.8 (3.9)	6.2 (4.4)
Urban	30.98	31.93	32.18	32.66	33.45	33.15	34.59	36.39	32.59	33.15
Missing on fa's ISEI	23.91	24.37	12.63	10.98	5.61	5.60	5.26	6.62	12.16	11.43
Sex difference in education	2.5		1.9		1.4		0.6		1.6	
N	665	595	1,156	1,084	855	911	399	393	3,075	2,983

Table 2. OLS Regression of Years of Schooling on Sibship Size and Control Variables, Separately by Four Cohorts, LHSC 1996 (N=6,058). [p-value in parentheses]

Independent variables	Cohort 1 (Pre-Liberation)	Cohort 2 (Early years after liberation)	Cohort 3 (Cultural Revolution)	Cohort 4 (Economic Reform)
Sibship size	-0.045	-0.166	-0.027	-0.176
	(.436)	(.002)	(.699)	(.011)
Male	2.575	2.331	1.449	0.623
	(.000)	(.000)	(.000)	(.008)
Urban	2.486	2.425	2.010	1.526
	(.000)	(.000)	(.000)	(.000)
Father's education	0.382	0.217	0.172	0.223
	(.000)	(.000)	(.000)	(.000)
Father's ISEI	0.036	0.032	0.021	0.326
	(.003)	(.000)	(.000)	(.000)
Missing on Father's ISEI	-0.772	-1.023	-0.714	-0.130
	(.008)	(.000)	(.092)	(.768)
Constant	0.809	3.703	5.650	5.752
	(.019)	(.000)	(.000)	(.000)
R^2	0.282	0.252	0.222	0.314
N	1,260	2,240	1,766	792

Table 3. OLS Regression of Years of Schooling on Sibship Size and Control Variables Across Four Cohorts, Separately by Rural/Urban Residence at Age 14, LHSC 1996 (N=6,058). [p-value in parentheses].

Independent variables	Cohort 1 (Pre-Liberation)		Cohort 2 (Early years after liberation)		Cohort 3 (Cultural Revolution)		Cohort 4 (Economic Reform)	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Sibship size	0.024	-0.064	-0.034	-0.193	-0.196	0.004	-0.463	-0.101
	(.857)	(.318)	(.685)	(.002)	(.008)	(.958)	(.000)	(.184)
Male	2.019	2.716	1.151	2.584	0.198	1.796	0.136	0.845
	(.000)	(.000)	(.000)	(.000)	(.377)	(.000)	(.743)	(.003)
Father's education	0.431	0.333	0.209	0.223	0.119	0.187	0.101	0.257
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.084)	(.000)
Father's ISEI	0.043	0.038	0.040	0.032	0.020	0.024	0.034	0.036
	(.019)	(.013)	(.000)	(.008)	(.001)	(.002)	(.014)	(.000)
Missing on Father's ISEI	0.386	-1.108	-0.273	-1.151	0.171	-1.065	-0.645	-0.118
	(.486)	(.001)	(.634)	(.000)	(.611)	(.050)	(.204)	(.825)
Constant	2.748	0.881	5.932	3.698	9.176	5.262	9.293	5.181
	(.003)	(.028)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
R^2	0.216	0.202	0.191	0.166	0.128	0.134	0.262	0.161
N	396	864	726	1,514	588	1,178	281	511

Table 4. OLS Regression of Years of Schooling on Sibship Size and Control Variables Across Four Cohorts, Separately by Sex, LHSC 1996 (N=6,058). [p-value in parentheses].

Independent variables	Cohort 1 (Pre-Liberation)		Cohort 2 (Early years after liberation)		Cohort 3 (Cultural Revolution)		Cohort 4 (Economic Reform)	
	Male	Female	Male	Female	Male	Female	Male	Female
Sibship size	-0.144 (.122)	0.093 (.181)	-0.016 (.803)	-0.307 (.000)	0.014 (.878)	-0.077 (.382)	-0.111 (.218)	-0.197 (.045)
Urban	2.165 (.000)	2.920 (.000)	1.959 (.000)	2.879 (.000)	1.296 (.000)	2.746 (.000)	1.030 (.002)	1.979 (.000)
Father's education	0.364 (.000)	0.416 (.000)	0.218 (.000)	0.219 (.000)	0.184 (.000)	0.166 (.000)	0.256 (.001)	0.198 (.001)
Father's ISEI	0.043 (.013)	0.024 (.131)	0.015 (.190)	0.048 (.000)	0.018 (.023)	0.024 (.001)	0.034 (.000)	0.031 (.014)
Missing on Father's ISEI	-1.675 (.000)	0.427 (.216)	-1.111 (.001)	-0.864 (.029)	-1.188 (.039)	-0.280 (.610)	0.580 (.383)	-0.691 (.320)
Constant	3.817 (.000)	0.253 (.553)	6.001 (.000)	3.739 (.000)	7.172 (.000)	5.615 (.000)	6.072 (.000)	5.922 (.000)
R^2	0.188	0.278	0.148	0.234	0.165	0.215	0.306	0.323
N	665	595	1,156	1,084	855	911	399	393

Appendix

Table A. OLS Regression Predicting Number of Siblings on Father's Source of Income for Pre-Liberation Cohort, Separately by Rural/Urban Residence, LHSC 1996. (number of siblings truncated at 7; standard errors in parentheses)

	Urban		Rural	
	No control[a]	*With control*[b]	*No control*[a]	*With control*[b]
Father's source of income (manager or cadre=1)	0.35 (.065)	0.28 (.151)	0.16 (.487)	0.13 (.585)
N	401	401	872	872

a. Only father's source of income as independent variable.

b. Also controlling for parental education and sex of respondent.

Table B. OLS Regression Predicting Years of Schooling on Sibship Size and Other Predictors of Economic Reform Cohort, Separately by Whether Father Involves in Agriculture or Small Business, LHSC 1996. (number of siblings truncated at 7; standard errors in parentheses)

	Father involves in agriculture or small business		Father involves in other occupation categories.	
	Model 1	Model 2	Model 3	Model 4
Number of siblings:				
Linear	-.038		-.411	
	(.654)		(.000)	
Categories (ref=0)				
1		.246		-.769
		(.834)		(.141)
2		-.356		-.871
		(.750)		(.086)
3		-.082		-1.862
		(.945)		(.002)
4		-1.156		-1.028
		(.301)		(.084)
5		.622		-3.297
		(.565)		(.000)
6		-.322		-1.226
		(.810)		(.045)
7		-.046		-2.781
		(.970)		(.150)
Parental education	.282	.288	.161	.189
	(.000)	(.000)	(.000)	(.000)
Male	.860	.876	.235	.165
	(.005)	(.004)	(.365)	(.532)
Urban	.759	.630	1.688	1.632
	(.197)	(.312)	(.000)	(.000)
Constant	5.459	5.549	8.573	8.649
	(.000)	(.000)	(.000)	(.000)
N	438	438	354	354