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家庭組成對教育成就的影響

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家庭中父母對小孩性別偏好所造成的資源配置不均問題近年來深受重視, 尤其在重男輕女的傳統社會。例如在印度, 學者發現女嬰在出生之後得到的哺乳與照護都少於男嬰, 女嬰的死亡率也較其他國家來得高。然而, 以這些國家的資料來分析性別偏見對女性帶來的影響, 研究的結果卻相當分歧, 大部分研究發現女性並未因重男輕女的性別偏見而有不好的表現; 在台灣, 女性進入大學就讀的比例反而還高於男性。女性表現不比男性差是否就表示性別歧視導致的資源剝奪問題不存在? 答案可能不是肯定的。女性可能因爲天生的性別特性, 例如較具韌性, 使得她們出生存活率高、在某些行爲上有較好的表現, 導致我們所觀察到的男女差異低估了性別歧視的程度。有鑑於此, 經濟學家近年來開始估計弟弟 (相對於妹妹) 對姐姐或哥哥教育成就的影響, 以便消除掉男女之間天生的差異。但即便如此, 這方法運用到性別歧視嚴重的國家, 例如印度, 仍很難找到家庭內性別歧視的證據。諾貝爾經濟學獎得主 Ester Duflo 與 Angus Deaton 都指出這個實證上的難題。

傳統迴歸模型估計弟弟對於姐姐或哥哥的教育成就影響時, 通常將觀察到的手足總數 (小孩總數) 放於控制變數之中, 這樣的模型估計有一個假設, 亦即弟弟的存在不會影響到兄弟姐妹的多寡。但這個假設在重男輕女的國家並不適用, 因爲父母會一直生育到有兒子爲止 (son-preferring stop rule), 因此前幾胎小孩的性別組合將會影響到父母的總生育數。在此種生

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育決策之下, 擁有弟弟對姐姐教育表現的影響可能會透過兩種管道: 一爲間接效果, 就是透過減少手足總數而對姐姐教育資源帶來的正向效果; 另一爲直接效果, 在小孩總數固定不變的情況之下, 弟弟的存在對姐姐會造成資源掠奪負面效果, 也就是性別歧視的效果。正是因爲這兩個管道的影響方向剛好相反、會相互抵銷, 造成實證上弟弟對姐姐影響的總效果普遍太小或不顯著。最重要的是, 在此種生育決策之下, 傳統模型控制了一個「會受到手足性別影響的變數 (實際的手足總數)」, 造成所謂「不良控制 (bad control)」的問題。如果手足性別會透過影響手足總數而影響小孩的教育成就, 那麼控制手足總數在實證上相當於強制性的把所有會生育到有兒子的家庭排除在分析範圍之外, 這種模型勢必會低估弟弟的存在對姐姐的直接掠奪效果。本文先從方法論來解釋這個實證難題, 並定義直接效果與間接效果, 提出嚴謹的實證模型, 然後應用到台灣的行政資料來檢視家庭中第一胎小孩的教育成就如何受到第二胎性別的影響, 其中教育成就變數是以「是否完成高中教育」以及「是否考進大學」來衡量。我們的實證模型結合方法論, 可以估算出弟弟對姐姐造成的直接影響 (性別歧視影響) 與間接影響。就我們所知, 雖然有少數文獻提到手足性別對小孩的表現可能會有直接與間接影響, 但目前爲止仍未有其他研究同時估算出這兩個效果。

除了估算出直接效果與間接效果, 本研究實證模型的設計也解決了兩個重要問題: 一爲第二胎小孩性別的內生性問題, 二爲家庭內小孩總數的內生性問題。由於1985年之後台灣超音波檢查愈趨普遍, 且實施「優生保健法」允許有限制條件的墮胎, 因此小孩的性別可能是父母親選擇的結果而非隨機外生。有鑑於此, 我們選取的家庭樣本限制在第二胎小孩出生於1985年之前的家庭。另外, 小孩總數的內生性在「小孩質量互補」的文獻中已經有深入的探討, 但在「手足競爭」的實證文獻上幾乎沒有研究重視此問題。誠如之前所提, 手足性別會透過影響手足總數而影響小孩的教育成就, 若不解決手足總數內生性的問題, 勢必會進一步干擾手足性別的直接效果與間接效果的估算。面對這個挑戰, 本文利用「第二胎是否爲雙胞胎」來度量小孩總數的外生變化, 這些實證策略需要一套具有詳盡家庭變數與小孩教育表現的資料才能支持。本研究串連台灣出生檔與大學聯考檔得到實證所需的家庭中小孩資訊 (出生年月、出生順序等、手足性別等) 與

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教育成就, 這獨特資料涵蓋龐大的樣本數目, 大大提升本研究估計的精確度。

本研究將長子與長女作爲分析樣本分開估計, 實證結果發現, 對長子而言, 弟弟所造成的直接效果與間接效果都非常接近零; 但對長女而言, 弟弟對姐姐造成的直接效果則是負的, 間接效果爲正的, 兩者抵銷之後的總效果接近零。利用同樣的資料, 我們也證實以傳統模型所估計出的結果會顯著低估直接效果與間接效果。針對過去的「手足競爭」文獻中缺乏家庭內性別歧視證據的疑難, 我們的研究結果提供一個新的解釋。

長女樣本所估計出的負向直接效果顯示, 若家庭中小孩數目固定不變, 弟弟對姐姐會有資源掠奪效果, 證實了家庭中仍存在性別歧視現象。而弟弟對姐姐的正向間接效果有很重要的意涵, 這代表弟弟的存在會使母親減少生育總數, 進而增加父母親分配在每位小孩 (包含女孩) 的資源。正向的間接效果, 也意味著若讓父母親可以自由選擇生育數目, 有兄弟的女孩可能會因此而享有小規模家庭的效益。相對於中國實施一胎化政策或後來放寬的二胎化政策嚴格控管家庭生育數目, 台灣讓父母親有生育選擇的自由, 重男輕女觀念促使家庭規模自然地減少, 同時家庭內男女資源分配也越來越平均。

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Best Paper Award for Research on Taiwan's Economy

The Impact of Family Composition on Educational Achievement

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Gender bias in families has been persisting across generations in many regions. Girls in India, for example, get weaned earlier, receive less childcare and health care, and suffer from higher mortality. However, some studies find no evidence that Indian females receive less care than males under normal circumstances (Duflo 2005). Deaton (1997, 2003) suggests that Indian families have carried out equal parental spending and vaccination for both genders. Using data from Taiwan—a society with a long tradition of preferring sons over daughters — we also find surprising evidence of females having the advantage of completing high school or attaining a university education.

One explanation for these mixed results is that women are more enduring than males given the same care (Waldron 1983); consequently, gender differences in child outcomes often understate the degree of gender bias. For purposes of detecting gender bias, one practical strategy for canceling out the endowment deficit of males is to estimate the sibling gender effect on child outcomes while keeping the realized number of siblings (sibsize) constant. The literature on sibling rivalry (or cross-sibling competition) has adopted that strategy. However, the method of "keeping the realized sibsize constant" does not work for households that would go on to have more children until they get a son—the so-called son-preferring stopping rule of childbearing (Yamaguchi 1989; Jensen 2005; Filmer, Friedman, and Schady 2009). Since the estimation method excludes households following the son-

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preferring stopping rule, previously estimated effects of sibling gender composition might have understated the degree of gender bias.

Son preference and the son-preferring stopping rule suggest that having a brother may affect a boy's or a girl's human capital formation in two ways. One is an indirect effect (IE) by decreasing potential sibsize, and the other is a direct effect (DE) where potential sibsize remains constant. Under son preference, DE captures the rivalry effect of a son (relative to a daughter) on child outcomes, keeping other things (including potential sibsize) constant. Under the son-preferring stopping rule, IE captures the gain/penalty from the reduced sibsize by a brother's presence, keeping other things (including potential sibling gender) constant. If child quality is independent of quantity, then IE is zero. However, if child quality decreases with quantity, then IE is positive. Because DE and IE may go in opposite directions, a brother's overall impact on child outcomes can appear to be too small, particularly in countries with strong pro-son bias.5 Therefore, understanding the relative importance of DE and IE is necessary for detecting gender discrimination.

Because the gender composition of the existing children affects the decision to have more children, "keeping the realized sibsize constant" has created bad-control problems. The problems understate DE and leave IE undefined since no variation in sibsize left for defining IE after holding constant the realized sibsize. The bad-control problem is more than an issue of endogenous sibsize. Even if sibsize were unrelated with unobserved determinants of child outcomes, the conventional method would still bias downward because of sibsize varying with sibling gender. Perhaps IE has been recognized and formulated in the literature, but IE's relative magnitude to DE is still an open question.

Rather than keeping the realized sibsize constant, Barcellos, Carvalho, and Lleras-Muney (2014) propose a new method to address the bad-control problem. They shut down the IE channel by restricting their sample to infants under 15 months of age. This strategy works because mothers cannot respond to a child's gender by having more babies in such a short window. They find strong evidence of gender imbalance in receiving childcare, which is not masked by the son-preferring fertility-stopping rule.

This study aims not to explain female advantage in education; instead, we seek to detect gender bias in family settings, although the aggregate statistics show patterns of female advantage in education. We provide causal estimates of the next brother's DE and IE on firstborn females/males' education. Our focus is the sibling gender effects on the firstborn (not on children

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born later); later-born children only exist if realized firstborn gender is such that parents continue fertility. The previous studies about family size effects have addressed the sample selection issue by estimating the impact of the later-born sibsize on the existing children. This selection issue is particularly relevant for Eastern Asian countries and several South-Eastern Asian fast-growing economies, where fertility has fallen below the replacement level. As more than 50 percent of Taiwanese families in our data have only one or two children, we address this selection issue by focusing on firstborn outcomes.

Our empirical work confronts four challenges. The first is to formulate DE and IE by overcoming the bad-control problem. Rather than using the realized sibsize to define DE and IE, we use potential sibsize because, in counterfactual worlds, it is possible to fix or change potential sibsize with a change in sibling gender composition. We decompose the overall impact of sibling gender on human capital accumulation into two separate causal channels: the active reallocation of parental resources along the direction of gender given potential sibsize (DE) and the passive effect of sibling gender through changing potential sibsize upon a change in sibling gender composition (IE). We show both theoretically and empirically that sibling gender's coefficient in a human capital formation model cannot be interpreted causally as the DE of sibling gender, even if consistently estimated. One can interpret the coefficient of sibling gender causally only in the absence of the son-preferring fertility-stopping behavior or the lack of an interaction term between sibling gender and family size in child outcomes. As expected, empirical results indicate a massive difference between the coefficient of sibling gender and the average DE, particularly for firstborn daughters, whose family size is more responsive to the next sibling gender compared with firstborn sons.

The second challenge is to address the endogeneity of family size. While extensive empirical literature has taken the endogeneity of family size seriously on various outcomes (e.g., child education), this is less of a recognized issue in studies on the effect of sibling gender composition. Given that the sibling gender effect works in part through its impact on family size, it is crucial to treat endogenous family size properly. Only controlling for the realized sibsize in regressions of child outcomes on sibling gender yields misleading results. Following the previous literature on family size effects on child outcomes, we address the endogeneity issue by exploiting the plausibly exogenous variation in sibsize due to twinning at the second birth,

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conditional on family background characteristics. Critiques of the twins' instrument have noted that the tradeoff between child quality and quantity is understated (or overstated) if parents who have secondborn twins invest more (or less) in the first child than those who have a secondborn singleton, due to an endowment reinforcing (or compensating) motive. Rosenzweig and Zhang (2009) recommend a remedy for this problem by including the secondborn children's mean birth weight. Because fetal conditions may reflect the parental lifestyle, we prefer not to have a covariate relating to unobserved family factors. Nevertheless, we discuss the results from Rosenzweig and Zhang's approach as robustness checks.

The third challenge is to address potential concerns about endogenous child gender due to possible sex-selective abortion or recall errors. We minimize this possibility by restricting the Birth Registry data to firstborn children born before 1985 when abortion was not legal, and sex-testing technology was not widely available. Using the same data like ours, Lin, Liu, and Qian (2014) have noted that the sex ratio at birth for the first two parities remained within the normal range between 1980 and 1992. The sex ratio started diverging from this after 1986 but only for the third- and higher-parity births. Consistent with their findings, our test statistics show that endogeneity of child gender for the first two births is not a concern in our data.

The fourth challenge is to overcome data limitations. Typically, data analysts can only partially or indirectly observe the family size and sibling gender composition and cannot observe child outcomes directly after infancy. Using Birth Registry data for all of Taiwan since 1978, we ensure that each family's sibsize and sibling gender composition are complete and accurate by tracing at least 15 years of fertility history for each mother who first gave birth before 1985. By matching Birth Registry records with University Entrance Test records, we can observe each firstborn child's educational outcomes during adolescence, completed family size, and sibling gender composition.

Using our modified approach, we find that both DE and IE are near zero for firstborn males. In contrast, firstborn females have a negative direct effect and a positive indirect effect, which almost cancels each other out, resulting in a near-zero total effect. This finding offers new evidence of gender bias in family settings, which cannot be detected by conventional methods. Conventional measures, such as gender gaps, have suggested clear female advantages of completing high school and entering university. Ordinary least

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squares (OLS) estimates indicate much smaller DE and IE than those constructed from our instrumental variables (IV) estimates. This study represents the first attempt to formulate and evaluate the indirect effect of sibling gender on child outcomes via a change in potential family size. The result pointing to a large and positive indirect impact has important policy implications. Suppose parents' ability to control their total fertility is restricted (as in China's two-child policy). In that case, the overall rivalry impact of sibling gender could be much more significant. Although we study a particular economy where son preference is strong, it is precisely in countries where son preference is strongest to expect DE and IE's coexistence, driven by gender discrimination and son-preferring stopping rules.

As a by-product of our analysis, we find the effects of family size on child education (and the direction of omitted variable bias) highly depend on sibling gender composition. OLS overstates family size effects if the next sibling is male and understates them if it is female. This contrast is particularly evident among firstborn girls. If the next sibling is also female, parents' utility gain from a larger family is more remarkable. If the next sibling is a brother rather than a sister, the son-preferring stopping rule kicks in, and parents' utility gain from a larger family decreases. The two-stage least squares estimates show that a third child in the family would lower firstborn daughters' high school completion rate or university admission rate by about one-third if the next sibling is female too. A next brother also reduces the effect of family size on firstborn males' education. However, the estimates are imprecise and much smaller in magnitude than the impact on firstborn daughters'.

Our findings on family size effects are related to the quality–quantity tradeoff literature that uses sibling sex composition as an instrument for family size (Angrist and Evans 1998; Black, Devereux, and Salvanes 2005, 2010; Conley and Glauber 2006; Cáceres-Delpiano 2006; Angrist, Lavy, and Schlosser 2010). Most of these studies use data from countries where gender bias within the family is arguably small, and high demand for sons is rare. The direct effect of sibling gender on child outcomes is likely negligible (Huber 2015). The indirect impact via reduced family size is zero (assuming parents do not follow the son-preferring stopping rule). However, for data from countries with gender bias, our results imply that the firstborn's gender (or the gender composition of children in general) cannot be a valid instrument for fertility or family size because it affects child outcomes directly and violates exclusion restrictions.

As with any study, this paper has some limitations. First, our empirical

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strategy is only valid when the secondborn's gender is random. However, the randomness of the secondborn's gender may not hold in other regions where sex-selective abortions are prevalent, as in India and China (Kishor and Gupta 2009; Wei and Zhang 2011). Second, using the twins' instrument, we find the proportion of compliers is 32—60 percent of the firstborn population. Given that 87 percent of our sample has two or three children, the percentage of compliers in some developing countries is likely lower due to larger family size.

Nevertheless, the estimated magnitude of intrafamily gender bias is significant for policy. Unlike the previous evidence of gender bias, mostly focusing on infant females, our results show that intrafamily gender bias has a sizable negative impact on firstborn female adolescents' education. However, it is mostly indirectly offset by parents' fertility-stopping rules. China recently started to relax the one-child policy and bring in the two-child policy. We predict that a next brother (relative to a next sister) would harm the firstborn's human capital formation because the policy shutdowns the indirect channel would have offset the direct rivalry effect.

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