RE-EXAMINING WOMEN'S WAGES AND FERTILTY:

HAS THE RELATIONSHIP CHANGED OVER TIME?*

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ABSTRACT. The opportunity cost or cost-of-time perspective posits that the higher wages and better employment opportunities of the more educated make time out of the labor force for childbearing and child rearing more costly. Increased options to combine work and family, however, undermine assumptions of this model and may weaken or even reverse the negative relationship between wages and fertility. We use rich longitudinal data from two cohorts of U.S. women to explore change in the relationship between wages and fertility.

U.S. class differentials in levels of fertility are longstanding (Freedman et al 1959; Whelpton and Kiser 1950; Blake 1968), with higher educated women generally having fewer children. A common explanation of the education gap in fertility is the better employment opportunities of the more educated, which make time out of the labor force for childbearing and child rearing more costly. The opportunity cost or cost-of-time perspective, as this is called, assumes that mothers opt out of paid work to care for children. Women's ability to substitute income for time in child care, however, undermines this assumption. Greater options to combine work and motherhood suggest that the hypothesized negative effect of women's wages on fertility may weaken or even reverse (Joshi 2002; Martin 2004).

The links between employment, earnings, and fertility was a topic of great interest in the 1970s and 1980s (e.g., Cramer 1980; Smith-Lovin and Tickemeyer 1978; Waite and Stolzenberg 1976), but little recent work has continued to track these associations (but see Budig 2003 on employment). We use discrete-time event history analysis to examine change in the relationship between wages and fertility across two cohorts of women, one reaching the end of their childbearing years in 1992 and the other in 2004. Our data span over twenty years in the lives of these two cohorts and include rich, prospectively measured characteristics, including family background, education, school enrollment, employment experience, and earnings. We estimate associations between fertility and predicted values of wage to address challenging issues of endogenity. Predictions further allow us to generate forward-looking indicators of wage that better tap theoretically relevant aspects of economic potential.

BACKGROUND

Opportunity costs. According to the "Columbia-Chicago cost-of-time" or opportunity cost view of fertility (Pollak and Watkins 1993; Becker 1991), women decide between alternative uses of their time—in child rearing or market work. The higher their potential wage, the higher the opportunity cost to them of having a child, on the assumption that they will reduce their labor force participation for child rearing. The higher educated will thus choose fewer children because children are more expensive for them in terms of earnings lost for employment withdrawal. Of course, well educated women typically marry better educated husbands (Mare 1995), and the earnings of their husbands are an important part of their class location. However, the income associated with higher social class is seen in the economic view to increase fertility, just as it increases the purchase of many consumer durables (Becker 1960). In common sense terms, men's earning power provides income that might make having a child more affordable. In principle, either men's or women's earnings (or potential earnings) could have either a price (opportunity cost) or income effect on fertility (Macunovich 1996). To the extent that women do most of the child rearing work that involves a reduction of market labor supply, the income effect of men's and the opportunity cost of women's earnings are expected to predominate.

Substituting income for time in child care. In contrast to the opportunity cost perspective, Joshi (2002, p. 461) notes: "As options emerge to combine motherhood and employment, the grounds to expect women's employment to have a large negative effect on fertility have weakened." Childcare has become more available and acceptable, and the more educated are able to pay for it (Rindfuss and Brewster 1996). Martin (2000) argues that there may be a growing positive correlation between women's work status and family formation. Indeed, he finds that while first birth rates before age 30 are declining for all women, first and

second birth rates (among those childless at age 30) are increasing at older ages for college graduates only. These increases are coming when wages are high relative to earlier in the lifecourse, thus are not well explained by opportunity cost models. In short, while higher education may provide strong incentives to delay fertility during career-building years, it may also increase women's ability to purchase services not available to the less educated, giving them more flexibility to optimally time births without necessarily limiting fertility.

OUR ANALYSIS

National Longitudinal Surveys (NSL). We rely on two panels from the National Longitudinal Surveys (U.S. Bureau of Labor Statistics 2005): the NLS Young Women (NLSYW) and the NLS Youth (NLSY). The NLSYW is a nationally representative sample of over 5000 women ages 14-24 when first interviewed in 1968. The NLSY provides nationally representative data on a more recent cohort of about 6300 women ages 14-21 in 1979. We follow these cohorts over an approximately 20-year period, until 1992 for the NLSYW and 2004 for the NLSY, until sample members are 42 years old on average. The NLS started as a national probability sample, representing all people of a particular cohort living in the United States at the initial survey date. NLS response rates have been relatively high: in the last survey years used here, retention rates were 63 and 78 percent for the NLSYW and NLSY, respectively. Sample weights adjust for known characteristics of nonrespondents and thus offset potential effects of cumulative attrition on the representativeness of the survey; we apply weights in our analyses.

Discrete-time hazard models. We use discrete-time hazard analyses to model the relationship between childbearing and wages. We allow the association between wage and fertility to vary by age (we include an interaction between wage and age). To test whether the

association between wages and childbearing has changed over time, we examine an interaction between wage and cohort.

In general terms, models for the *k*th birth can be written:

(1) $\log [P_{k(t)}/(1 - P_{k(t))}] = \lambda(t) + \boldsymbol{\beta}\mathbf{X}(t)$, $k = 1, 2,\ldots$

where the logit or log odds of a birth of order *k* at time *t* is an additive function of X's. Time *t* is age in our analyses, which we model as a quadratic function. We control for current education, education and age interactions (to account for the different age schedules of childbearing by education, e.g., Martin 2000; Rindfuss, Morgan, and Offutt 1996), school enrollment, employment status, marital status, and spouse wage. We run separate models for whites and blacks, since fertility patterns vary greatly by race, in both timing and number (Morgan 1996; Yang and Morgan 2003). Time-varying variables are lagged so that values precede any pregnancy events.

A simple transformation of the logit makes it possible to estimate the probability of a birth:

(2) $P_{k(t)} = 1/[1 + \exp(^{\lambda(t) + \boldsymbol{\beta}\mathbf{X}(t))}]$, $k = 1, 2,\ldots$

We apply this equation and use parameter estimates from our models to calculate age-specific birth probabilities by levels of wage. We then sum predicted birth probabilities over all ages 16-44 to generate total completed fertility specific to wage level, race, and cohort.

Sample. Our unit of analysis is person-years of age. Our final sample includes about 8,000 white and black respondents and 100,000 person-years. We analyze over 12,000 births occurring between 1970 and 2004 to women ages 16-44.

Measures of wage. We start with a basic indicator of a woman's actual current wage: the natural log of CPI-adjusted hourly pay. We then experiment with alternative indicators. We

generate predicted wages from regressions run separately by cohort, race, and age on full and part-time employment experience, current job tenure, education, school enrollment, a test of cognitive ability or skill level, job aspirations at first interview, and family socioeconomic status, including mother's and father's education, parental income, and whether the respondent grew up with both biological parents. Predicted values of wage have a few advantages relative to actual current wage. First, predictions reduce to some degree problems related to the endogeneity of fertility and wage (see discussions of reciprocal effects of fertility and employment, e.g., Budig 2003). Second, predictions allow us to generate forward-looking measures of wage that better tap economic potential. Particularly for higher educated women who may experience flat wage trajectories early in their careers and much steeper ones later (e.g., Xie et al. 2003), current wage may not be a good indicator of economic potential. We alter assumptions about time-varying factors such as employment experience and job tenure and generate predicted wages five and ten years into the future.

PRELIMINARY RESULTS

Table 1 describes the variables used in our analysis. Panel 1 lists those used in our discrete-time hazard models of fertility, all of which are time-varying. Panel 2 shows time-invariant and varying characteristics included in our wage predictions.

-- Table 1 about here --

Table 2 shows preliminary results of our hazard analysis, relying on the natural log of actual current CPI-adjusted hourly pay as our indicator of wage. Controls are included for education, education by age interactions, school enrollment, employment status, marital status, and spouse wage. Key to our questions are the wage, wage by age, and wage by cohort interaction terms. For whites, the coefficient on the log of current wage is -.4, suggesting a

negative effect of wage on fertility. The wage by age interaction is small and positive, meaning that the negative effect of wage declines as women age. And the wage by cohort interaction is also positive (.11) and statistically significant at the P<.05 level. This is consistent with the idea that increased options to combine work and motherhood have resulted in a weakened negative effect of wage on fertility over time.

-- Table 2 about here --

The story for blacks is similar (Table 2, second column): the main effect of wage is negative (although not statistically significant), and the interaction between wage and cohort is positive (.16) and statistically significant.

NEXT STEPS

Preliminary results suggest that the opportunity cost perspective may not be as powerful in explaining variation in fertility for more recent cohorts. We have yet to explore the relationship between predicted wage and fertility. On the one hand, we expect our predicted values of wage to incorporate less endogeneity than the actual current values shown in Table 2, and thus be less strongly correlated with fertility. On the other hand, we expect our forward-looking indicators of wage to be better measures of economic prospects and thus potentially more strongly correlated with fertility. As outlined above, we also plan to run simulations to illustrate the magnitude of wage effects on fertility. That is, we will use parameter estimates from our fertility models to calculate age-specific birth probabilities by levels of wage. We will then sum these over all ages 16-44 to generate total completed fertility by wage. These simulations will help us to assess the substantive importance of wage effects and change in wage effects over time.

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Table 1: Descriptive Statistics

Panel 1. Time-Varying Characteristics Used in Fertility Models at Three Points in Tim

	NLSYW							
	White				Black			
	All Years	1970	1982	1993	All Years	1970	1982	1993
Age	31.17	20.72	32.66	43.64	30.61	20.52	32.53	43.49
Less than high school	0.16	0.51	0.10	0.08	0.34	0.66	0.27	0.24
High school graduate	0.42	0.32	0.42	0.38	0.40	0.24	0.43	0.40
Some college	0.22	0.13	0.22	0.24	0.16	0.08	0.17	0.21
College graduate	0.20	0.04	0.25	0.29	0.09	0.01	0.12	0.15
Enrolled	0.15	0.52	0.07	0.06	0.14	0.48	0.08	0.06
Married & spouse absent	0.06	0.03	0.12	0.14	0.11	0.05	0.22	0.22
Married & spouse present	0.57	0.22	0.65	0.60	0.36	0.14	0.33	0.30
Employed in past year	0.66	0.56	0.61	0.72	0.68	0.47	0.70	0.76
Logged spouse annual income	8.23	9.21	8.63	8.12	7.22	9.37	9.05	8.56
Logged own current wage	2.36	2.03	2.44	2.60	2.23	2.00	2.32	2.41
	NLSY79							
	White				Black			
	All Years	1981	1993	2004	All Years	1981	1993	2004
Age	30.26	19.53	31.52	42.28	30.28	19.49	31.51	42.33
Less than high school	0.14	0.56	0.08	0.05	0.21	0.64	0.15	0.08
High school graduate	0.42	0.29	0.43	0.40	0.40	0.24	0.41	0.40
Some college	0.24	0.14	0.23	0.24	0.29	0.12	0.31	0.34
College graduate	0.20	0.01	0.26	0.31	0.10	0.00	0.13	0.17
Enrolled	0.17	0.64	0.07	0.03	0.16	0.63	0.07	0.03
Married & spouse absent	0.07	0.12	0.06	0.15	0.12	0.03	0.13	0.20
Married & spouse present	0.48	0.10	0.61	0.62	0.21	0.04	0.27	0.26
Employed in past year	0.80	0.48	0.84	0.80	0.70	0.26	0.78	0.81
Logged spouse annual income	8.98	9.74	8.71	9.63	7.06	8.94	6.78	8.62
Logged own current wage	2.36	1.98	2.45	2.65	2.25	2.07	2.29	2.49

Panel 2. Time-Varying and Invariant Characteristics Used in Wage Prediction

	NLSYW							
	White				Black			
	All Years	1970	1982	1993	All Years	1970	1982	1993
Years full-time work experience	4.01	0.26	4.42	9.79	4.21	0.24	4.76	10.92
Years part-time work experience	1.27	0.06	1.38	3.41	0.84	0.08	0.95	2.04
Current job tenure in years	1.70	0.32	2.01	1.07	1.69	0.27	1.85	1.15
Weeks worked but hours unknown	69.95	11.22	74.35	154.23	59.04	6.78	66.39	145.70
Aspired to work at age 35	0.26				0.46			
Duncan score of job aspiration	55.38				52.03			

Mother's ed: less than h.s.	0.34	0.62
Mother's ed: high school grad	0.42	0.17
Mother's ed: some college	0.10	0.03
Mother's ed: college grad	0.08	0.02
Mother's ed: missing	0.06	0.15
Father's ed: less than h.s.	0.36	0.48
Father's ed: high school grad	0.28	0.09
Father's ed: some college	0.08	0.02
Father's ed: college grad	0.12	0.01
Father's ed: missing	0.17	0.40
Lived with biological parents	0.86	0.61
Logged parental income	4.18	3.50
Missing parental income	0.05	0.04
Z-score IQ or AFQT	0.29	-0.50
Missing IQ or AFQT	0.24	0.52

NLSY79

	White				**Black**			
	All Years	1970	1982	1993	All Years	1970	1982	1993
Years full-time work experience	5.19	0.19	5.79	12.04	4.51	0.10	4.78	11.70
Years part-time work experience	2.32	0.06	2.41	5.58	1.43	0.03	1.54	3.32
Current job tenure in years	2.56	0.39	2.92	5.20	2.17	0.20	2.44	4.55
Weeks worked but hours unknown	11.12	0.12	12.12	27.24	9.37	0.11	9.94	23.78
Aspired to work at age 35	0.62				0.79			
Duncan score of job aspiration	56.98				56.76			
Mother's ed: less than h.s.	0.24				0.46			
Mother's ed: high school grad	0.49				0.32			
Mother's ed: some college	0.12				0.09			
Mother's ed: college grad	0.11				0.05			
Mother's ed: missing	0.04				0.07			
Father's ed: less than h.s.	0.26				0.38			
Father's ed: high school grad	0.37				0.26			
Father's ed: some college	0.11				0.06			
Father's ed: college grad	0.19				0.06			
Father's ed: missing	0.06				0.24			
Lived with biological parents	0.81				0.52			
Logged parental income	3.23				3.85			
Missing parental income	0.00				0.00			
Z-score IQ or AFQT	0.59				-0.45			
Missing IQ or AFQT	0.04				0.02			

Table 2: Discrete-Time Hazard Models of Fertility -- Actual Current Wage

	WHITE		BLACK	
	Coef.	Std. Err.	Coef.	Std. Err.
age	0.336	0.063 *	0.190	0.057 *
age squared	-0.010	0.001 *	-0.006	0.001 *
hs grad	-0.199	0.930	0.437	1.117
some college	-6.811	1.222 *	-3.129	1.463 *
coll grad	-13.206	1.573 *	-14.382	3.908 *
hs X age	0.005	0.074	-0.048	0.084
some coll X age	0.420	0.091 *	0.169	0.105
coll X age	0.801	0.108 *	0.862	0.250 *
hs X age sq	0.000	0.001	0.001	0.002
some coll X age sq	-0.006	0.002 *	-0.002	0.002
coll X age sq	-0.011	0.002 *	-0.012	0.004 *
enrolled	-0.693	0.053 *	-0.465	0.068 *
married spouse absent	0.550	0.061 *	0.063	0.075
married spouse present	0.802	0.055 *	0.181	0.089 *
logged spouse annual income	0.003	0.003	0.013	0.006 *
employed	0.012	0.034	-0.074	0.048
current wage	-0.397	0.099 *	-0.256	0.132
wage X age	0.014	0.003 *	0.004	0.005
coh	-0.173	0.082 *	-0.224	0.105 *
wage X coh	0.105	0.036 *	0.161	0.051 *
imputation flag	0.040	0.031	0.050	0.051
_cons	-4.905	0.780 *	-2.420	0.750 *