

Gauging the Randomness of Contraceptive Failures

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Within the economics literature on the effect of fertility on women's career outcomes, there has long been a search for factors that incorporate randomness into the number or timing of births. Along with using the incidence of miscarriages (Hotz, et al., 1997; Geronimus and Korenman, 1992), recent papers have used the incidence of contraceptive failures (Herr, 2008; Miller 2010). The following paper considers the validity of this approach by considering whether contraceptive failures are truly random, and for whom. The underlying worry is that although there exists a truly random medical element to contraceptive failure, women have some control over its likelihood through their sexual and contraceptive behavior. Failure rates may therefore change as the cost of an unintended pregnancy rises.

The following analysis considers this question using the National Longitudinal Survey of Youth (NLSY79). The two main benefits of this data source are that it captures key information on fertility intentions, behaviors (including contraception), and outcomes (e.g., contraceptive failures). (Although the NLSY captures contraceptive failure rates for all women, unfortunately its contraceptive behavior data is more limited.) Its longitudinal nature also allows me to consider the influence of pre- birth behavior and intentions on subsequent outcomes.

As one means of grouping women who may have systematically different contraceptive behavior, I focus my analysis separately on women by their marital status at the time they conceived their first birth. Among those married at conception, I build a sample that includes women for whom we observe information on intended first birth timing and current contraception behavior within 12 months of marriage. Among those unmarried, the sample includes women for whom we can observe this same information at any time before she became pregnant with her first child.¹

To gauge whether contraceptive failures are random, I test whether their incidence is correlated with a woman's score on the Armed Forces Qualification Test (AFQT), as a measure of her ability. If women with higher ability face a greater benefit of delaying first birth, AFQT scores may provide a proxy for the relative costliness of a contraceptive failure.² Table 2 compares the relationship between AFQT scores

¹ Unfortunately the NLSY did not begin collecting information on both expected fertility timing and contraception behavior until 1982. Given that the NLSY sample is 17-25 in 1982, this is a much more limiting factor for women who complete their schooling at high school or less, which is an especially strong limitation for those who conceived their first birth outside of marriage. Among those who finish with a high school degree or less, I therefore limit my analysis to the subset of the NLSY who were born in 1960 or later (relatively younger women in 1982). Among the married women this gives me a much more representative sample, but among the unmarried women the sample remains very select because many have their first birth before the data begin in 1982.

² Higher ability women may face a greater benefit of delay either for economic or social reasons. For instance they may have a higher payoff for (pre-birth) education and/or work experience, and they may face higher marriage market penalties for a pre-marital birth.

and the incidence of contraceptive failures, by education level and by marital status at first birth.³ If the incidence of contraceptive failures is random, there should be no correlation.

As Table 1 shows, this is not generally the case. There is a clearly significant relationship both among women who are married and unmarried at conception, and for all education groups except those with a college degree. Columns (1) and (3) show the results for all mothers in the NLSY by marital status; Columns (2) and (4) report the same results for the analysis samples. Although the relationships are generally less precisely estimated in the latter, the coefficients are very similar.

Table 1. Relationship between AFQT score and Contraceptive Failure Rates	Married at Conception		Unmarried at Conception	
	All ¹	Sample	All ¹	Sample
	(1)	(2)	(3)	(4)
<u>High School Diploma:</u>				
Contraceptive failure rate:	11.4	11.7	21.1	23.3
AFQT score (x 10-2)	0.174*	0.159	0.242*	0.240
	(0.074)	(0.134)	(0.104)	(0.170)
Sample Size:	366	134	330	144
F-statistic p-value:	0.02*	0.24	0.02*	0.16
<u>College +:</u>				
Contraceptive failure rate:	12.4	12.1	48.4	40.6
AFQT score (x 10-2)	0.031	0.070		
	(0.069)	(0.100)		
Sample Size:	494	243	58	44
F-statistic p-value:	0.65	0.49		

As Table 1 shows, however, among those education groups where contraceptive failure is correlated with ability, the relationship is positive rather than negative; higher ability women are *more* likely to have a contraceptive failure. At first glance, this result is surprising because intuition would suggest that women with a higher cost of an unintended pregnancy should be more careful and therefore *less* likely to have a contraceptive failure. What this ignores, however, is that one cannot have a contraceptive failure unless one is contracepting in the first place.

This result highlights the fact that the incidence of a contraceptive failure arises out of the combination of four primary factors: the frequency of sexual intercourse, the use of contraception if pregnancy is unwanted (Pc), the quality of contraception used (Cc), and the number of years between when a woman becomes sexually active and when she wants to become pregnant (τ).⁴ As Table 2 shows, all of these

³ For the sake of space I am showing here only the data for those women with only a high school diploma, and those with at least a college degree, at the time they become pregnant with their first child. (I do not report the regression results for the college-graduate women who conceive outside of marriage because the sample sizes are so small.)

⁴ This ignores underlying fecundity, which is unlikely to be correlated with ability and is largely unobservable to each woman until she becomes – or tries to become – pregnant for the first time.

proximate determinants other than sexual frequency are clearly associated with the incidence of a contraceptive failure leading to the conception of a woman's first birth.⁵

TABLE 2: Relationship between Contraceptive Failure Rates and Proximate Determinants	Married at Conception		Unmarried at Conception	
	Mean	Regression coeff ¹ (sd)	Mean ¹	Regression coeff ¹ (sd)
Contraceptive failure (%):	9.8	-	25.3	
Proximate determinants:				
Intended delay, τ (yrs)	1.57	0.024**	3.25	0.024*
(sd)	(1.49)	(0.008)	(2.24)	(0.009)
Contraceptive use, P_c ² (%)	79.9	0.074+	76.8	0.209**
- if $\tau > 1$	88.2	(0.040)	79.8	(0.064)
Contraceptive quality, C_c ³ (%)	65.1	-0.064+	58.9	-0.049
- if $P_c = 1$ & $\tau > 1$	82.6	(0.033)	76.7	(0.055)
Sample Size:		671		426

NOTES: (= sig at 1%; * = at 5%, + at 10%)**

1. Regression excludes women who report expecting no children (for whom I lack expected timing).
2. Contraceptive use, P_c , is coded as =1 if the individual reports that she is contracepting "always".
3. Contraceptive quality, C_c , is coded as =1 if the individual reports using a high-quality contraception, defined as those types that have "typical" failure rates of less than 10 percent per year of constant use. These include the pill, IUD, depo-provera, Norplant, condom with spermicide, and condom with diaphragm.

The relationship between ability and the probability that a woman's first child is conceived through a contraceptive failure will arise through the relationship between ability and each of these proximate determinants. When one assumes that the relationship is *negative*, this focuses on the negative link between contraceptive quality and failure rates, and the assumed positive link between ability and contraceptive quality used.

The observed *positive* correlation suggests that the more important pathway is through one of two possibilities. First, it may be through the positive link between ability and the *use* of contraception, P_c , which in turn is positively linked to contraceptive failure rates. Or second, through the positive link between ability and intended fertility delay, τ . All else equal, women who intend greater fertility delay are exposed to the risk of a contraceptive failure for longer, raising the overall probability that their first child is conceived through a contraceptive failure.

If no link exists between ability and failure rates, as we see for women with a college degree, this may arise two ways. There may be no relationship between ability and each of these proximate determinants, suggesting that the incidence is truly random. Or it may be that the link between ability

⁵ The NLSY only collected information on frequency of sexual intercourse in 1984 and 1985, thus we observe this data for only a subset of each sample. For the sake of space Table 3 only shows the data on the other proximate determinants. For those with sexual frequency data I find no link between this factor and subsequent failure rates.

and contraceptive quality exactly offsets the links between ability and contraception use and exposure, making contraceptive failures “effectively” random among these women.

As Table 3 shows, I find that the positive link between ability and contraceptive failure rates among women with less than a college degree arises primarily through the link between ability and the length of intended fertility delay. Among those women with some college who are married at conception, I also see a positive link through rates of contraceptive use. Counter to expectations, I see no link between ability and contraceptive quality.

Table 3: Relationship Between AFQT Scores and Proximate Determinants	Education at Pregnancy			
	Less than High School	High School	Some College	College+
	coeff (sd), N	coeff (sd), N	coeff (sd), N	coeff (sd), N
<u>Married at Conception:</u>				
$\tau^2 (x10^{-1})$		0.097+ (0.051)	0.103* (0.044)	0.033 (0.048)
	24	176	208	263
$Pc^3 (x10^{-1})$		0.010 (0.018)	0.022+ (0.013)	-0.007 (0.011)
	17	118	130	166
$Cc^4 (x10^{-1})$		0.005 (0.018)	-0.003 (0.016)	0.012 (0.018)
	14	98	115	153
Sexual frequency ⁵ ($x10^{-1}$)		1.071* (0.429)	0.010 (0.325)	-0.063 (0.046)
	18	92	94	77
NOTES: (** = sig at 1%; * = at 5%, + at 10%)				
1. These results reflect the coefficient on AFQT in a regression of each of the listed factors.				
2. The regression of intended delay (τ) on AFQT excludes those who report expecting no children.				
3. The regression of contraception use (Pc) includes only those who expect to become pregnant in more than a year (or never).				
4. The regression of contraceptive quality (Cc) includes only those who are contracepting ($Pc=1$) and who anticipate some pregnancy delay as outlined in note #3.				

Lastly, I find evidence that among women with a college degree, contraceptive failure rates are indeed random. For these women, the observation of no link between ability and contraceptive failure rates arises because there is no relationship between ability and any of its proximate determinants. Thus among these women alone, contraceptive failure rates are truly random events.