THE EFFECT OF GOVERNMENT TAX POLICIES ON FERTILITY RATES OF EDUCATED WOMEN

A Thesis submitted to the Faculty of the Graduate School of Arts and Sciences of Georgetown University in partial fulfillment of the requirements for the degree of Master of Public Policy in the Georgetown Public Policy Institute

By

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ABSTRACT

Since the 1990s, various tax reforms have introduced and expanded childrearing-related tax credits, especially the Taxpayer Relief Act of 1997, the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA) and the Jobs Growth and Tax Relief Reconciliation Act of 2003 (JGTRRA). While the Child Tax Credit has helped households and families to shoulder the burden of childrearing, whether these childrearing-related tax credit expansions have influenced the fertility decision of women, particularly those with higher education, is the central question in this study. While some research shows a positive and significant effect of “tax subsidies” on the fertility rates of women in general, whether these “tax subsidies” have a positive effect on highly educated women is not yet clear. This study examines how different groups of women with different opportunity costs of childrearing respond to the tax benefit packages aimed at reducing the cost of childrearing. This study uses Panel Study of Income Dynamics (PSID) longitudinal data to test women’s probability of having children based on the
amount of the Child Tax Credit using a logit, fixed effects model, and focuses particularly on how educated women perceive and respond to tax credits. It finds that the Child Tax Credit has a positive and statistically significant effect on the probability of women’s having an additional child, and the effect of child credit on fertility does not depend on the level of women’s educational attainment.
DEDICATION

I wish to express my heartfelt gratitude to Dr. Jon Schwabish for his constant direction and valuable advice. I also thank Professor Jeffrey Mayer for his wise counsel and encouragements, and the GPPI faculty, staff, and students for making the two years at the Georgetown Public Policy Institute a rewarding experience. Above all, I wish to express my deepest gratitude to my parents for their never ending trust and support for me.
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Chapter 1. Introduction

Population decline is no longer an issue limited to Europe and North America. Newly industrialized countries such as Taiwan, South Korea and Singapore are also seeing fertility rates decline below replacement rates. These countries are particularly concerned because the declines in fertility and subsequent labor force declines could negatively affect their future productivity and economic growth. For example, in Japan and Korea, the change in age structure is expected to have a significant slowing effect on economic growth (Bloom and Williamson 1998). Moreover, Bloom and Finlay (2008) argue that further declines in the fertility rates will lead to declines in the working-age share of national populations and pose new challenges for the Asian region if these countries want to maintain positive economic growth rates. Moreover, as the change in age structure has led to the increases in the old-age dependency ratio, the aging nations’ social security systems have encountered a critical issue of sustainability. The number of people who are dependent on the system is growing faster than the number of people who are contributing to it. The U.S. Social Security System is being challenged by the aging of the baby-boom generation and increasing longevity. The U.S. Congressional Budget Office (CBO) projects that the cost of Social Security benefits will rise from 4.2 percent of Gross Domestic Product in 2005

1 South Korea, which has the lowest fertility rate in the world, has slightly less than 1.1 births per woman, and Singapore has 1.2 births per woman. See Choe (2008), Gubhaju and Yoshiki-Durand (2003) for more discussion on Asian countries’ declining fertility.
to 6.4 percent in 2050. The United States boasts higher fertility rates than most other
developed countries. While the rate of 2.06 births per woman is much higher than the
birth rates of Europe, where women average about 1.4 births, it is expected to further
decline to below the replacement level, which is 2.1 births per woman. The U.S.
Census Bureau projects that the rate will fall from 2.06 from 2010 to 2.03 for all and
1.89 for non-Hispanic Americans in 2050.

Unlike other rapidly aging countries that have adopted extensive tools to raise
fertility, the U.S. government has not yet begun to actively offer benefits to
childbearing couples to encourage fertility. However, since the 1990s, the government
has adopted several childrearing-related tax subsidies to help parents relieve the burden
of raising children. For example, the Child Tax Credit that was created as a part of the
Taxpayer Relief Act of 1997 and effective for 1998, allowed taxpayers to receive a
fixed amount of credit and reduce their tax liabilities. Because the credit is partially
refundable, it provides families with additional funds to help raise children. The
Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA) further
increased the amount of the credit, and the Jobs Growth and Tax Relief Reconciliation

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2 See former CBO director Douglas Holtz-Eakin’s statement on February 2005 for more
discussion on cost of Social Security benefit projection.
<http://www.cbo.gov/doc.cfm?index=6068&type=0>

3 See U.S. Census Bureau report on “United States Population Projections by Age, Sex, Race,
and Hispanic Origin: July 1, 2000-2050”(2008) for more discussion on US population projections.

While the primary purpose of these credits is to help parents reduce the cost of childrearing, previous research has concluded that these tax subsidies can also encourage fertility. Whittington, Alm and Peters (WAP, 1990) found that even though the U.S. government did not explicitly aim to raise fertility through tax exemptions, the personal tax exemption has a positive and significant effect on fertility. WAP concluded that, to a degree, government can influence the fertility decisions of citizens through deliberate changes in tax policies. In addition, several others have also found a positive and significant relationship between the tax subsidies and fertility (WAP, 1990).

During the past several decades, however, the American demographic factors have changed dramatically, and women’s educational attainment has increased. Previous research, including the study done by WAP (1990), has found a strong negative correlation between women’s educational attainment and fertility. Martin (1999) points out that the educated women are likely to have fewer children than those who do not because they tend to spend their early adult years completing their educations and establishing work careers instead of starting families. He argues that birth rates can decline as increasing number of women delay childbearing in their early
childbearing years (1999). Furthermore, the negative correlation between higher educational attainment and fertility is because a large number of educated women seeking to get established in the labor force put off marriage and childbearing. According to a study done by Rindfuss, Morgan, and Offutt (1996) using Current Population Survey from 1963 to 1989, women with college degrees experienced dramatic shifts towards later ages of childbearing. They argue that the trend is due to the increased opportunity for these women to pursue careers. In other words, marriage and fertility can operate as constraints to women’s active labor force participation. Increased opportunity cost of childrearing is also another concern for women in the labor force.

Whether these tax benefits adopted by the governments that suffer from below the replacement rate fertility can encourage couples to give more children in the present decade is yet to be examined. Since the government subsidies might have helped to reduce the direct cost of childbearing by relieving the burden of taxation, but these childrearing-related tax credits might not be large enough to offset the women’s’ opportunity cost of childbearing. It is worth noting how the fertility behaviors of the educated and working women respond to implicit and explicit government tax policies as, in the 21st century, the world sees a growing number of women receive higher education and enter in labor markets.
This study tests the effect of government subsidies on the fertility rates of the educated women by examining how women with more than a college-level education responded to increase in the Child Tax Credit during the period 1999 to 2005.
Chapter 2. Background on Declining Fertility

While researchers acknowledge that there is no single, widely accepted determinant of fertility at the general level of population, it is possible to pin down several major factors causing declining fertility. Preston and Hartnett (2008) argue that in the 21st century, parents are increasingly concerned about childbearing aimed at self-fulfillment rather than childbearing aimed at social expectations. They argue that while the desire to satisfy social expectations has not disappeared, people began to perceive less social pressure to bear children, and increasingly, people justified childbearing in terms of its impact on their personal well-being, satisfaction, and happiness. The authors further argue that while most mothers are “very satisfied” and feel “overwhelming love” for their children, the rewards and costs of childbearing are not fully appreciated until one has a child.

Another reason some authors give for declining fertility is the changing social norms and declining importance of marriage as a social institution. Martin (1990) argues that a shift from normative to individualistic and experiential motives for childrearing leads to delayed marriage, delayed childbearing, and increased labor force participation. He argues that women accustomed to having her time of her own have little incentive to bear children. Preston and Hartnett (2008) argue that greater economic opportunities for women and vastly improved means of contraception have
given women more power in their lives and in their relationships. Furthermore, they argue that marriage became less essential as a precondition for sexual expression and the rise in divorce has encouraged women to invest in their education and careers (2008).

Changing social norms, increasing career opportunities and easier access to education have all contributed to an increase in women’s educational attainment. A plenty of data exists to prove a dramatic increase in women's education levels in recent decades. According to U.S. Census Bureau, about 33 percent of women 25 to 29 had a bachelor’s degree or more in 2007, compared with 29 percent in 1998. According to the same data, 26 percent of men in the same age group had a bachelor’s degree or more in 2007, and 26 percent in 1998. The OECD (Organization for Economic Co-operation and Development) provides data on the women’s entry rate to tertiary education of its member countries, and it can easily be confirmed that the trend is global in scope. In most countries, women’s entry rate to tertiary education has exceeded that of men (See Figure 1), and it is worth comparing how the women’s high entry rate to tertiary education is closely related to the high median age of the country. It is interesting to compare countries that have high median age with those that have lower median age: Countries such as Australia, New Zealand, Sweden and Finland

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4 See U.S. Census Bureau Facts for Features, 2000 and U.S. Census Bureau News “One-Third of Young Women have Bachelor’s Degrees” (2008), for more discussion on trend in women’s educational attainment
show higher female-to-male entry ratios to tertiary (i.e., college) education and high median age, whereas countries such as Turkey and Mexico have lower women’s entry rates to tertiary education and lower median ages.
Figure 1 - Female and Male Entry Rate to Tertiary Education and Median Age in OECD Countries, 2006

Source: OECD Education at a Glance, 2006
UN, World Population Prospects: The 2008 Revision Population Database
Research suggests that an increase in the number of women receiving higher education is another major determinant for declining fertility. Along with Martin (1999), Cleland (2002), the director of Centre for Population Studies discusses in his paper that the length of schooling is associated with the start of reproductive life, and women with higher education tend to have lower births. Data also show the strong and negative relationship between women’s educational attainment and fertility. According to the U.S. Department of Health and Human Services, the Monthly Vital Statistics Report on “Birth and Fertility Rates by Educational Attainment: United States, 1994”, fertility rates are negatively correlated with women’s educational attainment (See Figure 2).
In 1994, women with 0-8 years of education had the highest overall fertility, and they tended to give birth earlier in life compared to women with higher education. In addition, the data indicate that among women aged 25 years and older, women with less education have much higher fertility than women who have attended school longer. Another noticeable feature of the figure is that college-educated women tend to have low rates of first births in their twenties and higher rates in their thirties. This reflects delayed childrearing among educated women.
Figure 3 reports the first birth probabilities for women aged 20 to 44 years. That figure shows that women with less than 11 years of education tend to have their first births in their early 20s, whereas women with higher educational attainment delay their first births until their 30s.

The noticeable negative correlation between women’s educational attainment and fertility can be related to women’s increasing role in the labor market. A relationship consistently documented is increasing labor force participation of women...
in the United States. Changes in women’s social expectations and norms along with increases in demand for women’s labor in recent decades, have also contributed to the rise in women’s labor force participation (Preston and Hartnett, 2008). Preston and Hartnett add that the rise of service industries in which productivity is not associated with physical strength has also contributed to the increase.

**Figure 4 - Labor Force Participation Rates of Women by Age, 1950 and 1998**

According to data published by Bureau of Labor Statistics, labor force participation rates have generally increased across different groups of women, except for the age group 65 and over (Figure 4). The biggest increase has been among those
aged 25 and 34. The rate for this group more than doubled from 34.0 percent to 76.3 percent. Women aged 35 and 44 also saw a large increase from 39.1 percent to 77.1 percent. This increase in women’s labor force participation is even more striking when compared to the decreasing trend of male labor force participation in recent decades (See figure 5).

**Figure 5 - Labor Force Participation of Men and Women (1950-2010)**

The increasing trend of women’s labor force participation is consistent with the increasing educational attainment of women in the labor force. A recent data by Bureau of Labor Statistics reflects the trend. The Current Population Survey indicates that while workers with less than a higher school education and high school diploma
had a rapid drop since 1970, female workers with more than college education had a steep increase (See Figure 6).

**Figure 6 - Percent Distribution of Civilian Labor Force 25-64 Yrs of Age by Educational Attainment, Women: 1970-2005 Annual Average**


In general, with the increase in women’s educational attainment and labor force participation, fertility tends to drop. Researchers agree that fertility operates as a constraint on women’s active labor force participation, and consequently women with higher education and established career goals tend to have lower fertility rates (Ward and Weiss, 1982). Because they have well-paid jobs, they may perceive the opportunity cost of marriage and having children as very high.
Chapter 3. Literature Review

Recently, a number of studies have examined whether tax instruments have had any effect on national fertility rates. As most developed economies rapidly age, governments have used various tools to encourage population growth. Since 1965, in particular there has been a steady stream of government efforts to adopt measures to reverse the trend of declining fertility (Teitelbaum and Winter, 1985). For example, Eastern European countries have pronatalist policies such as lump-sum birth payments and child tax credits as early as the 1960s, and countries such as France, West Germany, the former Soviet Union, Canada, and Singapore have since implemented explicit policies to raise fertility rates. Countries such as Australia and Korea have implemented one-time birth payments, and others such as Canada and Singapore have adopted tax policies to influence fertility rates (Teitelbaum and Winter, 1985: Chamie, 2004).

In 1990, using Panel Study of Income Dynamics (PSID) data, Whittington, Alm, and Peters (hereafter WAP) estimated a national aggregate fertility equation for the United States from 1913 to 1984. WAP modeled fertility as a function of various economic and demographic factors and then tested whether the tax value of the personal exemption affected parents’ decisions to have a child. WAP argued that government tax policies can be regarded as subsidies to families to help reduce the cost
of childrearing. They concluded that the personal exemption for dependents have had a positive and significant effect on the national birthrate. Researchers from outside of the U.S. also found a positive and significant effect of tax policies on fertility. Buttner and Lutz (1990), for example, found a positive relationship between government tax policies and fertility in the German Democratic Republic. In addition, as Canada recently have experienced birth rates that fell well below the population replacement rate, the government began to subsidize its citizens’ childrearing by adopting extensive benefit packages such the child tax credit and family allowances to reduce the cost of childrearing-related activities. To examine the effectiveness of such policies, Zhang, Quan and van Meerbeegen (1994) examined whether Canadian parents who received the tax benefits have changed their fertility behaviors. As a consequence, they also found significant and positive effects of the exemption, the child tax credit and family allowance on fertility in Canada from 1921 to 1988.

Despite the strong positive and significant correlation derived by numerous researchers, whether the tax policies can successfully reduce the cost of childrearing activities in the future needs to be further examined. As researchers acknowledge, childrearing activities not only involve the direct cost but also the indirect cost of childrearing, i.e., the opportunity cost. In the past, when women’s dominant role was to stay home and bear and rear children, women’s opportunity cost of childrearing was
almost zero since opportunity cost is perceived as the lost wage from leaving a job to bear and raise children. However, as it was discussed earlier, in recent years, greater portion of women receive higher levels of education and participate actively in labor markets. As a result, it is crucial that researchers take into account women’s opportunity cost of childrearing when examining whether the tax benefits can sufficiently reduce the cost of childrearing activities. Therefore, researchers should try to estimate the relationship between tax policies and aggregate fertility by distinguishing groups of women depending on their potential opportunity cost of childrearing.

Most previous research has neglected to take into account women’s opportunity cost of childrearing. Both WAP and ZQM generated cost functions of childrearing in the aggregate. While admitting that the cost of a childrearing depends upon the cost of both time and the goods and services used in childbearing, WAP referred to the cost functions derived by Williams (1987) who took into account only the costs of goods and services used in childrearing while neglecting the costs of time. In this scenario, WAP assumed that the opportunity costs of mothers in raising children are equal regardless of their educational attainment and employment status. ZQM also treated mothers’ opportunity costs of child-rearing equally across individuals.
Admittedly, it is difficult to calculate the opportunity cost, and it is even more
difficult to generate the value for everyone in the sample population. However, as the
cost of childrearing is one of the major determinants in fertility, it is important to
consider women’s opportunity cost of childrearing when calculating the cost of inputs
used in childrearing. Parents forego economic opportunities when bearing and rearing
children, and women particularly forego income when they stay home to bear and rear
children instead of participating in work (Calhoun and Espenshade, 1988).
Determining how much time a woman loses from paid employment because of the
presence of children and a monetary value to the time that is lost is a complex task, and
researchers have used various tools to estimate women’s foregone earnings. However,
even without using these complex measures to estimate women’s opportunity costs, it
is fairly clear that career women have higher opportunity costs of rearing children than
housewives. Women with well-paying jobs have to forgo the earnings if they choose
to stay home to bear and raise children. That is to say, women with higher education
and committed careers have cost functions of childrearing that differ from those with
less education. Therefore, when estimating national fertility rates conditional on the
government tax policy, it is useful to distinguish women with different cost functions
of childrearing according to their education level and opportunity cost.
Chapter 4. Policy Relevance

As the national fertility rate constantly declines, the government is pressured to use effective tools to reverse the trend of declining fertility. In the past decade, the government has introduced various tax benefits to relieve the taxpayers’ burden of childrearing. One of the major tax benefits given to parents with dependents is the Child Tax Credit. Since when the Child Tax Credit was introduced as part of the Tax Relief Act in 1997, several changes were made to it during the past decade. In 1997, the credit was set at $400 per child and phased-out at a rate of $50 per $1,000 for couples with incomes above $110,000. The credit was increased to $500 in 1999 (for tax year 1998). In addition, the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA), enacted in the early 2000s, helped couples with children to temporarily lower individual income taxes by restructuring tax rates and increasing credits. EGTRRA raised the child credit from $500 to $600 in 2001, $700 in 2003 with a schedule to increase to $1,000 by 2010 for each child under 17 years old. The credit phases out rate remained same at a rate of $50 per $1,000 for couples with incomes above $110,000. The Jobs and Growth Tax Relief Reconciliation Act (JGTRRA) of 2003 accelerated the effects of the EGTRRA, and increased to $1,000 for tax years 2003 and 2004. By examining the fertility behavior of married women, it is possible to test the effect of such expansion on fertility. If the Child Tax Credit has a positive and
significant effect on all groups of women, the credit can be used as a tool to promote fertility. On the other hand, if the credit does not have a positive and significant effect on female groups that cause the largest decline in the national fertility, then the government should seek for more effective tools.
Chapter 5. Model

This study examines the probability that a married couple has an additional child given the level of female education and the availability of the Child Tax Credit. The present study uses panel data for married women, beginning before the Child Tax Credit was introduced and following the same women over the period when the credit was introduced and expanded, and tracking changes in the number of children per family. A regression model is used to calculate the probability that each family has an additional child conditional on the level of female education and the amount of the Child Tax Credit. I hypothesize that controlling for other demographic characteristics, educated women respond differently than less educated women to benefits from tax credits because of the different opportunity costs of having a child.

The study uses logit, fixed effects regression model to analyze the longitudinal data with repeated measures for independent variables on the binary dependent variable. The fixed effects model controls for both observed and unobserved individual characteristics that could influence the dependent variable. The binary dependent variable measures the probability of a married woman having an additional child between the periods of study.
To examine whether women of different education levels respond differently to the tax credit, the study compares the model with the interaction of the child tax credit and the education variables and the one without the interaction terms. The study examines whether the coefficient estimates of the Child Tax Credit and the interaction of the credit and education variables have a statistically significant effect on women’s probability of having children.
Chapter 6. Data

The data used in the study are from the 1999 to 2005 Panel Study of Income Dynamics (PSID). Because the PSID collects and reports data every two years, this study uses 4 years of data from 1999 to 2005, i.e. 1999, 2001, 2003, and 2005. The PSID is a longitudinal study with a representative sample of over 7,000 family units. The PSID has followed the same families since 1968 and collected data on economics, health, and social behavior.

The dependent variable is the probability that a married woman has an additional child. Based on the initial number of children for each family unit in 1999, any family that had an increase in the number children is assigned a value of 1, and those without any increases in the number of children are assigned a value of 0. Separate education variables for women with less than high school (less than 12 years), some college education (between 12 and 14 years), and more than college education (more than 14 years) are included in the model to separately examine the effect of the level educational attainment on fertility. To examine whether women of different educational levels respond differently to tax incentives, the interaction of the Child Tax Credit and the education variables is also added to the model. Since the study mainly focuses on the response to the expansion of the Child Tax Credit of females who have
more than a college-level education, the model tests whether the interaction of the child tax credit and education variables are statistically different from zero.

The study assumes the PSID reported total family income as the family adjusted gross income, and subtracted the standard deduction for each member of the family from the AGI, and added the relevant amount of the Child Tax Credit to derive taxable income. Then, the study calculates the tax liability by multiplying the taxable income brackets by the marginal tax rate. The income variable measures male income, non-wage and property income, and a separate variable for female wage/salary is added to the model to control for the effect of income on fertility. The PSID data include income information for the previous year, so the data included in this study are for tax years 1998, 2001, 2003 and 2004.

Because the PSID does not ask respondents to report the childrearing-related credits, for the purpose of this study, the Child Tax Credit variable is derived based on the family income and number of children. The amount of the Child Tax Credit is fixed at $400, $500, $600, and $1,000 per child, for years 1998, 2000, 2002 and 2004 respectively, for tax payers’ total earnings below $110,000. For tax payers’ earnings in the phase-out region, i.e., between $110,000 and $118,000 for 1998, between $110,000 and $120,000 for 2000, between $110,000 and $122,000 for 2002, between $110,000 and $130,000 for 2004, amount at the phase-out rate is applied. All dollar values are
adjusted to 2008 dollars using the Consumer Price Index. Finally, to examine whether any annual variations affect the regression results, the two models are reported separately with and without the time dummy variables.

The resulting sample size, after pooling all 4 years’ data (1999, 2001, 2003 and 2005) is 6,349 observations, after taking the 1999 year data as the base year and set to missing, the sample size decreased to 3,170. Table 1 presents variable definitions and summary statistics for the variables in the models.
### Table 1– Variable Definitions and Summary Statistics

<table>
<thead>
<tr>
<th>Variable Definition</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Families with an increase in the number of children</td>
<td>10%</td>
<td>0.30</td>
</tr>
<tr>
<td>Real value of tax liability*</td>
<td>15.27</td>
<td>43.21</td>
</tr>
<tr>
<td>Real tax value of child tax credit*</td>
<td>0.73</td>
<td>0.79</td>
</tr>
<tr>
<td>Total family income minus wife wage/salary*</td>
<td>62.38</td>
<td>123.40</td>
</tr>
<tr>
<td>Total wife wage/salary*</td>
<td>29.01</td>
<td>41.99</td>
</tr>
<tr>
<td>Years of Educational Attainment</td>
<td>13.84</td>
<td>2.35</td>
</tr>
<tr>
<td>% Women with less than high school education (&lt; 12 years)</td>
<td>7%</td>
<td>0.26</td>
</tr>
<tr>
<td>% Women with college education (12-14)</td>
<td>52%</td>
<td>0.50</td>
</tr>
<tr>
<td>% College graduates (&gt;14)</td>
<td>40%</td>
<td>0.49</td>
</tr>
<tr>
<td>Dummy variable equal to one for year 2001</td>
<td>0.33</td>
<td>0.47</td>
</tr>
<tr>
<td>Dummy variable equal to one for year 2003</td>
<td>0.33</td>
<td>0.47</td>
</tr>
<tr>
<td>Dummy variable equal to one for year 2005</td>
<td>0.33</td>
<td>0.47</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>3,170</td>
<td></td>
</tr>
</tbody>
</table>

*Note: unit is in thousands of dollars

Approximately 10 percent of the sample had an increase in their number of children from the base year 1999 to 2005. The average child tax credit is about $730, and the average tax liability for the sample is about $15,270 (in 2008 dollars).
Approximately 7 percent of the sample received less than high school education, and more than half of the sample had some college education. About 40 percent of the sample had higher educational attainment – more than 14 year of schooling.
Chapter 7. Analysis

The logit fixed effects regression model found that the Child Tax Credit has a positive and statistically significant effect on fertility. Table 2 reports the regression results. The finding is consistent with previous research, i.e. WAP’s findings of a positive and significant effect of personal exemption on fertility, ZQM’s findings of a positive and significant effect of Personal Exemption, Family Allowance, and the Child Tax Credit.
Table 2 – Impact of the Child Tax Credit on Fertility in the United States, 1999-2005

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax Liability</td>
<td>0.179***</td>
<td>-0.26***</td>
<td>0.177***</td>
<td>-0.265***</td>
</tr>
<tr>
<td></td>
<td>(0.048)</td>
<td>(0.086)</td>
<td>(0.048)</td>
<td>(0.087)</td>
</tr>
<tr>
<td>Child Tax Credit</td>
<td>0.43***</td>
<td>1.63***</td>
<td>0.396</td>
<td>2.014***</td>
</tr>
<tr>
<td></td>
<td>(0.146)</td>
<td>(0.27)</td>
<td>(0.493)</td>
<td>(0.774)</td>
</tr>
<tr>
<td>Male Income</td>
<td>-0.041</td>
<td>0.089***</td>
<td>-0.041***</td>
<td>0.091***</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.024)</td>
<td>(0.012)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>Female Income</td>
<td>-0.052**</td>
<td>0.08***</td>
<td>-0.052***</td>
<td>0.081***</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.024)</td>
<td>(0.013)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>Education 2</td>
<td>0.048</td>
<td>0.582</td>
<td>-0.011</td>
<td>0.882</td>
</tr>
<tr>
<td></td>
<td>(0.865)</td>
<td>(0.958)</td>
<td>(0.957)</td>
<td>(1.132)</td>
</tr>
<tr>
<td>Education 3</td>
<td>0.885</td>
<td>1.299</td>
<td>0.902</td>
<td>1.618</td>
</tr>
<tr>
<td></td>
<td>(0.93)</td>
<td>(0.994)</td>
<td>(1.07)</td>
<td>(1.171)</td>
</tr>
<tr>
<td>Yr2003</td>
<td>-</td>
<td>-1.987***</td>
<td>-</td>
<td>-2.001***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.349)</td>
<td></td>
<td>(0.3504)</td>
</tr>
<tr>
<td>Yr2005</td>
<td>-</td>
<td>-4.217***</td>
<td>-</td>
<td>-4.234***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.607)</td>
<td></td>
<td>(0.609)</td>
</tr>
<tr>
<td>Educ2*ctaxcrdt</td>
<td>-</td>
<td>-0.076</td>
<td>0.076</td>
<td>-0.403</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.516)</td>
<td>(0.76)</td>
</tr>
<tr>
<td>Educ3*ctaxcrdt</td>
<td>-</td>
<td>-0.033</td>
<td>-0.033</td>
<td>-0.399</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.532)</td>
<td>(0.767)</td>
</tr>
<tr>
<td>Log</td>
<td>-204.2</td>
<td>-168.35</td>
<td>-204.11</td>
<td>-168.11</td>
</tr>
<tr>
<td>Number of Observations</td>
<td></td>
<td></td>
<td></td>
<td>590</td>
</tr>
</tbody>
</table>

Notes: ***p<0.01, **p<0.05, *p<0.10
Standard errors in parentheses

The Child Tax Credit appears to positively affect the fertility decision of married women. Only in the model with interaction terms and no time dummies, the child tax credit variable showed no statistical significance at the conventional
significance level. However, when the time dummies were added back to the model, the child tax credit variable went up to its significance level. The categorical education variables did not show the expected result. Contrary to WAP’s result, which showed a negative and statistical significance of the education variable, the categorical education variables were not statistically significant.

The interaction terms between education levels and the child tax credit do not appear to have any statistically significant result. In other words, the null hypothesis that the effect of the Child Tax Credit on the probability of having an additional is different for high levels of educational attainment of women is different than it is for lower levels of education, is not accepted at any conventional significance level. The hypothesis that the “effect of the Child Tax Credit on the probability of an additional child depends on the level of women’s educational attainment” could not be proven with the regression model.

The results were also similar when the logit, fixed effects model was run separately for women with different levels of educational attainment (Table 3). The child tax credit variable has a positive and significant effect on fertility regardless of the education level. The logit, fixed effects model failed to run for the lowest education categorical group of women because the group had not enough within group variation.
In conclusion, this model failed to prove the hypothesis that the effect of the Child Tax Credit for the highly educated women has no significant effect.

### Table 3 – Impact of the Child Tax Credit on Fertility by Women’s Level of Educational Attainment in the United States, 1999-2005

<table>
<thead>
<tr>
<th>Variables</th>
<th>Education 12-14 yrs</th>
<th>Education &gt;14 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td></td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Tax</td>
<td>0.173*** (0.047)</td>
<td>-0.257*** (0.085)</td>
</tr>
<tr>
<td></td>
<td>0.173*** (0.066)</td>
<td>-0.319** (0.14)</td>
</tr>
<tr>
<td>Child Tax Credit</td>
<td>0.415*** (0.145)</td>
<td>1.61*** (0.268)</td>
</tr>
<tr>
<td></td>
<td>0.173*** (0.245)</td>
<td>-0.319** (0.419)</td>
</tr>
<tr>
<td>Male Income</td>
<td>-0.0398*** (0.0115)</td>
<td>0.088*** (0.023)</td>
</tr>
<tr>
<td></td>
<td>-0.045*** (0.016)</td>
<td>0.102*** (0.039)</td>
</tr>
<tr>
<td>Female Wage</td>
<td>-0.049*** (0.013)</td>
<td>0.079*** (0.024)</td>
</tr>
<tr>
<td></td>
<td>-0.049*** (0.018)</td>
<td>0.100** (0.04)</td>
</tr>
<tr>
<td></td>
<td>-1.932*** (0.341)</td>
<td>-2.211*** (0.586)</td>
</tr>
<tr>
<td>Yr2003</td>
<td>-</td>
<td>-1.932***</td>
</tr>
<tr>
<td></td>
<td>(0.341)</td>
<td>(0.586)</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-4.363***</td>
</tr>
<tr>
<td></td>
<td>(0.595)</td>
<td>(0.994)</td>
</tr>
<tr>
<td>Log Likelihood Value</td>
<td>-204.82</td>
<td>-169.27</td>
</tr>
<tr>
<td></td>
<td>-92.66</td>
<td>-80.05</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>590</td>
<td>269</td>
</tr>
</tbody>
</table>

Notes: ***p<0.01, **p<0.05, *p<0.10
Standard errors in parentheses
There exist several potential factors that could have biased the results. First, the Child Tax Credit variable is derived based on the PSID reported total family income. A gap might exist between the reported value of family income, and the actual family earnings used to receive the credit, and the gap could have distorted the results especially if the individual income is in the phase-out range. Second, there exist more childrearing-related tax benefits that this study does not take into account. For example, EGTRRA also expanded the Child and Dependent Care Tax Credit (CDCTC), and as mentioned earlier, increased the EITC phase-out point. Neglecting these changes could bias the results toward zero. Finally, the study assumes the values of children are equal. In other words, the study assumes a constant marginal value of an additional child. This could bias the result since the value of first child could be different from the value of the second, the third, and etc. Futures studies can improve the precision of the result by using a larger data set that includes more individuals for the longer period of time.
Chapter 8. Conclusion

The study failed to prove the hypothesis that fertility behavior of the highly educated women does not depend of the government tax policies, namely the Child Tax Credit. The effect of the Child Tax Credit is not different for high levels of women’s educational attainment than it is for the lower levels of women’s educational attainment. The result might be due largely to the size of the opportunity cost of the educated women compared to that of the less educated women. One explanation is that the opportunity cost of the educated women is not large enough to deter them from leaving work to bear and rear children. The result could also be interpreted as that the amount of the Child Tax Credit is large enough compared with their opportunity cost of leaving work to encourage women from leaving work to bear and rear children. Finally, this result could also reflect the Americans’ well-operated day care system, high quality and cost-effective public education system, and the reliable legal system that ensure companies to provide equal opportunities to women. Therefore, whether the study result can hold in other countries remain to be seen in future studies.
References


Leibowitz, Arleen. "Education and the Allocation of Women's Time."


