A Behavioral Model to Explain Gender-Conditional Parity Progression Patterns: Applications to Danish Twin Registry Data

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Extended Abstract

Empirical research in demography and other disciplines has demonstrated that women/parents consider the gender of previous children in making reproductive decisions regarding having another child. Common cultural preferences are often for males, only very occasionally for females, and quite often for gender balance. Parity-progression ratios assume that the probability of a woman/couple's next child, conditional on the current number of children, is at least partially determined by behavioral responses to parity patterns.

Rodgers and Doughty (2001) defined a parity-conditional decision model that accounted for differential progression to next child conditional on prior gender patterns. Two types of parameters are included, ones accounting for the biology of gender, and ones accounting for behavioral stopping probabilities, conditional on previous gender patterns. The model estimates the probability of a number of binomial outcomes. To illustrate with one gender pattern, consider the following piece of the model:

P(BBG) = PB*(1-b1)*PB*(1-b2)*PG*m3

This equation defines the probability of a respondent having a three-child family with a boy, then a boy, then a girl. PB and PG are the unconditional probabilities of having a boy or a girl, which in this formulation is parity uncontional, but in other forms of the model is allowed to be parity-specific, allowing for the estimation of a biological process whereby the biology of gender has a parity-conditonal status. b1 and b2 are the probabilities of stopping after a boy, and equivalent g1 and g2 probabilities are defined in other equations as relevant. m3 is a parameter that is estimated separately when balance – at least one boy and one girl – was achieved for the first time. The overall model consisted of each equation for all possible gender compositions up to a four-child family (more than four child families in the NLSY79 were truncated).

In Rodgers and Doughty (2001), this model was fit to U.S. childbearing patterns by gender from 6089 respondents (approximately split by gender) from the National Longitudinal Survey of Youth original 1979 data (the NLSY79). In the best-fitting model, the probability of stopping after the first child was independent of gender, and P=.31. The probability of stopping after the second child was P=.53 if the second gender matched the first, but was P=.62 if gender balanced was achieved after the second child. The probability of stopping after the third child was .74. A number of other models were estimated that all supported the importance of gender balance to this sample of U.S. respondents.

One advantage of this model is that the biology of gender is estimated separately from the behavioral aspect of proceeding to the next child. The forms of the model that allowed for parity-specific probability of a boy or girl did not fit any better than the parity-unconditional model, supporting behavior genetic models presented in the same paper that suggested no genetic component to the biology of gender (i.e., having a boy or girl is a binomial outcome, unconditioned by genetic processes).

In the current work, a similar model is fit to gender patterns from the Danish twin registry. Note that for a PAA presentation we will reverse the direction, and redefine the model to account for transition behavior, rather than stopping behavior. This will allow us to link the model explicitly to the extensive demographic literature on parity progression. The part of the twin registry we use – the Middle Aged Danish Twin (MDAT) sample -- includes a representative sample of twins from cohorts born between 1931 and 1952. 40 twin pairs of each zygosity (MZ, DZ-same-sex, and DZ-opposite-sex) were randomly sampled from each birth cohort, for a total sample size N=5280, or 2520 twin pairs. We compiled the gender composition of the childbearing pattern for each respondent in this database, and combined those in several different categories.

The modeling effort is ongoing, though we have preliminary results that demonstrate interesting and interpretable patterns. When we fit the model to MZ twin pair patterns, we obtained the estimated probabilities in Table 1. In that table, PB, PG, and PT are the estimated (unconditional) probabilities of having a boy, having a girl, and having a twin (we have not yet fit parity-conditional versions of this model). Though these probabilities are well-known from biological and previous empirical studies, allowing the model to estimate them in this simple form provides a validity check on the model. The estimates were virtually identical with past population-based estimates. The other estimates – B1, G1, T1, B2, G2, and T2, estimate the probability of having a boy on for the first child, a girl for the first child, a twin pair for the first child, a boy for the second child, etc. These estimates show that women/couples were substantially more likely to stop after having twins, and with almost identical probabilities after having a boy or girl.

In work that is currently ongoing, we are estimating the same model parameters for DZ-same-sex twin patterns, for DZ-opposite-sex twins patterns, for all pairs combined, and separately by gender of the parent (i.e., the gender of the MDAT respondent). We will test statistically for invariance across these categories, as well as evaluating the parity-conditional status of the PB, PG, and PT parameters. We will also extend the model, which is currently truncated at two children, to 3 children. Ultimately, we will truncate the model at three children, because few of the MDAT respondents had more than three children, and the number of equations becomes difficult to handle beyond four children because of the many possible gender combination possibilities.

Table 1: Estimated parameters for N=1760 MZ twins in the Danish twin registry MDAT sample (see text for interpretation of parameters)

Unconditional Gender Probabilities	Stopping Probabilities
PB = .501	B1 = .273
PG = .483	G1 = .262
PT = .016	T1 = .650
	B2 = .719
	G2 = .714
	T2 = .835