Family or career? The effect of sibling sex composition on education and timing of family formation

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Research question

- ► How does a (twin)sister (instead of a (twin)brother) affect one's education, age at first marriage and age at first birth?

Motivation

▶ How does the family of orientation affect long term outcomes?

   ▶ a lot of progress on the effect of parental education, birth order, family size

   ▶ controversy about the impact of sibling sex composition

      ▶ Butcher and Case (1994): (any) sisters decrease women's education -> use it as IV

      ▶ Kaestner (1997): no effect for whites, but for blacks, sisters increase men's education

      ▶ Hauser and Kuo (1998): unable to replicate any of these differences on three large US datasets

Motivation II

- ▶ Parental preferences for sibling sex composition confound previous estimates: family size is an outcome, but they use it as a control variable
  - ▶ we use dizygotic twins to address this issue (not the usual FE twin-trick!)
    - ▶ if we do find effects in this setting, cannot be because of parental preferences bias
- ▶ We look at the effect of closest sibling
  - ▶ if we do not find effects in this setting, hard to argue that there is any
- ▶ Effects can be expected not only on education but also on family formation

Mechanisms through parents

- ▶ Parental investment in children's education (Becker, 1991)
  - ▶ Credit constraints: sisters increase education (for both gender)
  - ▶ No credit constraints: only if parents are not neutral towards inequalities
    - ▶ compensation: brothers increase women's education, sisters lower men's education
    - ▶ reinforcement: brothers lower women's education, sisters increase men's education

- ▶ Family size (due to parental preferences for sibling sex composition)
  - ▶ preference for mix: brothers lower men's education and sisters lower women's education
  - ▶ preference for boys: sisters lower education (for both gender)

Mechanisms through parents II

- Reference group theory: B&C argue that if a woman has a sister, parents apply lower educational standards for her because they group the children by gender
  - the gender gap in education reversed by most developed countries, so why would we expect lower standards for women?
  - could work for timing of family formation, the gender gap is still present there
    - sisters lower age at family formation for women

Sibling-to-sibling effects

- Reference group theory: children may look at their siblings as role models or reference points
- Child development (B&C): spillover of feminine and masculine traits
    - Becker (1991): education is a masculine trait - outdated...
    - might be important for family formation
        - women are more risk averse (Croson and Gneezy, 2009; Eckel and Grossman, 2008) and more risk averse individuals marry sooner (Schmidt, 2008; Spivey, 2010) - if there are spillovers, sisters lower age at family formation
- Teaching each other
    - sharing human capital: direction of effect depends on gender gap in education
    - sharing "family capital": likely to be gender-specific -> same-sex sibling lowers age at family formation

Interactions between education and family formation

- Early family formation and education are negatively associated, especially in case of women (Waite and Moore, 1978; Marini, 1978)
  - Time constraints and the relative nature of preferences
  - Education usually completed by age 25
  - Early family formation has small negative impact on education
  - Trade-offs are less pronounced for men than for women
    - children & household take more time from women
    - men value beauty more, women value earnings potential more (Goud and Paserman, 2003; Fisman et al. 2006; Hitsch et al. 2010)

Implications for empirical analysis

▶ Several potential mechanisms and possible interactions

▶ Not a systematic test of all the potential mechanisms

▶ RQ: does the gender of the sibling have an impact on the main outcome variables?

  ▶ if it does, we try to look for potential explanations

Our strategy: use dizygotic twins

- Identify the effect of having a sister instead of a brother as a co-twin
- They develop from two different embryos, just like two singleton siblings
- Sex selection: X-sperm or Y-sperm reaches the given ovum first
  - fusion happens the same time
  - penetrability of cervical mucus is linked to the success of X and Y sperms and it changes over time
  - same-sex twins are more common than opposite-sex twins

Contributions

- Parental preferences cannot confoud
  - previous studies controled for family size, while it was an outcome
  - we do not need to control for family size
    - our estimates do not suffer from this bias
    - we can explicitly examine family size as an outcome
- Siblings of same age
  - previous studies treated all siblings the same
  - strength of mechanisms may depend on age difference
    - credit constraints less relevant if children are far apart in age
    - close-in-age siblings are more likely to be compared to each other
    - close-in-age siblings spend more time together

Potential problems

- Hormonal transfer in utero
  - female mice mature later and have longer cycles if their fetuses were located between male fetuses in utero (vom Saal, 1989)
  - Resnick et al. (1993) argue that hormonal transfer might be present for humans as well (sensation-seeking scores)
  - Loehlin and Martin (1998) compare OS women to SS women on an extensive set of variables related to reproduction
    - no remarkable differences
    - neither age at menarche, nor cycle length is significantly different
  - Nonetheless, we will check age at menarche in our sample to be sure

Data

- 3690 dizygotic Australian twins born between 1964 and 1971
  - between 1980 and 1982, parents voluntarily registered 4262 twin pairs with the ATR
  - out of these, 6265 individuals responded to a voluntary survey in 1996-2000
  - we drop monozygotics and those younger than 25

Descriptives I.

	Women	Men
Age	29.98	30.01
Education	12.18	12.01
Mother's education	10.12	10.48
Father's education	10.22	10.54
Married	0.68	0.62
Age at first marriage	23.78	24.83
Teen marriage	0.10	0.05
Nr of kids	1.01	0.77
Age at first birth	25.64	26.63
Teen birth	0.04	0.01
Twin sister	0.59	0.42
Nr. of obs.	1987	1703

Marriage includes de facto marriage.

Descriptives II.

	Whole sample			
	Women		Men	
	Mother's ed.	Father's ed.	Mother's ed.	Father's ed.
Sister	-0.258*	-0.326**	0.067	0.219
	(0.138)	(0.164)	(0.142)	(0.171)
N	1905	1850	1608	1591

Clustered robust standard errors are shown in parentheses. Constant included

Descriptives III.

| Education | All women | | | | Restricted sample of women | | | |
| level | Mother's educ. | | Father's educ. | | Mother's educ. | | Father's educ. | |
	SS	OS	SS	OS	SS	OS	SS	OS
5	11.64	7.65	14.56	10.92				
9	47.35	48.9	46.31	45.67	51.25	51.05	53.09	50.54
11.5	25.04	26.33	19.02	20.91	29.38	29.82	23.01	23.96
13	8.29	8.82	6.28	7.46	10.12	9.79	7.52	8.35
15	4.67	4.93	8.64	9.19	5.66	5.72	10.21	10.51
17	3	3.37	5.19	5.86	3.59	3.61	6.17	6.65
Total	100	100	100	100	100	100	100	100

Descriptives IV.

	Restricted sample			
	Women		Men	
	Mother's ed.	Father's ed.	Mother's ed.	Father's ed.
Sister	-0.004	-0.112	0.085	0.199
	(0.123)	(0.147)	(0.130)	(0.155)
N	1583	1538	1420	1405

Clustered robust standard errors are shown in parentheses. Constant included.

Main results I.

	Education		Teen marriage		Married by 25	
	Women	Men	Women	Men	Women	Men
Twin sister	-0.294***	-0.104	0.033**	0.004	0.038*	-0.018
	(0.109)	(0.117)	(0.014)	(0.011)	(0.023)	(0.023)
N	1987	1701	1987	1703	1987	1703

Note: Clustered robust standard errors are shown in parentheses. All regressions include a constant, age, age square, parental education and indicators for imputation (missing parental education was imputed). Significance levels: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Main results II.

	Teen parenthood		Parent by 25		Nr of kids by 20		Nr of kids by 25	
	Women	Men	Women	Men	Women	Men	Women	Men
Twin sister	0.020**	-0.002	0.015	0.007	0.020**	-0.001	0.038	0.022
	(0.009)	(0.005)	(0.018)	(0.016)	(0.010)	(0.005)	(0.029)	(0.022)
N	1987	1703	1987	1703	1987	1703	1987	1703

Note: Clustered robust standard errors are shown in parentheses. All regressions include a constant, age, age square, parental education and indicators for imputation (missing parental education was imputed). Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Results on mechanisms I.

- "When you were 6 to 13, was it important to your parent(s) that you and your twin did well at school?"
  - "No, neither", "Yes, both", "Only me" or "Only twin"
  - Your education important: 1 if "Yes, both" or "Only me", 0 otherwise
  - Your education more important: 1 if "Only me", 0 otherwise

	Your educ. important		Your educ. more imp	
	Women	Men	Women	Men
Twin sister	-0.015	-0.007	-0.006**	0.004
	(0.014)	(0.014)	(0.003)	(0.003)
N	1961	1674	1961	1674

Note: Clustered robust standard errors are shown in parentheses. All

regressions include a constant, age, age square, parental education

and indicators for imputation (missing parental education was imputed).

Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Results on mechanisms II.

	Nr of younger siblings		Nr of siblings		Age at menarche
	Women	Men	Women	Men	Women
Twin sister	0.093*	-0.044	0.060	-0.138	0.100
	(0.052)	(0.057)	(0.098)	(0.111)	(0.073)
N	1978	1692	1978	1690	1949

Note: Clustered robust standard errors are shown in parentheses. All regressions include a constant, age, age square, parental education and indicators for imputation (missing parental education was imputed). Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Summary of results

- ▶ Women are significantly affected by the gender of their co-twin
- ▶ Having a sister instead of a brother lowers their education and age at first marriage and first birth
- ▶ Results on education cannot be explained by direct mechanisms - results probably led by family formation mechanisms
- ▶ Uterine hormonal transfer is not supported

Discussion and conclusions

- Having a sister changes preferences and/or abilities such that women form families earlier and they obtain lower education as a byproduct of these mechanisms
  - Hauser and Kuo (1998) datasets: OCG (married women), SIPP, NSFH (oversamples recently married)
    - "There was only one potential exception to our null findings, namely, that we observed consistently negative effects of having any sisters on white women's high school graduation within cohorts born from 1940 to 1959 in the Survey of Income and Program Participation. The effects observed for these cohorts in the OCG and NSFH surveys were consistent in sign, but none was statistically significant."

- Functional specification: co-twins have an impact, so perhaps age differentials matter
- Effect on completed fertility and later marital patterns?

Results on restricted sample I.

	Education		Teen marriage		Married by 25	
	Women	Men	Women	Men	Women	Men
Twin sister	-0.274**	-0.120	0.032**	0.002	0.044*	-0.034
	(0.122)	(0.129)	(0.014)	(0.011)	(0.026)	(0.026)
N	1524	1383	1524	1383	1524	1383

Note: Clustered robust standard errors are shown in parentheses. All regressions include a constant, age, age square, parental education and indicators for imputation (missing parental education was imputed). Significance levels: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Results on restricted sample II.

	Teen parenthood		Parent by 25		Nr of kids by 20		Nr of kids by 25	
	Women	Men	Women	Men	Women	Men	Women	Men
Twin sister	0.018**	0.001	0.022	-0.004	0.020**	0.001	0.034	0.015
	(0.009)	(0.004)	(0.019)	(0.016)	(0.010)	(0.004)	(0.029)	(0.024)
N	1524	1383	1524	1383	1524	1383	1524	1383

Note: Clustered robust standard errors are shown in parentheses. All regressions include a constant, age, age square, parental education and indicators for imputation (missing parental education was imputed). Significance levels: *** $p<0.01$, ** $p<0.05$, * $p<0.1$