Fertility and the Personal Exemption: Implicit Pronatalist Policy in the United States

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The effect of the income tax system has been largely ignored in existing empirical work on fertility.[1] This neglect is surprising. It has often been demonstrated that tax impacts on behavior can be quite substantial, even in areas in which economic costs and benefits are not commonly thought to play a dominant role.[2] Moreover, the governments of many countries act as if they believe that they can affect the birthrate through tax incentives. A concern about population decline has induced some governments to adopt explicitly pronatalist policies (Michael S. Teitelbaum and Jay M. Winter, 1985). France and West Germany have extensive systems of family allowances. East Germany and Hungary have implemented policies that include one-time birth payments and paid maternity leave (Henk J. Heeren, 1982, Jerome S. Legge, Jr., and John R. Alford, 1986). Canada and Singapore also attempt to influence fertility rates through tax policies (Malcolm Gillis, Dwight H. Perkins, Michael Roemer, and Donald R. Snodgrass, 1983). At the other extreme, China has received international attention for the extreme antinatalist economic incentives that it has instituted. A few studies report that these policies have some impact on fertility rates, but the magnitude of that impact is still an issue (Kingley Davis, Mikhail S. Bernstam, and Rita Ricardo-Campbell, 1986).

The United States has not implemented such explicit policies as family allowances or paid maternity leaves. However, the federal income tax has a feature that may implicitly affect the decision to have a child: the personal exemption for dependents. As noted by Joseph Pechman (1983), the personal exemption is justified not as a policy for influencing the fertility decision, but as relief for low-income households and families of the burden of taxation; its amount is roughly based on the income needed to maintain an adequate diet. Nevertheless, the personal exemption also represents a clear subsidy for each child, a subsidy whose value depends upon the marginal tax rate of the family. The effect of this tax feature on the aggregate fertility rate in the United States has not been previously examined.

In this paper, we estimate an aggregate fertility equation for the United States from 1913 to 1984. Fertility is modeled as a function of various economic and demographic factors, including the tax value of the personal exemption. The primary result is that the personal exemption has a positive and significant effect on the national birthrate, and this result is robust to a variety of specifications. Although the elasticity of the birthrate with respect to the exemption is not large, it appears that the United States—and perhaps other countries as well—can influence to a degree the fertility decisions of its citizens through deliberate changes in tax policies.

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[1] A few economists have examined this issue. Peter H. Lindert (1978) estimates child costs over time and includes the tax benefits as an input to those costs. T. Paul Schultz (1981) speculates that the tax system might affect the demand for children. More recently Thomas Espenshade and Joseph J. Minarik (1987) estimate the impact on fertility of the 1986 reform act. In their analysis, however, they ignore the potential effect of a change in the cost of a child and focus, instead, on income effects.

[2] This literature is enormous. A useful starting point is Henry J. Aaron and Joseph Pechman (1981).

TABLE 1—CHILD COSTS AND THE PERSONAL EXEMPTION FOR DEPENDENTS

Study	Annual Child Costs Medium Income Group[a]	Tax Value of Personal Exemption[b]	Personal Exemption As a Percent of Annual Expense in Percent
Turchi (1983)			
(1981 Dollars)			
Avg Male Child	$3470.76	$325.00	9.36
Espenshade (1984)			
(1981 Dollars)			
One Child	5900.04	325.00	5.51
2nd Child Addition	3255.48	325.00	9.98
3rd Child Addition	2311.20	325.00	14.06
Olson (1983)			
(1982 Dollars)			
One Male Child	7293.12	295.00	4.04
2nd Child Addition	5015.16	295.00	5.88
BLS (1982)			
(1981 Dollars)			
One Child	3405.00	325.00	9.54
2nd Child Addition	2938.44	325.00	11.06
3rd Child Addition	2958.84	325.00	10.98
USDA (1982)			
(1981 Dollars)			
Avg Urban Child	4466.64	325.00	7.28

[a]Child costs derived from Williams (1987), II-145. (Monthly expenses × 12 months)
[b]In 1981 the value of the personal exemption is 1,000 dollars per dependent and the average marginal tax rate is 32.5 percent; in 1982 the personal exemption is 1,000 dollars per dependent and the average marginal tax rate is 29.5 percent.

Section I examines the impact of the personal exemption on the costs of a child. Section II presents the empirical model of fertility, and discusses the data and variables that are used. Section III presents the empirical results. Conclusions and policy implications are summarized in Section IV.

I. Child Costs and the Personal Exemption

The standard economic model of fertility posits that children provide their parents with positive utility in either consumption or production. The cost of a child depends upon the cost of time inputs and the cost of the goods and service inputs used in child rearing.[3] The cost of a child also depends upon the annual tax savings generated by that child, equal to the value of the personal exemption multiplied by the marginal tax rate of the parent claiming the child as a dependent. This annual subsidy rises with the marginal tax rate and with the size of the personal exemption.

The value of the personal exemption is not inconsequential relative to the annual cost of raising a child. Robert G. Williams (1987) has compiled data on child costs from a number of economic studies. As shown in Table 1, these estimates vary considerably. However, it is obvious that in all cases the tax subsidy represents a large portion of the annual monetary expenses of child rearing. Using a medium socioeconomic status as a measure, the tax value of the personal exemption represents from 4 to 9 percent of the annual estimated monetary cost of raising one child. For subsequent children, the tax value of the personal exemption increases as a portion of the annual child costs, ranging from almost 6 to 14 percent.

[3]See Gary Becker (1960) and Schultz (1973) for a theoretical discussion. For examples of empirical studies linking fertility and economic variables, see William P. Butz and Michael P. Ward (1979), Marc Nerlove and T. Paul Schultz (1970), Michael Wachter (1975).

It is also important to recognize that the personal exemption is an ongoing support item. The parents of a child receive this tax subsidy for every year that the child is filed as a dependent. In most cases this will be a minimum of eighteen years. Thus the personal exemption is a stream of subsidies to birth, not a one-shot payment. At a discount rate of 10 percent, the present value of an annual stream of payments of \$325—the average tax value of the personal exemption in 1981—is nearly \$3000; at a discount rate of 5 percent the present value rises to almost \$4000.

The personal exemption assumes a much different role than other economic subsidies to children that have been examined. For example, the relationship between birthrates and various income maintenance programs like Aid to Families with Dependent Children (AFDC) has been explored, and the results generally fail to prove that higher welfare payments lead to higher fertility.[4] AFDC, however, is a system of payments extended only to those with economic need, usually only to single parent families, and is not necessarily received over the entire dependency period of the child.

It is clear that the personal exemption encourages fertility by decreasing the relative cost of children. Of course, whether and how much individuals in fact respond to this incentive is an empirical issue.

II. The Empirical Framework

The previous section argued that the cost of children affects the fertility decision, and that these costs depend in part upon the tax value of the personal exemption. However, there are clearly other factors that influence the birth decision. This section discusses those other factors and presents the basic model of fertility.

We estimate the following reduced form equation for the period 1913, the year in which the modern federal income tax came into existence, to 1984:

$$\begin{aligned}(1)\quad \text{General Fertility Rate} &= \beta_0 + \beta_1\text{Personal Exemption} \\ &+ \beta_2\text{Income} \\ &+ \beta_3\text{Unemployment} \\ &+ \beta_4\text{Infant Mortality} \\ &+ \beta_5\text{Immigration} + \beta_6\text{Female Wage} \\ &+ \beta_7\text{Birth Control} + \beta_8\text{World War II} \\ &+ \beta_9\text{Time Trend.}\end{aligned}$$

Table 2 gives the variables, definitions, and means.

The dependent variable, the general fertility rate, is the birthrate per thousand women between the ages of 15 and 44. This is the group commonly considered to be at risk of pregnancy. The general fertility rate is less sensitive to changes in the age and sex structure of the population than the crude birthrate. The fertility rate series is reported in Appendix 1.

Due to biological constraints, the birth of a child will lag the decision to have a child. For this reason we estimate the fertility equation in lagged form. Several different lag structures are used to test the sensitivity of our results to assumptions about the timing of the fertility decision process. The correct lag structure is difficult to identify. One appealing structure is an inverted V pattern with weights initially increasing and then decreasing. The rationale for this form comes from the biological average of 24 to 31 months required to produce a birth (T. Paul Schultz, 1981). Under this structure, the variable is lagged four periods from the current period, and the peak comes in the $t-2$ period. The constructed variable W_{it} becomes:

$$(2)\qquad W_{it} = w_1 X_t + w_2 X_{t-1} + w_3 X_{t-2} + w_4 X_{t-3} + w_5 X_{t-4},$$

[4]See Glen G. Cain (1977) and David T. Ellwood and Mary Jo Bane (1985).

TABLE 2—VARIABLE DEFINITIONS AND MEANS

Variable Name	Definition	Mean	Standard Deviation
General Fertility Rate	Births per 1000 women aged 15 to 44	95.50	19.64
Personal Exemption	Real tax value of personal exemption	100.40	65.88
Male & Asset Income	Real after-tax personal income per family net of female earnings	7466.37	2982.78
Unemployment	Unemployment rate of civilian labor force	0.071	0.053
Infant Mortality	Infant mortality per 1000 live births	43.02	26.84
Immigration	Immigration of at-risk group as a percent of resident at-risk group	0.003	0.0035
Female Wage	Average after-tax female wage	1.22	0.532
Pill	Dummy variable equal to one in years 1963 to 1984	0.305	0.464
WW II	Dummy variable equal to one in years U.S. was in World War II	0.069	0.256
Time Trend	Time trend equal to one in 1913 and increasing by one each year	36.50	20.92
Female Education	Female high school graduates each year as a percent of female population	0.009	0.004

where $w_1 < w_2 < w_3$ and $w_3 > w_4 > w_5$. The lag structure thus declines around the mean lag of two years, which is the average time required to produce a birth. A two-year, rectangular lag structure is also examined:

$$(3) \qquad W_{it} = w_1 X_t + w_2 X_{t-1} + w_3 X_{t-2},$$

where $w_1 = w_2 = w_3$. Several other lag structures have been estimated with no significant impact on the results.

The independent variable of primary interest is the real tax value of the personal exemption, equal to the personal exemption multiplied by the average marginal tax rate. The federal income tax began in 1913, and the personal exemption became a feature of the federal tax system in 1917. We deflate values of the personal exemption using the Consumer Price Index. We use average marginal tax rates estimated by Robert J. Barro and Chaipat Sahasakul (1983, 1986).[5] Although Congress has changed the personal exemption only nine times between 1913 and 1984, the real tax value of the exemption exhibits substantial fluctuation due to changes in the average marginal tax rate and in the price level. See Figure 1 and Appendix 1 for this series.

Additional independent variables include both those that affect birthrates by changing

[5]Barro and Sahasakul (1983, 1986) calculate the average marginal tax rate from 1916 to 1983. Their methodology is employed to calculate the rate for 1984. Though the empirical work reported here looks at values 1913 to 1984, there was no personal exemption prior to 1917. Thus no values of PE are missing. Barro and Sahasakul report average marginal tax rate series weighted by adjusted gross income and by number of returns filed; both approaches are calculated arithmetically and geometrically. All four series were tried in estimating the model with no substantial difference in the results.

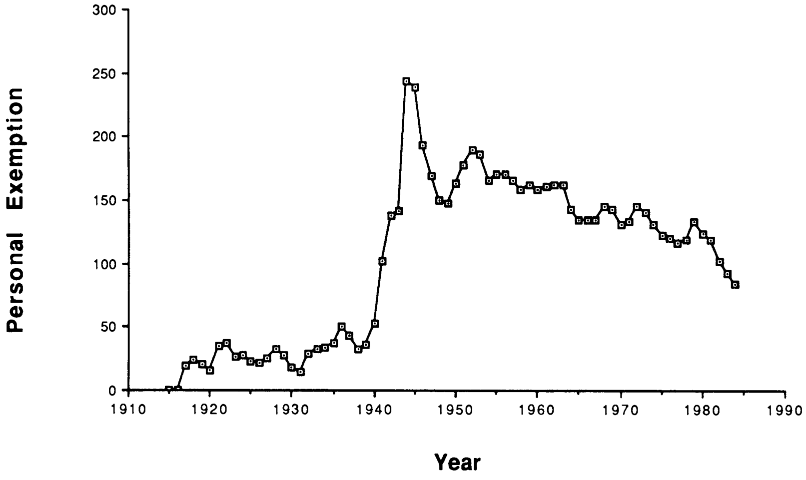

FIGURE 1. REAL TAX VALUE OF PERSONAL EXEMPTION

the demand for children and biological factors that influence the supply of births. Income is measured as the sum of male earnings and non-wage family property income.[6] Because women in general still commit more time to the care of children than do men (Arleen Leibowitz, 1975), women's wages are a reasonable proxy for the time cost of children. Consequently, if mother's earnings are included in family income, the estimated coefficient on that variable confounds the estimates of the income effect with those of a price effect. To estimate a pure income effect, we therefore consider family income net of mother's earnings. If children are a normal good, we expect the sign on income to be positive. However, Gary Becker and H. Gregg Lewis (1973) argue that high income families may invest more in the quality of each child, so that income may have a negative effect on quantity.

Measuring the cost of time inputs presents major difficulties. In fact, the lack of an adequate measure of the value of women's time may be partially responsible for the relatively small number of time-series studies on fertility. Women's wages were not regularly reported in the first half of the century, so there is no continuous wage series available for statistical work. In addition, as much of the cross-section work on fertility during the last decade has noted, the observed market wage is a biased measure of the value of time for women who do not work in the market.[7] This paper constructs a wage series from various sources. June O'Neill (1985) reports the ratio of female to male wages from 1955 to 1982. Using these ratios and data on production wages, we construct a female wage series. We then multiply wages by the average marginal tax rate to obtain the after-tax female wage. See Appendix 2 for details about the construction of this series. Though the series represents only one sector, wage trends across sectors over time are highly correlated.

The infant mortality rate is included to capture two possible effects. The death of a child could cause an increase in the birthrate if families are concerned about completed family size; this is commonly called the replacement effect. However, infant mortality increases the cost of producing a surviving child. If the cost effect dominates, then an increasing infant mortality rate could lower the birthrate.

[6]Male earnings are from the Statistical Abstract, various years, and Current Population Reports, Series P-60. Average property income is derived from the national income accounts.

[7]See, for example, James Heckman (1974).

Unemployment may also have an ambiguous effect on fertility rates. Unemployment results in lower transitory income, so that high rates of unemployed workers would lower birthrates if children are a normal good. However, unemployment is also likely to lower the opportunity cost of spending time in the production of children. The time effect would result in a higher birthrate. Because of its transitory nature, we predict that unemployment will primarily affect the timing of births rather than the number of ever-born children.

Birthrates also differ across cultures. Changing immigration rates in the United States may therefore account for a portion of the change in U.S. fertility over time.

A dummy variable equal to one during World War II (1941–45) accounts for the absence of young men during the war years, and a dummy variable equal to one for the years that the birth control pill has been widely available (1963–1984) is also included. Finally, we use several specifications of a time trend to capture any unobserved socioeconomic factors that might affect fertility and that have changed over time.

III. Estimation Results

Table 3 reports estimation results. Generalized least squares estimation is performed with a Yule-Walker first-order autocorrelation correction scheme. Six models are presented, including those with differing lag structures. Figure 2 compares the actual fertility rate with the rate predicted from model 4. In general, the fit is good. However, actual rates are slightly higher than predicted during the peak baby boom years and somewhat lower than predicted during the years of the Great Depression.

Of primary concern here is the impact of the real tax value of the personal exemption. The personal exemption has a positive and significant impact on birthrates in all specifications in Table 3. The results are robust to the specifications of different lag structures, models 1–4, to the exclusion of a time trend, model 5, and to the substitution of female education for female wages, model 6. The coefficients range in value from 0.121 to 0.236, and the estimated elasticities of fertility with respect to the personal exemption range from 0.127 to 0.248. These estimated elasticities are consistent with the wage elasticities of fertility estimated in our study and smaller than those reported in other time-series studies.[8] The largest values occur with a five-period inverted V lag structure. These results suggest that an increase in the tax value of the personal exemption of 50 dollars will increase the general fertility rate by 6 to 12 births per 1000 women at risk.

Perhaps surprisingly, the coefficient on real personal income per household is often negative, although not significantly different from zero. The negative sign on income is a fairly common result in cross-sectional tests.[9] With a few exceptions such as Marc Nerlove and T. Paul Schultz (1970), time-series studies have generally found a positive impact.[10]

Other variables generally have predicted signs. The coefficients on the infant mortality rate are positive, indicating that in the United States the replacement effect dominates the cost effect, but the coefficient is rarely statistically significant. The positive coefficient is consistent with the estimates by Schultz (1974) in Taiwan, Nerlove and Schultz (1970) in Puerto Rico, and Michael P. Shields and Ronald L. Tracy (1986) in the United States. Unemployment has a negative effect on childbirth, which suggests that the temporary income effect dominates the value of time effect of unemployment.

The performance of the measure of female wages is generally disappointing; the sign is usually negative, but the coefficient is often insignificantly different from zero. It might be argued that female wages and fertility are simultaneously determined, so that inclusion of a female wage creates endogeneity problems. We tested for endogeneity using the Jerry A. Hausman (1978) specification test. This test consisted of regressing the sus-

[8]Our wage elasticities range from 0.03 to 0.18. Butz and Ward (1979) report a wage elasticity of 0.751 to 1.846.

[9]See also Julian Simon, 1969.

[10]See, for example, Wachter (1975), Butz and Ward (1979), Shields and Tracy (1986).

TABLE 3—IMPACT OF THE PERSONAL EXEMPTION ON FERTILITY IN THE UNITED STATES, 1913–1984

Independent Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Personal Exemption	0.121**	0.191**	0.230**	0.157**	0.236**	0.211**
	(2.714)	(4.040)	(4.805)	(3.959)	(5.018)	(4.56)
Male & Asset Income	−0.0004	0.0004	−0.0004	−0.0019	−0.0005	0.001
	(0.147)	(0.141)	(0.174)	(0.760)	(0.258)	(0.644)
Unemployment	−73.430**	−36.862	−31.455	−30.328	−34.639	−16.828
	(2.147)	(1.108)	(0.998)	(1.000)	(1.112)	(0.526)
Infant Mortality	0.083	0.303	0.310	0.296	0.439**	0.180
	(0.325)	(1.263)	(1.284)	(1.300)	(2.470)	(0.750)
Immigration	774.24**	1529.20**	1372.87**	319.55	1433.43**	1181.48**
	(2.487)	(3.183)	(3.119)	(1.244)	(3.324)	(2.723)
Female Wage	5.647	−2.157	−8.712	−11.261	−13.804	–
	(0.360)	(0.153)	(0.661)	(0.867)	(1.200)	
Pill	−10.856*	−8.958	−6.922	−5.561	−7.854	−5.952
	(1.772)	(1.622)	(1.364)	(1.067)	(1.599)	(1.197)
WW II	−17.223**	−10.449**	−5.353	0.016	−4.997	−4.771
	(3.452)	(2.596)	(1.356)	(0.004)	(1.279)	(1.240)
Time Trend	−0.539	−0.389	−0.377	0.025	–	−0.471
	(1.002)	(0.785)	(0.803)	(0.051)		(1.171)
Female Education	–	–	–	–	–	−2196.46*
						(1.781)
Intercept	102.979**	79.961**	81.628**	93.978**	74.488**	93.270**
	(4.175)	(3.373)	(3.531)	(4.114)	(3.519)	(3.975)
R^2	0.916	0.931	0.941	0.943	0.940	0.944
Elasticity of Fertility with Respect to Exemption	0.127	0.201	0.242	0.165	0.248	0.221

Absolute value of t-statistic in parentheses.

Model 1:	No lags on independent variables.
Model 2:	Three-year rectangular lag on personal exemption; no lags on other independent variables.
Model 3:	Five-year inverted V on personal exemption; no lags on other independent variables.
Model 4:	Two-year lag on all independent variables except pill, World War II and time trend.
Model 5:	Five-year inverted V on personal exemption; no lags on other independent variables; no time trend.
Model 6:	Five-year inverted V on personal exemption; no lags on other independent variables, female education used as a proxy for female wage.

**: Significant at the 5 percent level.
*: Significant at the 10 percent level.

pected endogenous variable-female wages-on all exogenous variables in the fertility regression plus the variables education, race, and urban population. The actual value of the wage and the residual from this regression were then included in a fertility regression. Endogeneity is not a significant problem if the t-statistic on the residual is insignificant. Identification was achieved by including variables—education, race, and urban population—in the wage equation that are excluded from the fertility equation. The t-statistic on the wage residual was 0.555, which indicates that endogeneity is not a severe problem. As an additional test of the sensitivity of our results to the possibility of endogenous wages, Table 3 reports a reduced form fertility regression that uses female education as a proxy for female wages (model 6).

We examined a variety of other specifications, and the results are generally consistent with those presented in Table 3.[11] The results are robust to the inclusion of additional variables such as the racial distribution of

[11] These results are available upon request.

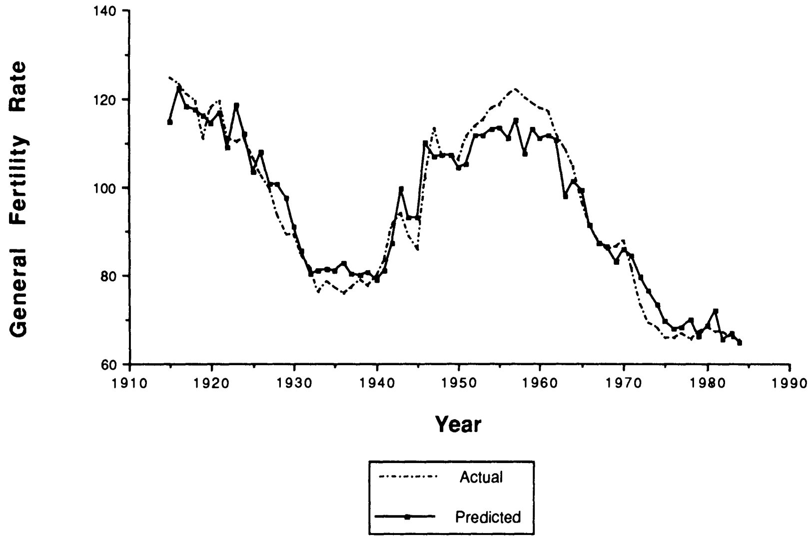

FIGURE 2. GENERAL FERTILITY RATE—ACTUAL AND PREDICTED

the population and the percent of urban population. These variables, however, did not contribute significantly to the explanatory power of the equations, and they were dropped from the analysis. The results are also robust to various lag structures for the independent variables and to the specification of various time trends, (for example, no time trend, a linear time trend, and a quadratic time trend). We also tested for structural differences in the estimates across different subperiods. Regressions done separately for periods 1913–48 and 1949–84 both yielded positive and significant coefficients on the tax value of the personal exemption. A Chow test on this split sample indicated that there was no structural difference in the full regression and the sub-regressions.[12] Because the largest variations in the tax value of the personal exemption occurred during a short period of time, 1940–49, the subperiod results are somewhat sensitive to the particular years included in each subperiod. On the whole, however, these results support the hypothesis that an increase in the tax value of the personal exemption leads to an increase in the demand for children.

IV. Implications for Public Policy

Our empirical results indicate that tax policy, at least in the form of the personal exemption, has an impact on aggregate family birth decisions. The policy ramifications for this particular tax feature are potentially important. Consider, for example, what our estimates imply about the impact of the Tax Reform Act (TRA) of 1986 on the birthrate. The TRA changes the tax value of the personal exemption in several ways. The statutory value of the personal exemption increases from $1,080 in 1986 to $2,000 in 1989 when fully phased in; thus the nominal value of the personal exemption virtually doubles. However, this increase is dampened because marginal tax rates are reduced for many taxpayers.[13] The overall impact will depend on whether the increasing nominal value of the personal exemption or the falling marginal tax rate dominates. Further, the personal exemption is fully applicable only to taxpayers with taxable incomes of amounts less than $149,250; the birth subsidy is not extended to the highest income households. Finally, a large number of

[12]The Chow test yielded on F-statistic of 0.420 with 8 and 56 degrees of freedom, which is less that the critical value of 1.69.

[13]Jerry A. Hausman and James Poterba (1987) calculate that 47.7 percent of taxpayers will have a marginal tax rate decrease of 0 to 10 percent, and 11.3 percent will have a decrease greater than 10 percent.

households will no longer be within the tax system under the new tax law. The zero bracket amount is increased substantially; thus the lowest income groups will be outside of the tax system.

Consider a married couple filing jointly with income of $16,000. Prior to TRA, this couple received a personal exemption per dependent of $1,080 and faced a marginal tax rate of 16 percent; the tax value of the personal exemption in 1986 dollars was therefore $173. In 1989, earning the same income, this couple now would receive a personal exemption per dependent of $2,000 and face a marginal tax rate of 15 percent. Assuming a 4 percent rate of inflation, the tax value of their personal exemption in 1986 dollars would now be $267, an increase of almost 55 percent. A family who faced a marginal tax rate of 49 percent on taxable income of $109,400 prior to TRA would experience a much smaller change in the tax value of the personal exemption. Formerly, this subsidy had a value to them of $529. Under TRA this subsidy is worth $533, an increase of less than 1 percent. The average increase in the tax value of the personal exemption is fifteen percent.

Overall, the estimates in this paper indicate that the TRA changes in the personal exemption may generate a significant increase in the birthrate. Using the most conservative coefficient estimate of the impact of the personal exemption on birthrates (0.121), the increased personal exemption when fully phased in will cause an increase of 7.53 births per thousand women at risk. This represents an 11 percent rise in the current birthrate. Middle income families will receive the largest birth incentive, while low and high income groups will experience a disincentive to births. Although the elasticity of births with respect to the personal exemption is small, statutory changes in the value of this subsidy have usually been relatively large. In particular, the changes due to TRA are longer than the changes during all but a few other years in our time-series. Thus our estimated fertility response is substantial.

Of course, there are other aspects of TRA that might mitigate the fertility effect of an increase in the personal exemption. For example, the lower marginal tax rates instituted by the law will increase the opportunity cost of spending time with children and may lower the demand for children. In addition, if TRA leads to an increase in after-tax income, and if the income elasticity for child quality is large, the demand for numbers of children may decline. In this paper we do not address these other factors and thus the total impact of TRA on fertility is likely to be smaller than the estimates that we present here. Because of the potentially large impact of this tax policy tool on fertility rates, empirical work using micro structures data or data from countries with different tax structures would be useful to provide additional evidence about the size of this impact.

APPENDIX 1

General Fertility Rate and the Personal Exemption for Dependents, 1913–1984

Year	Birthrate	Real Tax Value of PE
1913	124.7	0
1914	126.6	0
1915	125.0	0
1916	123.4	0
1917	121.0	19.27
1918	119.8	23.94
1919	111.2	20.07
1920	117.9	15.33
1921	119.8	34.32
1922	111.2	36.65
1923	110.5	25.83
1924	110.9	27.34
1925	106.6	22.85
1926	102.6	21.13
1927	99.8	24.61
1928	93.8	31.96
1929	89.2	27.29
1930	89.2	18.40
1931	84.6	14.91
1932	81.7	28.36
1933	76.3	31.95
1934	78.5	33.91
1935	77.2	36.98
1936	75.8	50.12
1937	77.1	42.79
1938	79.1	32.22
1939	77.6	36.53
1940	79.9	53.33
1941	83.4	102.49
1942	91.5	137.70
1943	94.3	141.20
1944	88.4	243.83
1945	85.9	238.40
1946	101.9	193.16

APPENDIX 1—Continued

Year	Birthrate	Real Tax Value of PE
1947	113.3	168.90
1948	107.3	149.79
1949	107.1	147.05
1950	106.2	163.10
1951	111.5	178.14
1952	113.9	189.43
1953	115.2	186.51
1954	118.1	165.46
1955	118.5	170.57
1956	121.2	171.00
1957	122.9	165.12
1958	120.2	158.66
1959	118.8	162.19
1960	118.0	158.28
1961	117.2	160.71
1962	112.2	161.58
1963	108.5	161.61
1964	105.0	142.73
1965	96.6	134.60
1966	91.3	133.94
1967	87.6	133.80
1968	85.7	145.10
1969	86.5	142.62
1970	87.9	130.58
1971	81.8	132.99
1972	73.4	144.85
1973	69.2	140.87
1974	68.4	130.49
1975	66.0	122.36
1976	65.8	120.08
1977	66.8	116.11
1978	65.5	118.98
1979	67.2	132.93
1980	68.4	123.17
1981	67.4	119.31
1982	67.3	102.04
1983	65.8	92.49
1984	65.4	83.90

APPENDIX 2

Average Female Real Wage, 1913–1984
(1967 = 1.00)

Year	Wage	Year	Wage
1913	0.461	1924	0.738
1914	0.458	1925	0.712
1915	0.467	1926	0.713
1916	0.492	1927	0.717
1917	0.503	1928	0.747
1918	0.554	1929	0.737
1919	0.547	1930	0.738
1920	0.627	1931	0.735
1921	0.657	1932	0.702
1922	0.681	1933	0.786
1923	0.720	1934	0.972

APPENDIX 2-Continued

Year	Wage	Year	Wage
1935	0.959	1960	1.776
1936	0.928	1961	1.739
1937	0.981	1962	1.777
1938	0.988	1963	1.812
1939	1.000	1964	1.855
1940	1.043	1965	1.903
1941	1.084	1966	1.859
1942	1.147	1967	1.918
1943	1.278	1968	1.979
1944	1.351	1969	2.063
1945	1.358	1970	2.064
1946	1.359	1971	2.057
1947	1.368	1972	1.094
1948	1.405	1973	2.061
1949	1.323	1974	2.034
1950	1.239	1975	2.103
1951	1.235	1976	2.170
1952	1.287	1977	2.187
1953	1.423	1978	2.277
1954	1.404	1979	2.206
1955	1.661	1980	2.136
1956	1.669	1981	2.106
1957	1.729	1982	2.173
1958	1.746	1983	2.216
1959	1.765	1984	2.240

Construction of Wage Series Years. 1914, 1920–1948: From Historical Statistics, Series D830–844, Average Hourly Earnings of Production Workers by Sex.

Years 1913, 1915–1919: Estimated based on average wage growth in production, from Series 802–810 and Series 765–778.

Years 1955–1982: O'Neill (1985) calculates a female/male wage ratio based on annual wage earnings and average hours worked by both sexes. This ratio is transformed into a female/average wage ratio, so that information on average production wages can be used to determine female production wages. Using the relationship:

$$\text{Female/Male} = (\text{Average/Male}) \times (\text{Female/Average})$$

the female/average ratio can be calculated from O'Neill's (1985) existing series on female/male wages and data on male wages and average wages found in Statistical Abstract, various years. This ratio is adjusted upward by 0.027, to account for the difference between O'Neill's ratio and the observed female/male wage ratio in production in 1939, a year in which both are available. Finally, the adjusted female/average ratio is multiplied by the average wage in manufacturing to arrive at a female wage rate.

Years 1949–1954, 1983–1984: Using median wage earnings, and adjusting for an approximate 9 percent hour differential between men and women, the ratio of female to male wages is calculated. This is transformed into a female/average ratio using the techniques described above. This ratio is multiplied by the average manufacturing wage.

We compared this series to a decennial series provided by Claudia Goldin. This series trends in the same way as Goldin's series.

REFERENCES

Aaron, Henry J. and Pechman, Joseph A., eds., *How Taxes Affect Economic Behavior*, Washington: The Brookings Institution, 1981.

Barro, Robert J. and Sahasakul, Chaipat, "Measuring the Average Marginal Tax Rate from the Individual Income Tax," *Journal of Business*, October 1983, *56*, 419–52.

______, "Average Marginal Tax Rates from Social Security and the Individual Income Tax," *Journal of Business*, October 1986, *59*, 555–66.

Becker, Gary, "An Economic Analysis of Fertility," in *Demographic and Economic Change in Developed Countries*, Princeton, NJ: Princeton University Press for the NBER, 1960.

______ **and Lewis, H. Gregg,** "On the Interaction Between the Quantity and Quality of Children," *Journal of Political Economy*, March/April 1973, *81*, S279–S288.

Butz, William P. and Ward, Michael P., "The Emergence of Countercyclical U.S. Fertility," *American Economic Review* June 1979, *69*, 318–28.

Cain, Glen G., "Fertility Behavior," in *The New Jersey Income Maintenance Experiment*, Vol. III, Harold W. Watts and Albert Rees, eds., New York: Academic Press, 1977, 225–50.

Calhoun, Charles A. and Espenshade, Thomas J., "Childbearing and Wives' Foregone Earnings," *Population Studies*, *42*, March 1988, 5–37.

Davis, Kingley, Bernstam, Mikhail S. Ricardo-Campbell, Rita, eds., *Below-Replacement Fertility in Industrial Societies*, Cambridge: Cambridge University Press, 1986.

Ellwood, David T. and Bane, Mary Jo, "The Impact of AFDC on Family Structure and Living Arrangements," in *Research in Labor Economics*, Vol. 7, Ronald G. Ehrenberg, ed. Greenwich: JAI Press, 1985, 137–207.

Espenshade, Thomas and Minarik, Joseph J., "Demographic Implications of the 1986 U.S. Tax Reform," *Population and Development Review* March 1987, *13*, 115–27.

Gillis, Malcolm, Perkins, Dwight H., Roemer, Michael and Snodgrass, Donald R., *Economics of Development*, New York: W. W. Norton & Co., 1983.

Gronau, Reuben, "The Intrafamily Allocation of Time: The Value of the Housewife's Time," *American Economic Review*, September 1973, *63*, 634–51.

Hausman, Jerry A., "Specification Tests in Econometrics," *Econometrica*, November 1978, *46*, 1251–71.

______ **and Poterba, James,** "Household Behavior and the Tax Reform Act of 1986," *Journal of Economic Perspectives*, Summer 1987, *1*, 110–19.

Heckman, James, "Shadow Prices, Market Wages, and Labor Supply," *Econometrica*, July 1974, *42*, 679–94.

Heeren, Henk J., "Pronatalist Population Policies in Some Western European Countries," *Population Research and Policy Review*, 1982, *1*, 137–52.

Legge, Jr., Jerome S. and Alford, John R., "Can Government Regulate Fertility? An Assessment of Pronatalist Policy in Eastern Europe," *Western Political Quarterly*, December 1986, *39*, 709–28.

Leibowitz, Arleen, "Education and the Allocation of Women's Time," in *Education, Income and Human Behavior*, F. Thomas Juster, ed., New York: McGraw-Hill, 1975, 171–97.

Lindert, Peter H., *Fertility and Scarcity in America*, Princeton, NJ: Princeton University Press, 1978.

Nerlove, Marc and T. Paul, Schultz, *Love and Life Between the Census: A Model of Family Decision Making in Puerto Rico, 1950–1960*. Santa Monica: Rand Corporation, RM-6322-AID. September 1970.

O'Neill, June, "The Trend in the Male-Female Wage Gap in the United States," *Journal of Labor Economics*, January 1985 Supplement, *3*, S91–S116.

Pechman, Joseph, *Federal Tax Policy*, Washington: The Brookings Institution, 1983.

Schultz, T. Paul, "A Preliminary Survey of Economic Analyses of Fertility," *American Economic Review*, May 1973, *63*, 71–87.

______, "Birth Rate Changes over Space and Time: A Study of Taiwan," in *Economics of the Family*, Theodore W. Schultz, ed. Chicago: University of Chicago Press, 1974, 255–91.

______, *Economics of Population*, Reading, MA: Addison Wesley, 1981.

Shields, Michael P. and Tracy, Ronald L., "Four Themes in Fertility Research," *Southern Economic Journal*, July 1986, *53*, 201–16.

Simon, Julian, "The Effect of Income on Fertility," *Population Studies*, November 1969, *23*, 327–41.

Teitelbaum, Michael S. and Winter, Jay M., *The Fear of Population Decline*, Orlando, FL: Academic Press, 1985.

Wachter, Michael, "A Time Series Fertility Equation: The Potential for a Baby-Boom in the 1980's," *International Economic Review*, October 1975, *61*, 609–24.

Williams, Robert G., *Development of Guidelines for Child Support Orders: Final Report*, U.S. Department of Health and Human Services, Office of Child Support Enforcement, March 1987.