Maternity Timing, Wealth Accumulation, and Economic Well-Being in Retirement

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Abstract

Given that the United States' recent history is marked by large scale entry of women into the workforce and large changes in employer pension plans, family planning impacts should be expected. During the past 30 years, large and simultaneous changes to both family and retirement planning have emerged. This paper focuses on the interaction of these changes by first developing a life cycle model which considers fertility and savings choices in the context of these changes. We then empirically assess how household structure, household wealth, labor force participation, and pension type relate to female fertility and its timing. After considering the empirical evidence, we address the normative issue of optimal fertility within a life cycle model. The normative analyses focus on the individual household level, incorporating both fertility and savings for old age. This study ends with a further consideration of possible national public finance impacts, examining aggregate fertility impacts for PAYGO funded public pension finance.

(163 words)

1.0 Introduction

From the World War II and up though the 1970's, most U.S. workers held Defined Benefit (DB) employer pensions with embedded single or joint survivor annuities. During the past 30 years, however, large and simultaneous changes to both family and retirement planning have emerged. Today, pension coverage is more individual and more directly tied to employee labor force participation, in particular, wages, than in the past. As a result, families' fertility choices can impact pension contribution streams and pension accumulations, in ways that were not previously possible. A need to revisit the literature on the economics of fertility and to develop within it a contribution directed toward women's fertility, savings, and economic well-being in retirement thus emerges.

This paper considers fertility and savings choices in the context of these changes within a life cycle framework. We hypothesize that defined contribution pension structures may impact household fertility behavior, conditional on female labor force participation and pension coverage. We consider how household structure, household wealth, labor force participation, and pension type relate to female fertility and its timing, both theoretically and empirically. In the sections that follow, we first review the economic literature on life cycle fertility. We then construct a life cycle model to predict dynamics, and engage in empirical work that estimates effects of Defined Contribution (DC) plan participation on fertility, controlling for work force participation, employer pension participation, and other standard observable characteristics. We consider our results in light of our model's predictions, and engage in normative analyses focusing on sustainable levels of household fertility and savings for old age. Finally we consider our results in light of standard life tables and total fertility rates found in the demographic literature, and end with a further consideration of possible national public finance impacts – examining aggregate employer pension related fertility impacts for PAYGO funded public pension finance.

2.0 Review of Topic and Literature

Our study of fertility and retirement savings behavior centers naturally on women. Women are particularly important to consider in the context of recent dynamics for two reasons. First, pregnancy and infant care may impose particular biological burdens which make women more vulnerable to workforce absences and thereby impact savings for retirement. Indeed, some recent evidence suggests that women tend to be less financially prepared for retirement than men (Glass and Kilpatrick 1998; Stanford and Usita 2002). Second, longer life expectancy and greater frailty together increase savings requirements for women relative to men. Taken together, these two factors make women more vulnerable to poverty in old age.

Both total fertility and fertility timing contribute to demographic changes and to their nature and timing. Importantly, literature from the 1970's and 1980's, such as Heckman and MaCurdy (1980) and Moffitt (1984), considered workforce and marital changes in a life cycle context in what now appears to have been the beginning of the revolution of employer pension changes toward Defined Contribution type structures. Moffitt's work employs a dynamic life cycle model in which earning and fertility decisions are made simultaneously, and wages are endogenized to reflect these choices. This work is the closest predecessor to the work we propose here. In the ensuing 20 years since Moffitt's paper, we believe it has become important to endogenize worker pension savings to previous measures of savings in the life cycle framework used to predict optimal female fertility patterns. We modify the Moffitt model, incorporating these changes and simplifying it where possible.

Given the full context of continuing societal change, we must also acknowledge that workforce changes which impact fertility can feedback to the timing and magnitude of payroll tax capacity. Thus, there are possible impacts for public finance, including most directly the financing of a PAYGO public pension system. Indeed, any system financed in full or part on a pay-as-you-go (PAYGO) basis relies on increases in productivity and the size of the workforce over time in order to finance benefits for the aged out of contributions from current workers – especially in cases where longevity improves over time. Thus, if changes to private pensions impact fertility by a great enough extent, we should expect changes to the financial stability of public pensions as well. As such, we find a final opportunity to measure one important tenant of the sustainability of the PAYGO system by considering current fertility predictions in the context of our results.

3.0 Theoretical Model of Fertility, Earnings, and Retirement

In this section we develop a theoretical life cycle model which incorporates fertility, earnings, and retirement savings decisions. We begin with a basic life cycle framework which allows for lifetime utility to be distributed over periods of time from 0 to T as follows:

-1- $$U = u(g_0) + \sum_{t=1}^{T} b^t u(c_t, g_t)$$

Where b is a time discount factor limited to be between 0 and 1, u represents utility from consumption at period t as comprised by: c representing child services, and g, representing all other goods. We take T to be the date of retirement. We assume that there are no children born in period zero. Alternately one can assume that c is fixed in the period beginning t=1 in which any decision is being made.

Ignoring the interactions of c and g in determining utility for the moment, the Euler equation describing utility smoothing can be expressed generically as:

-2- $$b^t u'(c_t, g_t) = b^{t+1} u'(c_{t+1}, g_{t+1})$$

Where we allow for evolution of the discount rate over time, as is suggested by the recent literature on (quasi) hyperbolic discounting (Diamond and Kozegi, 2003; Liabson 1997). Taking T as fixed allows us to abstract from retirement timing decisions in the model, and thus to abstract from any formal consideration of leisure's utility. Considering leisure to be inelastically consumed allows us to consider remaining time as distributed between work and child rearing in each period as follows:

-3- $$h_t + k_t = 1, \qquad \forall t \subset \{1, T\}$$

Where *h* represents work for pay, and *k* represents non-market time devoted to child rearing. *k* can vary according to child age, which allows workforce participation to be a function not only of the number of children but also of their spacing. This expositional setup generally follows from Moffitt (1984), where labor supply and fertility decisions are joint, "In the same sense as the consumption of two goods is joint" (pg. 263). For convenience and by convention, we normalize time between these two components to add to 1. Children are accounted for with a child production function which assumes both a time (*k)* and a dollar cost (r) in each period, expressed simply as:

-4- $$c_t = k_t + n\,r_t$$

Where *n* represents the number of children in the household, and thus $n\,r_t$ is the number of children in the household multiplied by their dollar cost at time *t*. Notice, that for the r component, this implies static child costs over the course of upbringing and no economies of scale in household child production. Both assumptions are made for the sake of simplification. Empirically, *n* then represents average child costs for the average household over the course of upbringing. We next introduce a wage function for the mother which depends importantly on wages and hours worked in the previous period, and which we condition on education, *E*, as a proxy for earnings, and other factors, *X*.

-5- $$w_t = f(w_{t-1}, h_{t-1} \mid E, X)$$

And finally, we have a savings function which allows accumulations to period *T*, the known date of retirement.

-6- $$S_T = \sum_{t=0}^{T} s_t \prod_{t+1}^{T} (1 + r_t)$$

S_T is assumed to be sufficient for consumption over the remaining lifespan, consistent with other perfect foresight planning aspects of the model. To justify this approach, one can consider S_T itself is a rationally set goal, which smoothes consumption recursively from a known mortality date though an Euler equation process in all retirement periods, and finally to period *T* utility. Equally, one can consider that S_T is a required funding level for an annuity which smoothes consumption between period T and all periods thereafter. In either case, S_T itself is comprised of periodic savings, s_t, as follows:

-7- $$s_t = (1 + e)w_t h_t - g_t - n r_t$$

Where e is designed to account for any employer match to retirement savings contributions. This system allows us to consider fertility along with both employer and personal retirement saving.

In this system of equations the number and spacing of children determine earnings paths that maximize U conditional on affording S_T. Theoretically, in this setup, even given the significant degree of determinism in the model presented, there may be opportunities for multiple equilibria, such that our female labor force participant might be indifferent to having one child at one point in time, versus two children at two alternate points of time. In general however the discrete time frame for the model and the objective function together reduce the number of solutions to one, assuming well ordered preferences in the utility of children, over time.

3.1 Preferences and Fertility in a Multi-period Model -- Comparative Statics:

One way to consider solutions is with respect to the evolution of relative utility from c_t - -assuming non-disposal of children (i.e. adoption out of the biological family). Abstracting from savings requirements in general, on average, the female labor force participant satisfies

-8- $$u'(c) \cong u'(g)$$

However in any one period, we allow that more utility may come from one or the other component. And due to the discrete nature of children, global utility takes on discrete values. Intertemporally, for the case of multiple births segmentation may occur such that in the period ahead of a birth, more utility is derived from g and just subsequent to birth, more from c. In general, births are timed such that *iff*

-9- $$\sum_{t}^{T} b^t u(c_{(n+1)}, g(c_{(n+1)})) \geq \sum_{t}^{T} b^t u(c, g(c))$$

Then the marginal child is born in period t. The complete household size is achieved when the condition no longer holds for any remaining period [t, T).

3.2 Fertility and Wages in the Model -- Comparative Statics:

By equation -5-, ($w_t = f(w_{t-1}, h_{t-1} \mid E, X)$) wages themselves are a function of fertility, although there is a tradeoff between h, and k. This is true for all types {E,X}, though the particular dynamics are allowed to be a function of levels of education and other pertinent factors.

4.0 Data and Method

We engage two data sources in our current work. The first is the year 2000 United States Census Data. The second is the *Health and Retirement Study (HRS)*. Using these two publicly available data sources in tandem, retrospective employment, fertility, and savings information can be observed for women over the past several decades. The basic approach in employing these data is as follows: the Census cross sectional data allow us to identify earning impacts related to fertility across the lifecycle. The *HRS* panel data allow us to discern the fertility impacts derived from engaging a Defined Contribution type pension plan. Below we describe our data and method in greater detail.

The *Public-Use Microdata Sample (PUMS)* 2000 *U.S. Census* 1% data is offered through the Public Data Quiries, Inc. These data are employed to create a series of age-earnings profiles that vary by education and fertility. First, a total of 859,990 person observations were extracted from the PDQ software by selecting all female observations who had positive person weight, and for whom "household/family type and employment status" information was available. We further culled these data limiting our sample to those who chose a single racial group and one of two educational attainment categories offered by respondents for the purpose of simplicity as follows. Out of the nine available racial groups, we omit all but those who chose their primary race as "White alone," "Black or African American alone," or "Asian alone." In addition, out of the 17 possible educational attainment levels, we omit all but those who reported "high school graduate," or "bachelor's degree," the categories with the highest numbers of respondents. These two criteria reduced our sample size to 353,965 women. After assessing the age of these women and the children's age categories, women aged between 25 and 48 were kept in the sample, with others discarded. This leaves us with a final sample size of 184,752. Descriptive statistics using the selected personal and family characteristics, weighted with the person weights, are shown in Table 2.

Fertility information included in the *PUMS* data is from the variable called "presence and age of own children under 18 years." Four categories are provided as follows: "with own children under 6 years only," "with own children 6 to 17 years only," "with own children under 6 years and 6 to 17 years," and "no own children under 18 years." One concern is the omission of information on mature offspring from our sample. Notably only the third category allows us to identify households with one or more children. As well, it occurs to us that step children, foster children, and adopted children may or may not be included depending on the respondents' interpretation of the word "own" in the answer categories. As such, we do not make reference to the total number of children in the work that follows; "children" and fertility in the work with the *PUMS* data refer to women with at least one minor child. As women age, they tend to move out of our fertility sample, again appearing infertile, regardless of experience. This imposes greater convergence between our two series than is likely to be observed in a panel data setting.

In the figures in this paper, in order to establish the link between fertility and lifetime earnings, we engage the sub-sample of the *PUMS 2000 1%* sample of women to present two sets of personal earning information for six combinations of the racial and educational categories. The variable of interest is "wage and salary income in 1999" for each respondent, and one set of the earning is preferred by choosing the most frequent "fertility" types for each age for each of the racial and educational category. We refer to the combinations of the most "frequent" type for each age group as "typical fertility."

For instance for White women with high school education, typical fertility is observed for maternal ages between 25 and 27 as "living with own children of under 6 years only." For maternal ages between 28 and 30 we observe women "with own children under 6 years and 6 to 17 years;" and between age 31 and 43, we observe women to be "living with their own children 6 to 17 years only." Finally from age 44, they were increasingly likely to be living "with no child under 18 years," becoming indistinguishable from a sample of childless women. Similarly for White women with bachelor's degrees, typical fertility follows "no own children under 18 years" through age 29, "with own children under 6 years only" through age 34, "with own children under 6 years and 6 through 17 years" through age 37, and finally "with own children 6 to 17 years only" through age 48. Although not included in our sample, the "typical fertility" pattern between age 49 and 60 is to have "no own children under 18 years" for this group.

In Figures 1 though 6 we display earnings patterns for our cross sections of women between 25 and 48 years old, as three year moving average series. The earnings are weighted using the person weights. The top two panels of each figure display earnings distributions for the sample of "no child throughout[1]" and "typically fertile" women. These distributions are comprised of median, 95th, and 5th percentile earnings. The moving average approach works to smooth anomalies across the cross section, and make underlying patterns more visible to the reader. Notably, across all panels displaying distributions, for all groups, the 5th percentile is indistinguishable from zero.

The final panel of each figure compares median wage and salary income distributions for our "no child throughout" and "typically fertile" groupings. It is here that we find observable impacts of "typical" fertility on wage and salary, throughout the cross section.

Figures 1, 3, and 5 illustrate trends for White, Black, and Asian American high school graduates (respectively) who do not continue their education. Figures 2, 4, and 6, give the patterns for these three racial groups, in the case where terminal degree is the four year bachelor's degree.

Earning profiles of White women with bachelor's education are shown in Figure 2. From the late twenties and though the late forties, due to the observed "M" shape, White women with a bachelor's degree earned less when they experienced the "typical fertility" of their cohorts than if they had no child throughout.

The strongest observed negative fertility impacts are found in panel 3 of Figures 2 and 6, representing White and Asian college graduates. These groups together represent 35.7 percent of our sample. Patterns for Black women are very different with earnings of the "typical fertility" group dominating their peers with no child mildly, throughout the range. Out of 21,423 Black person-observations, 10,091 are included in the "typical fertility" group while 7,102 are included in the "no child throughout" group, suggesting that relatively small samples of women "with no child throughout," along with differences in marital and educational patterns may be driving this result.

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[1] No child "throughout" refers to the idea that none of the women contained in the cross section have a child they consider their own in their household in 2000, that is to say, throughout the cross section..

Similarly, our Asian high school graduate population is also relatively small, making the impacts of fertility difficult to ascertain for this group. As well we suggest that "Asian" is a particularly heterogeneous group in terms of heritage and cultural assimilation. In fact, since the immigration act of 1965, the Asian American population has changed in composition, and includes a great number of recent immigrants from South East Asia. These women's experiences may be very different than their longer settled East and Central Asian counterparts. Thus the switching we see here in panel three of Figure 5 is likely due both to a small sample for this group, and to the variation of experiences within the group labeled as "Asian American only."

While our ability to observe the experiences of subgroups is sometimes confounded by the factors just described, our total sample is robust for consideration of fertility impacts on women's earned wage and salary income. In summary then, based on work with the *PUMS*, there is ample evidence that fertility has negative impacts on earnings throughout the cross section.

Our second data source is the *RAND Version f* assembly of the *Health and Retirement Study (HRS).* This longitudinal data set covers the period from 1992 though 2004, tracking cohorts born between 1931 and 1953.

We utilize the *RAND HRS Version f.1* data which contain assembled data from the *HRS* over the period of 1992 to 2004, and improve several measures over the recently distributed *Version f* data. While these data omit some important variables which might be desired for a full life cycle analysis, the *RAND* data improve upon the *HRS* data significantly in several ways. Of particular note, *RAND* has developed some very thoughtful imputations for key variables, especially regarding measures of wealth and pension coverage, a key component which we wish to explore in order to test our hypothesis that defined contribution pension structures impact household fertility behavior, conditional on female labor force participation, and pension coverage. We engage these data to look for fertility impacts stemming from variation in workforce participation and pension coverage, by type. These data are augmented with additions from the originals *HRS* to overcome the problems of omission that might otherwise deter one from using the *RAND* data for our purposes.

Our preliminary investigation of seven waves of the *HRS* (1992-2004) with these data indeed suggests that defined contribution pension coverage is correlated with lower fertility. To account for left censoring of fertility at zero children, a Tobit model, rather than ordinary least square regression, is used. Reduced form analysis employing a Tobit regression for a sub-sample of the *HRS*, consisting of female respondents with pension coverage who were married at the time of the interview in 2004, yields a negative impact of about 0.14 children over the life cycle. This measured impact is statistically significant at the 95% confidence level in the specification included here. In other specifications we have found negative impacts, but significant depends on controlling for religiosity (which is correlated with increased fertility) and spousal pension coverage (which could damp or amplify fertility related incentives depending on coverage, and type).

5.0 Results and Discussion

We have presented evidence from the *HRS* in line with the idea that private pensions can impact fertility, and that the type of pension can impact this directly, even after considering cohort effects (birth year). We have supported this idea with evidence linking the fertility to earnings losses for women from the *PUMS*. One way to consider this work is to find that maternity is significantly associated with household wealth and retirement savings decisions. That is only part of what we would like to get at however. In ongoing work we hope to find that the impacts of maternity timing on household wealth and retirement savings are different among cohorts in a fixed effects model, this gets beyond the linear estimated impact of the birth year variable and allows us to absorb impacts on fertility based on differences in labor force participation and pension structures, driven by cohort. Extending our consideration of family income measures to work with the *PUMS* might be relevant as well. Finally, a goal of our continued work is to use our reported results to estimate potential impacts for U.S. public pension finance. Our theoretical work and our preliminary empirical results are in line with these expectations.

5.1 Implications of Impacts for Demography and Public Finance

Theoretical and empirical work to date does suggest that DC Pensions have negative impacts on fertility, important for demographic dynamics over the coming 50 or so years, and thus relevant to public finance of government, and of public pension programs in the US, and elsewhere. What remains unclear at the current is what the likely magnitude of these impacts might be. Without more detailed information on impacts for the timing of fertility, one would be remiss to comment further at this point.

Finally, given estimated timing impacts we expect to consider current fertility and life tables in the context of our work. This should allow us to discuss our results in light of current aggregate data, and to consider any observed divergences possible implications for worker-to-retiree ratios in the public pension system over the next generation, as we refine our work over the coming months.

6.0 Conclusions and Final Thoughts

Maternal life cycle decisions are increasingly directly driven by market forces. Fertility decisions are made in the context of other consumption and savings decisions, and perhaps holding public pension expectations fixed. Our model and research design suggest that it is important to consider changes in private and public pensions simultaneously in the context of fertility and labor force decisions, both for measures of households' financial well-being, and for aggregate measures.

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TABLE 1

Tobit regression	Number of obs = 5482
	LR chi2(8) = 482.72
	Prob > chi2 = 0.0000
Log likelihood = -11402.213	Pseudo R2 = 0.0207

# of children	Coef.	SE	t	P>|t|	[95% CI]	
R birth year	-.086	.004	-18.66	0.000	-.095	-.077
R receives pension	-.110	.065	-1.67	0.095	-.239	.019
S receives pension	-.023	.067	-0.35	0.724	-.155	.108
DC pension held	**-.137**	**.065**	**-2.08**	**0.037**	**-.266**	**-.008**
HH other wealth(net)	-3.77e-08	1.52e-08	-2.47	0.013	-6.76e-08	-7.80e-09
HH house wealth(net)	-2.18e-07	4.82e-08	-4.53	0.000	-3.13e-07	-1.24e-07
Marriage duration	-.052	.002	-19.52	0.000	-.057	-.047
R religion	.204	.105	1.94	0.053	-.002	.412
Constant	173.658	9.092	19.10	0.000	155.8338	191.4827
/sigma	1.960229	.0189704			1.923039	1.997418

Obs. summary:		
	91	left-censored observations at child<=0
	5391	uncensored observations
	0	right-censored observations

In Table 1, the Tobit model is specified as follows: The number of children for each female respondent is regressed against birth year (which estimates a cohort effect), pension receipt by respondent and spouse both in 2004, whether or not the respondent holds a defined contribution pension, the household's net housing wealth, the household's net non-housing wealth, duration of the respondent's longest marriage, whether the respondent identifies herself as belonging to any organized religion – regardless of type. While only one specification is included here, in alternate specifications, DC pensions were found to have consistently negative impacts on fertility. However, significance was diminished when factors like religion, and spousal pension receipt were omitted.

TABLE 2

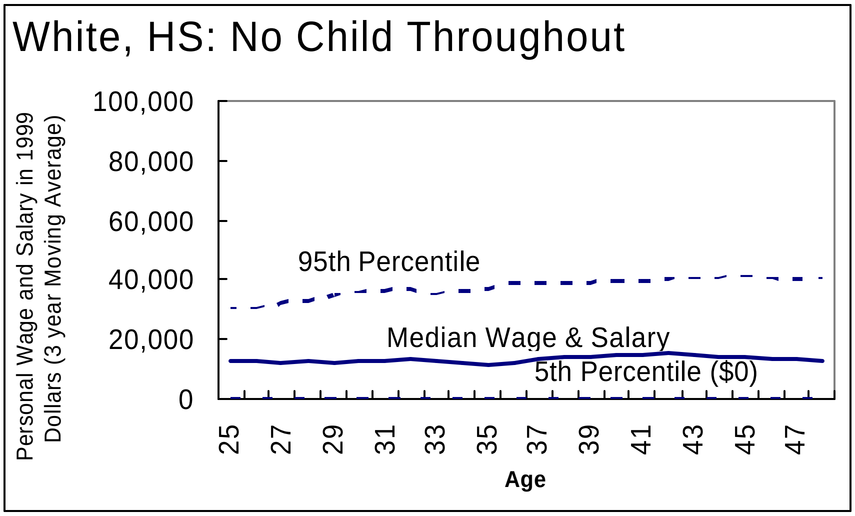
Descriptive Statistics for Women Included in the 2000 PUMS 1% Sub-Sample

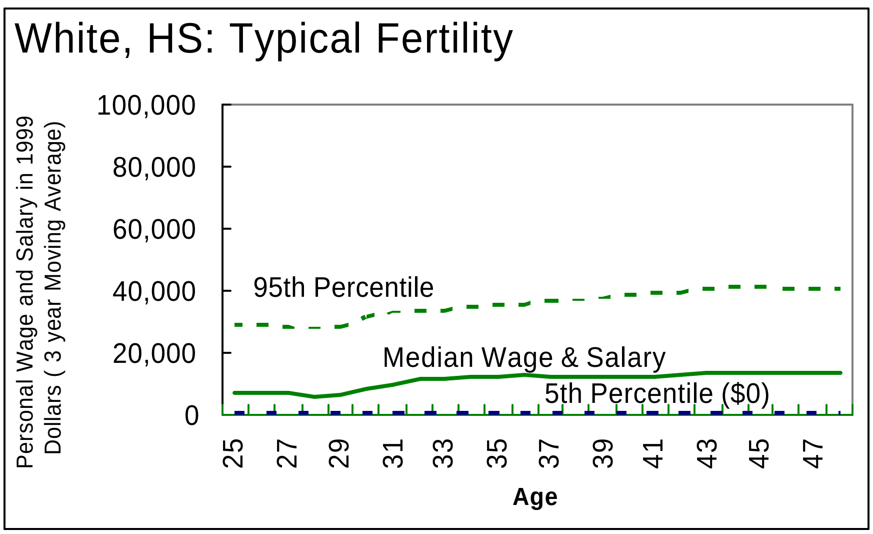
Variables	White		Black		Asian		All Groups	
	High School	Bachelor's	High School	Bachelor's	High School	Bachelor's	High School	Bachelor's
Characteristics of Respondents:								
Age (in years)	37.58	36.81	36.47	36.65	37.25	36.03	37.42	36.75
Person's total income in 1999 (Median in $)	13,000	25,200	13,800	30,000	11,800	24,000	13,000	25,900
Had any wage or salary income in 1999 (vs. not)	73%	80%	76%	90%	64%	70%	73%	80%
Wage or salary income in 1999 (median in $)	11,600	24,000	12,000	29,000	9,600	22,000	11,800	24,100
Marital status (percent of sample)								
Now married	76.83	84.75	39.86	55.05	81.07	81.93	72.55	82.55
Widowed	1.03	0.43	1.96	1.62	1.01	0.41	1.14	0.51
Divorced	11.45	6.35	12.26	12.22	5.70	2.76	11.44	6.50
Separated	2.81	1.22	7.95	3.89	1.31	1.06	3.39	1.39
Never married	7.88	7.25	37.97	27.22	10.91	13.83	11.49	9.05
Family Characteristics:								
Family type and employment status (percent of sample)								
Married-couple family: husband and wife in labor force	50.25	64.05	23.31	45.03	41.67	50.20	46.91	62.82
Married-couple family: husband in labor force (wife not)	19.98	19.08	7.77	7.53	24.28	24.73	18.62	18.69
Married-couple family: wife in labor force (husband not)	4.29	2.72	4.56	3.85	6.01	4.32	4.35	2.90
Married-couple family: neither in labor force	4.47	2.04	5.52	3.04	11.03	6.96	4.72	2.44
Male household, in labor force	2.70	0.92	3.12	1.89	3.64	2.14	2.77	1.07
Male householder, not in labor force	0.78	0.31	1.79	1.10	1.34	0.64	0.91	0.39
Female householder, in labor force	13.10	9.26	35.74	29.89	8.72	7.96	15.68	10.57
Female householder, not in labor force	4.43	1.62	18.19	7.67	3.32	3.05	6.03	2.12
Presence and age of own children under 18 years								
With own children under 6 years only	6.59	20.97	8.12	15.10	13.70	19.45	9.50	20.47
With own children 6 to 17 years only	44.07	34.14	43.02	34.70	38.66	29.52	43.85	33.66
With own children under 6 years and 6 to 17 years	13.95	14.09	15.66	12.74	13.97	12.87	14.15	13.92
No own children under 18 years	32.39	30.80	33.20	37.47	33.68	38.16	32.51	31.75
N	94,664	60,355	15,823	5,600	2,778	5,532	113,265	71,487

Notes: Numbers are means for continuous variables, unless otherwise noted, and column percents for categorical variables. All statistics are weighted.

FIGURE 1

Income and Fertility for White Women with High School Degrees





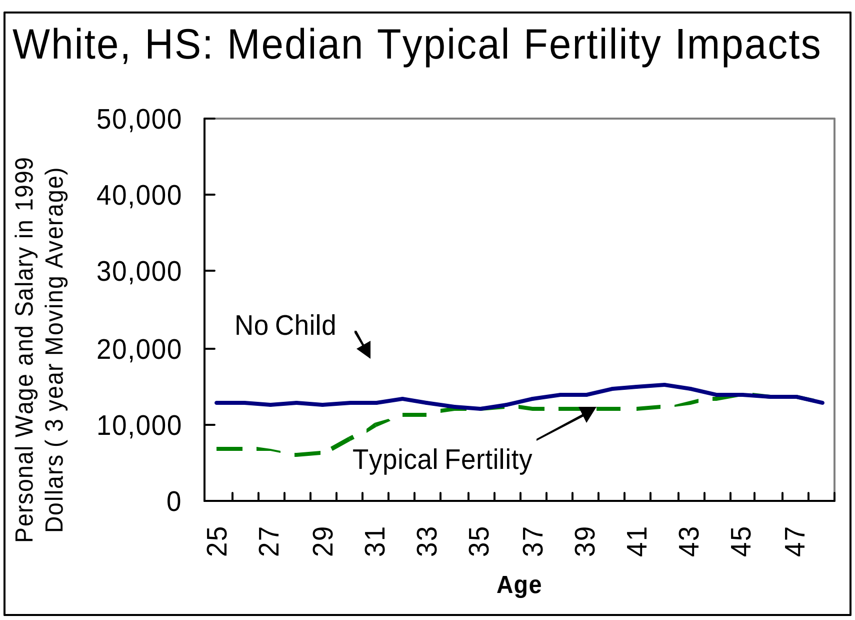


FIGURE 2

Income and Fertility for White women with Bachelors Degrees

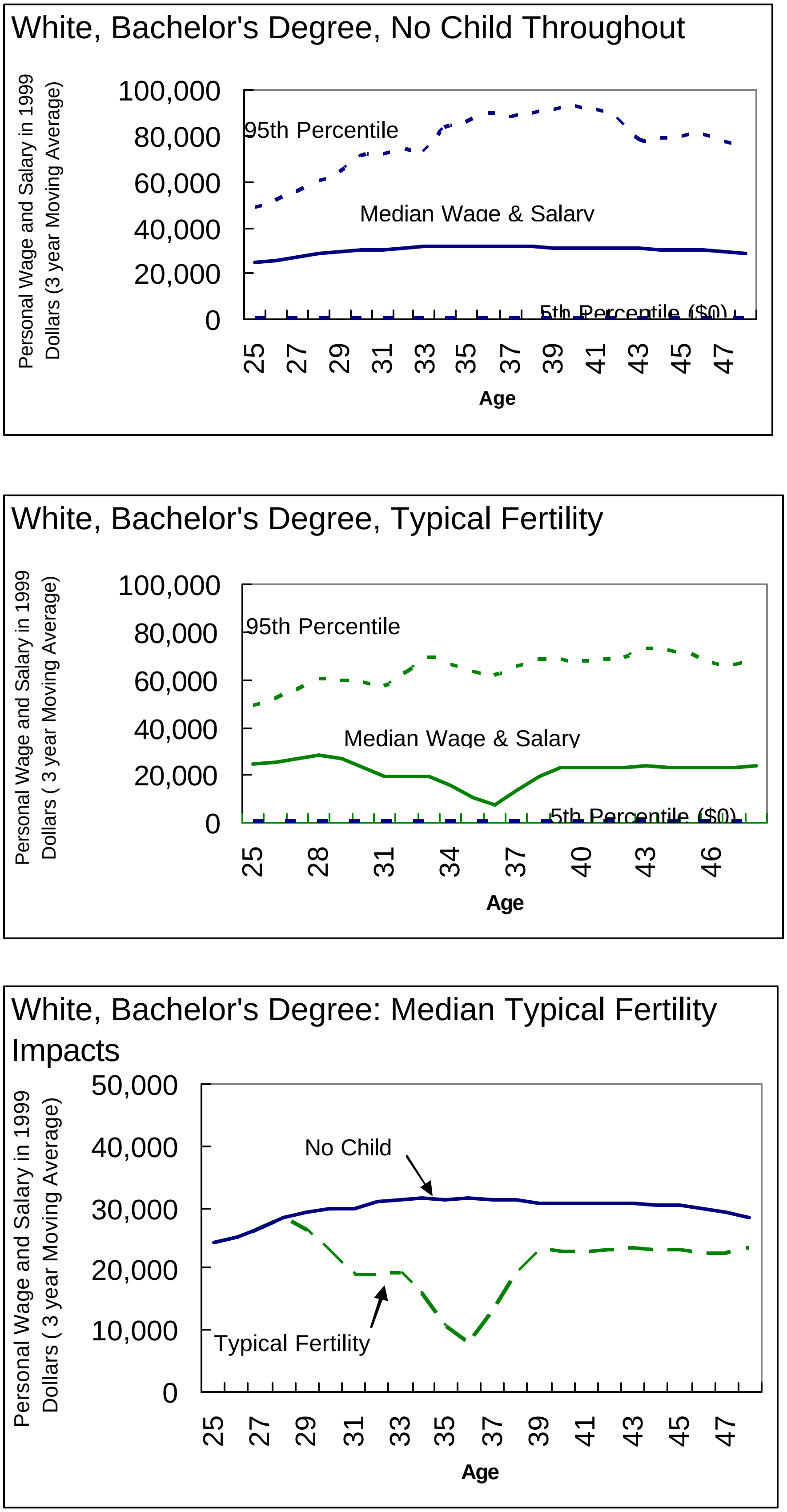
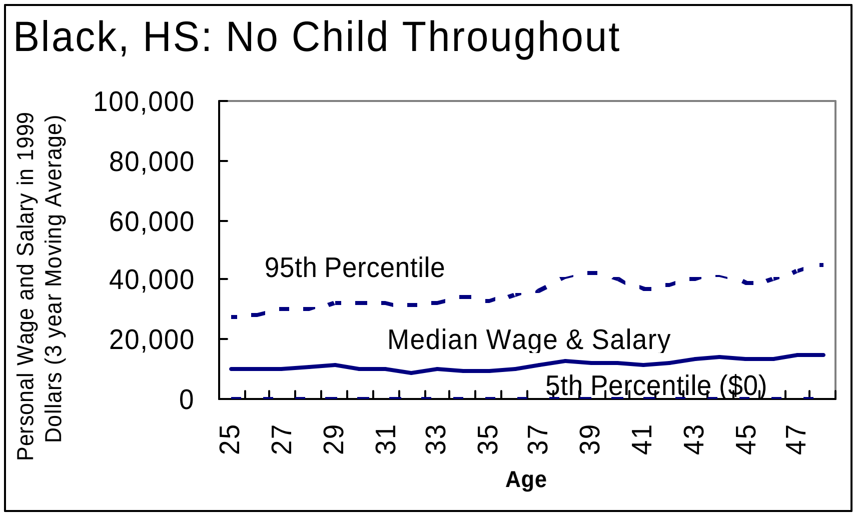
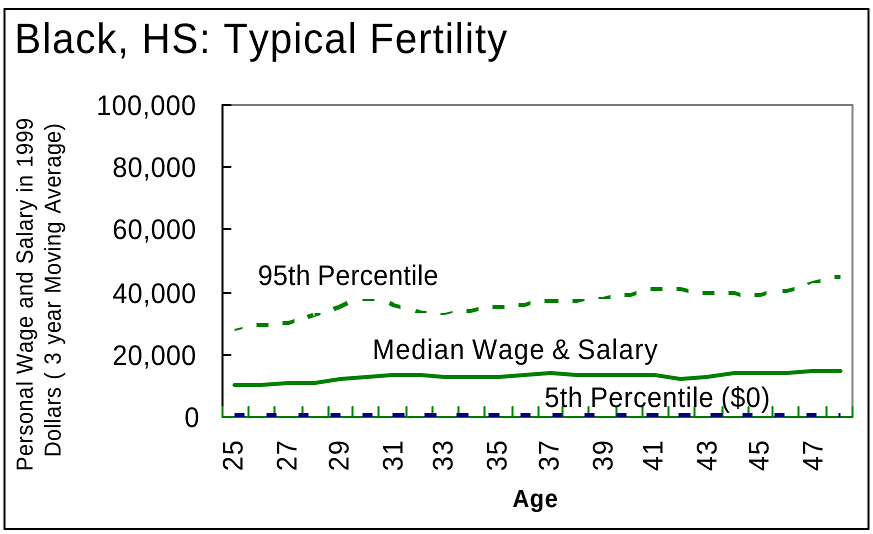


FIGURE 3

Income and Fertility for Black women with High School Degrees





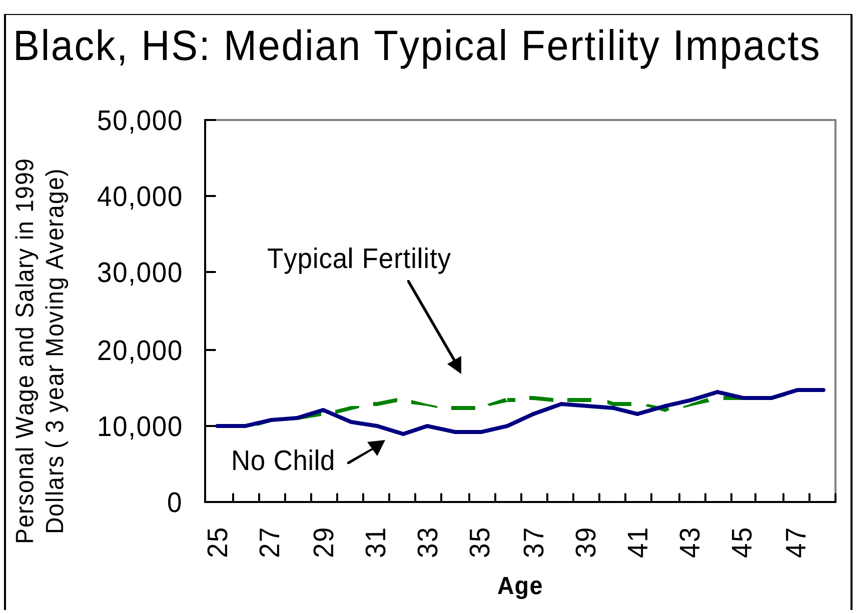
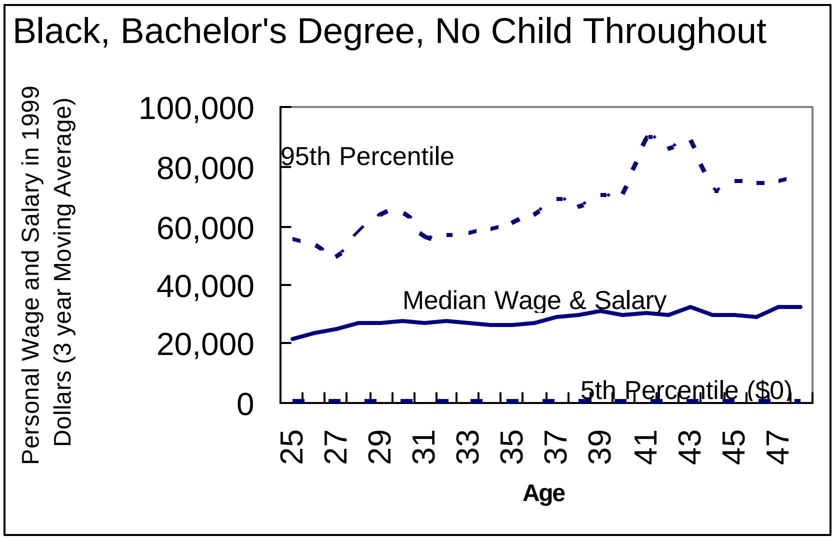
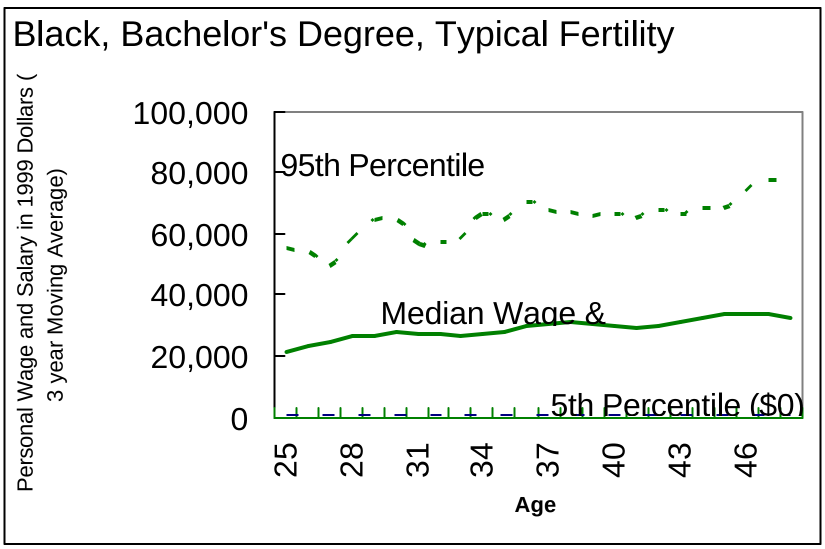


FIGURE 4

Income and Fertility for Black women with Bachelors Degrees





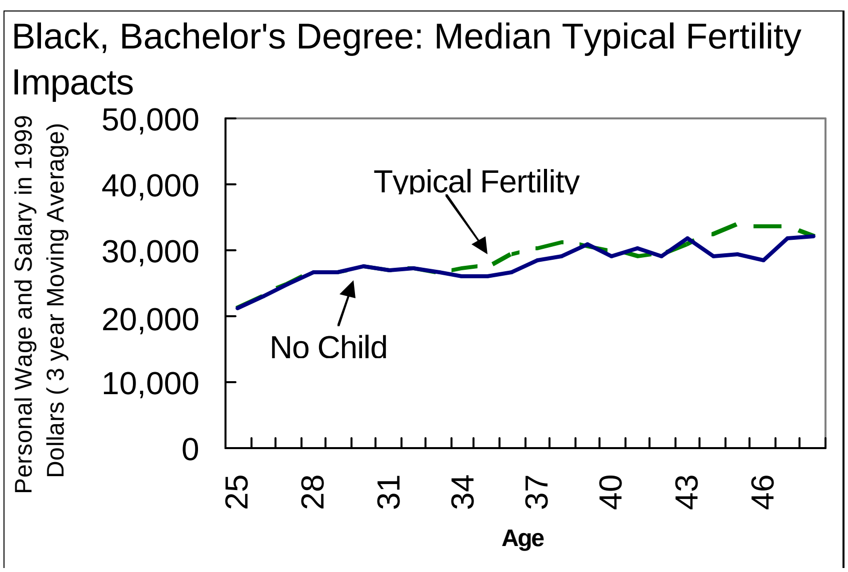
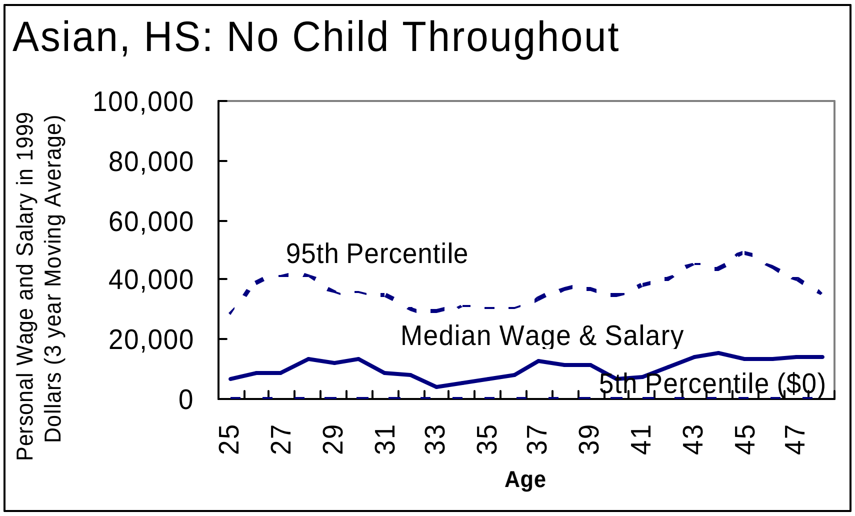
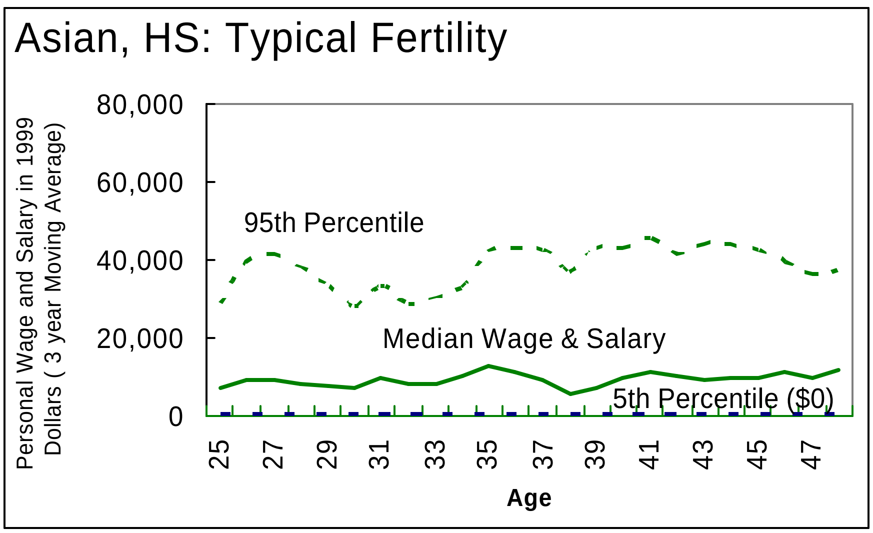


FIGURE 5

Income and Fertility for Asian women with High School Degrees





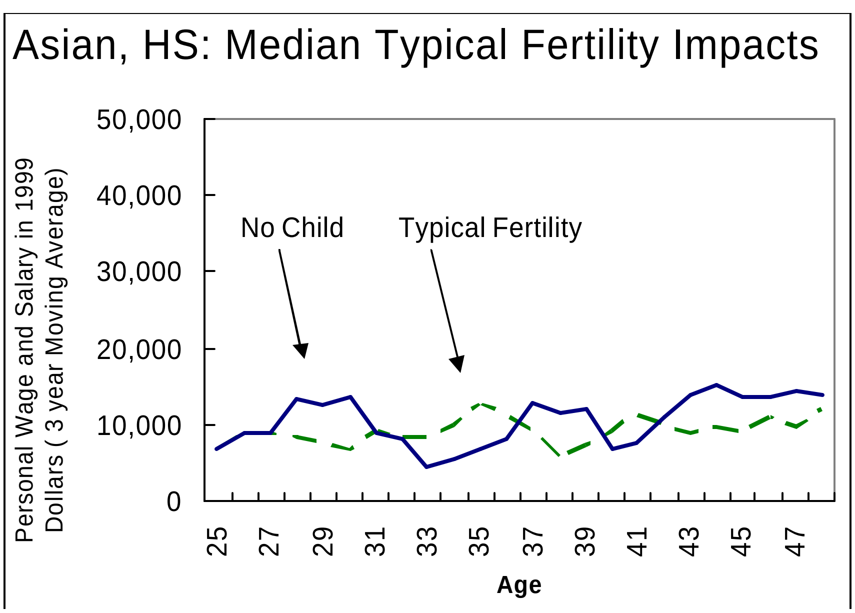


FIGURE 6

Income and Fertility for Asian women with Bachelors Degrees