Taxes and Female Labor Supply[1]

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Abstract

The Economic Recovery Act of 1981 and the Tax Reform Act of 1986 changed the U.S. income tax structure in a dramatic fashion. In particular, these two reforms reduced the marginal tax rates for married households. In this paper I investigate what part of the rise in labor force participation of married women between 1980 to 1990 (a rise of 13 percentage points) can be accounted by the changes in taxes. I build an heterogeneous agent model populated by married households. Households differ by age and educational attainment levels of their members and decide whether the second earner, the wife, should participate in the labor market. I select parameter values so that the model economy is consistent with the 1980 U.S. economy in terms of income tax structure, wages (skill premium and gender gap), marital sorting (who is married with whom), and female labor force participation. Using counterfactual experiments I find that 20-24% of the rise in married female labor force participation is accounted for by the changes in the income tax structure. Changes in wages account for 62-64%, and changes in marital sorting account for 14-16% of the rise in the participation rate of married women.

1 Introduction

The U.S. income tax structure has changed dramatically during the 1980s. This change was result of two landmark legislations, the Economic Recovery Tax Act of 1981 (ERTA) and the Tax Reform Act of 1986 (TRA). These reforms lowered marginal statutory tax rates significantly and reduced the number of tax brackets from 16 to 4. Figure 1 shows marginal statutory income tax schedules for married households filing jointly before and after each tax reform. Although these changes affected all tax payers, high income earners realized the largest benefits from these reforms. The top marginal tax rate declined from 70 to 31 percent whereas marginal tax rate that a married household with mean income faces dropped from 37 to 28 percent.

A critical aspect of these tax reforms is their effect on labor supply behavior. Possibly the most important recent change in the U.S. labor markets is the drastic rise in labor force participation of married women. In the second half of the twentieth century the participation rate of married women has more than tripled. In particular, between 1980 and 1990 the participation rate of married women between ages 20 and 59 has increased from 57.2 to 70.2 percent. During the same period weekly market hours per working married women has increased from about 32 hours per week to 36 hours as well.[1]

A reduction in income tax rate affects labor supply behavior in two ways. First, it increases the rewards of supplying additional hours for workers.

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[1] As reported by Jones, McGrattan, and Manuelli (2003), the bulk of the rise in female labor supply during the second half of 20th century is due to married females. Therefore, the paper focuses only on the labor supply of married individuals.

This may or may not increase the labor supply depending on whether the substitution or the income effect dominates. The second effect is on participation margin. For people who are out of the labor force, benefit of participating in the labor market increases with lower taxes. A well-known feature of the U.S. tax system is that primary and secondary earners in a married household are not treated equally. The marginal tax rate that the second earner faces for the first dollar of her/his earnings is the rate that the primary earner faces for the last dollar of his/her earnings. As a result, a large reduction in the marginal tax rates can create significant participation incentives for secondary earners if she/he is not in the labor force.[2] Since the majority of secondary earners are married women, about 96 percent were even in 1990, ERTA and TRA were likely to play an important role in the rise in the participation rate.

During the 1980s, along with these tax reforms, there were also other changes in the U.S. economy that possibly have affected the labor force participation rate of married women. First, the educational composition of married population has changed. During this period the fraction of college graduate females has increased, while the fraction of females with less than a high school degree has declined. In addition, the degree of marital sorting has increased. Second, there were changes in the wage structure. Gender gap has declined as the hourly earnings of married females have improved relative to hourly earnings of married men. This increased the opportunity

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[2]For a review of incentive effects of the U.S. tax structure for married women, see McCaffery (1997).

cost of staying at home for married women. Furthermore, college premium has increased for all workers.[3]

In this paper I evaluate the contribution of the decline in the income tax rates, the changes in earnings, and the changes in the educational composition of married population to 13 percentage point increase in the labor force participation of married women between 1980 and 1990. To do this, I first document how earnings (by education, gender and age), and educational composition of households have changed in this decade. Then, I estimate effective tax functions for 1980 and 1990. I use the income tax data from Internal Revenue Service to estimate a smooth effective tax function which relates actual tax payments to household income. Next, I build a static heterogeneous agent model populated by married households, in which households differ by age and educational attainment levels of their members. A household belongs to one of four age groups (20-29, 30-39, 40-49, or 50-59), and one of three education groups (less than high school, high school degree, or college degree or more). While the model consists of households with different ages, it abstracts from life-cycle dynamics. A household makes labor supply decisions for its members. Following Cho and Rogerson (1988), I assume that if the husband and the wife both participate in the labor market, the household incurs a fixed utility cost. I select parameter values so that the model economy is consistent with the 1980 U.S. economy in terms of income tax structure, wages (skill premium and gender gap), marital sorting (who is married with whom), and female labor force participation. Then, I

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[3]See Section 2 for an overview of changes in the earnings structure and educational attainment of population.

ask the following question: *If the households of the 1980 were taxed at 1990 rates, how much higher the participation rate of wives would be?*

The simulations suggest a substantial amount: 20 to 24 percent of the increase in labor force participation of married women is due to the decline in the income tax rates. The changes in wage profiles account for 62 to 64 percent, while the changes in the educational composition of households account for 14 to 16 percent of the rise in the participation rate. Furthermore, the decline in taxes account for about 27 percent of the rise in weekly hours per working married women, while the rest is accounted for by changes in the earnings structure.

Although the focus of the current analysis is to evaluate the contribution of the tax reforms to the rise in the participation rate between 1980 and 1990, the current framework can also be used to investigate the role of taxes in the rise in the participation rate in 1970s and 1990s. The participation rate was 43.5 percent in 1970, and became 70.4 percent in 2000. Even though the calibrated model successfully explains the rise in the participation rate after 1980, it fails to explain the rise in the participation rate from 1970 to 1980 (from 43.5 percent to 57.2 percent), and hence to any future decade.[4] After 1990, there was a considerable slow down in the rise of the participation rate. It rose only by 0.2 percentage points during 1990s. I find that the rise in

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[4]Factors such as technological progress in home production (as argued in Greenwood, Seshadri, and Yorukoglu (2005)), growing presence of a new type of man, one brought up in a family in which the mother worked, (as argued in Fernández, Fogli, and Olivetti (2004)), cultural change arising from women's updating their beliefs about their long-run payoffs from work via an intergenerational learning process (as argued in Fernández (2007)) were possibly more critical for the participation decision of women during this period.

taxes after the Omnibus Budget Reconciliation Act of 1993 was indeed a significant factor for this slow down.

Related Literature

The impact of 1980s tax reforms on individual labor supply behavior is analyzed by a number of empirical papers. Burtless (1991) and Bosworth and Burtless (1992) investigate the labor supply effects of tax reforms in 1980's. They analyze the trend in labor supply for different demographic groups, from 1968 to 1988 and from 1968 to 1990, respectively, and find a significant break in labor supply trend of married women starting in 1981. They argue that this was a result of the Economic Recovery Act of 1981. Eissa (1995) studies the impact of Tax Reform Act of 1986 on labor supply responsiveness of married women. She shows that the labor supply of high-income married women increased as a result of this reform.[5] Moreover her results suggest that more than half of the responsiveness of the labor supply was on the participation margin. In a recent paper, Eissa, Kleven and Kreiner (2008) study labor supply and the welfare effects of more recent tax reforms, which include the introduction of Earned Income Tax Credit (EITC), on single mothers. Although the emphasis of their study is different, their results also show that distinguishing between intensive and extensive margins is critical and there is a large participation response by single mothers.

The current paper is also related to several recent literatures. First, it is related to recent papers that look at the role of taxes in accounting for cross-country differences in labor supply behavior, e.g. Prescott (2004),

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[5]In particular, Eissa (1995) looks at the labor supply response of married women in richest 1% of married households.

Olovsson (2008), and Davis and Henrekson (2005), and Rogerson (2006).[6] Second, it is related to several papers that build general equilibrium models of fiscal policy. Using a general equilibrium framework, Ventura (1999) explores quantitative implications of a revenue neutral tax reform in which the current income and capital income tax structure in the U.S. is replaced by a flat tax. Finally, Altig and Carlstrom (1999) analyze the effects of 1986 tax reforms on income distribution. Both Ventura (1999) and Altig and Carlstrom (1999) use life-cycle frameworks with heterogenous, but single person, households.[7] Finally, it is related to papers that analyze aggregate implications of the participation (extensive) margin. Cho and Rogerson (1988), Cho and Cooley (1994), Mulligan (2001) and Chang and Kim (2006), among others, are examples of the papers in this group. Kleven and Kreiner (2007) study optimal taxation of two-person households when households face an explicit labor force participation decision.

The rest of the paper is organized as follows. Section 2 reports some of the crucial changes in the female labor force participation, wages, and

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[6]There is also a large literature that tries to explain the long run changes in the labor supply behavior of married women. See, among others, Greenwood, Seshadri, and Yorukoglu (2005), Fernández, Fogli, and Olivetti (2004), Jones, Manuelli, and McGrattan (2003), Fernández (2007), and Attanasio, Low and Sanchez-Marcos (2008). Greenwood and Guner (2008) study joint evolution of marriage and divorce together with rising market hours for married households.

[7]Among other recent paper that study tax reforms within dynamic heterogenous agent models with single-earner households, see Altig et al (2001), Conesa and Kruger (2006) and Diaz-Gimenez and Pijoan-Mas (2006). Chade and Ventura (2002) study differential tax treatment of single and married agents, the so-called marriage tax penalty, within an equilibrium model of marriage and divorce.

the distribution of individuals by educational attainments that took place between 1980 and 1990. Section 3 documents the changes in the U.S. income tax structure that took place in the same period. Section 4 describes the economic environment. Section 5 reports the calibration results and describes the features of the benchmark economy. Section 6 explores the contributions of different factors to the change in the labor force participation of married females. Section 7 evaluates the contribution of changes in taxes to the rise in labor force participation rate of married women in 1970s and 1990s. Section 8 concludes.

2 Changes in Married Female Labor Force Participation

In this section I document some of the crucial changes in the female labor force participation, wages, and the educational attainment distribution of married households that took place between 1980 and 1990. All the statistics that I report here are based on the Current Population Survey (CPS) or Census data as tabulated by IPUMS (Integrated Public Use Microdata Series). Since the main focus of this study is the labor supply behavior of married females, I restrict the analysis to married individuals. Moreover, in order to analyze individuals who are potentially in the labor force I consider those who are 20 to 59 years old. I divide the population into three educational categories: less than high school (denoted as $<hs$), high school (hs), and college (col). The first category consists of people who have less than a high school degree, the second category consists of people who have a high

school degree or some college education, and the final category consists of people who have a college degree or a higher educational attainment. Based on these three categories I construct nine household types by the educational attainments of the husbands and the wives.

The labor force participation of married females in each of these nine household types is shown in Table 1 (Census data). Cells in this table report participation rates for different household types, e.g., the participation rate of females in households in which both the husband and the wife have less than a high school degree, i.e. ($<hs,<hs$) cell, is 45 percent. As expected, given their husbands' education, females' labor force participation is increasing in their own education. The participation rates have increased for all groups between 1980 and 1990. Overall, in this period the average labor force participation rate of married women increased by 13 percentage points (from 57.2 percent to 70.2 percent).

Table 1: Female Labor Force Participation by Education (%)

	1980				1990		
		Female's				Female's	
Male's		Education		Male's		Education	
Education	$<$hs	hs	col	Education	$<$hs	hs	col
$<$hs	45	60	76	$<$hs	51	69	84
hs	47	59	75	hs	53	72	86
col	45	54	66	col	53	66	76

Table 2 reports the labor force participation rates of married women by age groups in 1980 and 1990. To this end, I first divide married households

between ages 20 and 59 into 4 broad age groups, 20-29, 30-39, 40-49, and 50-59. A household belongs to a particular age group if both husband and wife are in the same age bracket.[8] The table shows that the participation rates have significantly increased for married women from all age groups. For the youngest group there has been a 10.2 percentage point increase, whereas for the oldest group there has been a 12.2 percentage increase.

Table 2: Female Labor Force Participation by Age (%)

Age	1980	1990
20-29	61.1	71.3
30-39	57.3	70.6
40-49	60.6	75.1
50-59	49	61.2

During the same period, average working hours per married working men did not change much, whereas hours per married working women increased. CPS data shows that the average hours per married working men is 49 hours per week in 1980, and 49.8 hours per week in 1990. On the other hand, the average hours per married working women is 32.4 hours per week in 1980, and 36 hours per week in 1990.[9]

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[8]This restriction follows from the modeling decision discussed in Section 4. The number of marriages excluded due to this restriction is about 30.7 percent of the unrestricted sample in 1980.

[9]To find the average working hours per worker, I first find the mean annual working hours for the group that I consider. Then I multiply this number by 112/5000 and find the average weekly hours per worker. For females and males mean annual working hours per worker are 1445 and 2189, respectively. These numbers are very close to ones reported

Next, I construct age-earning profiles using CPS data. I find average hourly wages for husbands and wives in each age group described above . Average hourly wage is calculated as annual salary and wage income divided by total hours worked last year.[10] To make the wages comparable between 1980 and 1990, I normalize the earning profiles by the mean wage rates of the samples in each period ($6.92 in 1980 and $12.15 in 1990).

Tables 3 and 4 show wage profiles for 1980 and 1990, while Table 5 summarizes the percentage changes in average hourly wages from 1980 to 1990.[11] These tables show how the gender gap, and the college premium for men and women changed during this period. For almost all education-age cells, the wages of married women either increased more or declined less than the wages of married men. As a result, the gender gap declined significantly during this period.[12] Meanwhile, the college premium for both genders increased. Interestingly, the premium for men increased more than the one for women. This fact together with the decline of gender gap might look

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by Blau and Kahn (2007).

[10] Average hourly wage is calculated as $\frac{\text{Annual Salary\&Wage Income}}{(\text{\# of weeks worked})(\text{ \# of usual hours worked in a week})}$. I follow Katz and Murphy (1992) for the sample selection. I consider only the full-time workers, exclude people who earn less than the half of the minimum weekly wage, and exclude the people who are self-employed or unpaid workers. The minimum hourly wage rate in 1980 was $3.10, $3.80 in 1990 and $5.15 in 2000. I find the minimum weekly wage by multiplying these numbers by 40 hours.

[11] Findings in Table 3 and 4 are consistent with Gottschalk (1997).

[12] Olivetti (2006) also documents a large increase in returns to experience for married women during this period. Her results show that higher returns to experience was a critical determinant of rising market hours of married women during recent decades. Since I focus on a static accounting exercise here, I abstract from human capital accumulation aspect of female labor supply behavior.

puzzling. However, a closer inspection of Table 5 shows that on average the wages of high school graduate men declined, whereas the wages of high school graduate women increased, which attenuated the increase in college premium for women. Finally, Table 5 shows that the young and unskilled people experienced the largest decline in the wages.[13]

From 1980 to 1990 the educational composition of the population has also changed. Table 6 shows the distributions of married households according to the educational attainments of their members in 1980 and 1990. The statistics shown are compiled from Census data. The fraction of the married households with both members having at least a high school degree increased from 69.52 percent to 82.06 percent. This increase is mostly due to the rise in the percentage of college graduates. The share of female high school graduates slightly increased; it was 64.93 percent in 1980 and 66.93 percent in 1990. On the other hand the share of male high school graduates increased from 54.79 percent to 59.69 percent. In contrast, the proportion of the women with a college degree has increased from 14.80 percent to 21.89 percent.

Using the data on distributions and wages one can find gender gap values

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[13]The analysis here takes a human capital approach to productivity and associates different productivity levels with completed schooling categories. An alternative approach would be to associate different skills with percentiles of schooling distributions, separately for each gender. This would be in line with a signalling approach. When we repeat the current analysis with three skill groups corresponding to bottom, middle and top part of schooling distribution for each gender, the results were similar. It would be interesting, however, to repeat the same analysis with finer divisions of schooling distributions, since with three broad categories both approaches result in similar wage statistics.

Table 3: Age-Earnings Profiles, 1980

	Male			Female		
Age	<hs	hs	col	<hs	hs	col
20-29	0.83	1.01	1.08	0.62	0.65	0.83
30-39	0.98	1.29	1.54	0.56	0.72	1.03
40-49	1.08	1.43	1.79	0.60	0.73	0.96
50-59	1.12	1.38	1.94	0.59	0.76	1.11

Table 4: Age-Earning Profiles, 1990

	Male			Female		
Age	<hs	hs	col	<hs	hs	col
20-29	0.62	0.81	1.12	0.45	0.59	0.90
30-39	0.75	1.07	1.51	0.51	0.72	1.11
40-49	0.91	1.27	1.76	0.63	0.78	1.19
50-59	0.89	1.26	1.84	0.54	0.77	1.20

Table 5: Percentage Change in Earning Levels from 1980 to 1990

	Male			Female		
Age	<hs	hs	col	<hs	hs	col
20-29	-25.6	-19.9	4.2	-27.2	-8.7	7.9
30-39	-23.4	-16.5	-2.4	-8.2	-1.1	7.8
40-49	-16.4	-11.1	-2.0	4.0	6.8	23.9
50-59	-20.3	-8.4	-5.2	-9.6	1.2	7.8

for females according to their education. In 1980 the gender gap values for

Table 6: Distribution of Married Households by Educational Attainment (%)

| | 1980 | | | | | 1990 | | | |
| | Female | | | | | Female | | | |
Male	<hs	hs	col	Total:	Male	<hs	hs	col	Total:
<hs	12.13	9.86	0.34	22.33	<hs	5.96	6.47	0.29	12.72
hs	7.59	43.53	3.66	54.79	hs	4.91	48.44	6.33	59.69
col.	0.55	11.54	10.79	22.89	col.	0.30	12.02	15.27	27.59
Total:	20.27	64.93	14.80	100	Total:	11.18	66.93	21.89	100

females with less than high school education, high school graduate females, and college graduate females are 0.537, 0.579 and 0.693, respectively.[14] Using 1980 distribution and 1990 wages, I find these gender gap values as 0.589, 0.669, and 0.816, respectively.[15] A critical fact from these observations is gender gap improved more in favor of more educated women.

This analysis provides the following critical facts for the current study. From 1980 to 1990, (i) female labor force participation of married women increased by 13 percentage points, from 57.2 percent to 70.2 percent; (ii) gender gap declined and skill premium increased, (iii) the proportion of the married households with both members having at least a high school degree increased.

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[14]Gender gap is calculated as the ratio of females' hourly wage and males' hourly wage.

[15]By using the distribution of 1980 I control for the changes in the marital sorting between 1980 and 1990. Hence, the gender gap values reported above are only due to the changes in relative wages of males and females.

3 Changes in the U.S. Tax Structure.

Both the Economic Recovery Act of 1981 and the Tax Reform Act of 1986
changed the U.S. income tax structure significantly. The 1986 reform was
particularly significant in generating a much flatter tax schedule. The basic
federal schedules that apply to married couples filing jointly for the years 1985
and 1990 are shown in Figure 1.[16],[17] While the reduction in the marginal tax
rates is clear from Figure 1, the statutory taxes does not reflect the effective
taxes that people pay. In this section I document changes in the effective tax
rates that took place in the 1980s. The analysis is based on the tax data
from publications of Statistics of Income Division of IRS. I first document
the average tax rates by different income groups. I then use this data to
construct tax functions for married couples for 1980, 1985 and 1990.

Since the data is tabulated by income brackets, I am only able to calculate
the average tax rate faced by an agent who earns the average income in a
given income bracket. The data provides us with the following information
for each income bracket: 1) the total amount of adjusted gross income, 2)
the total amount of income tax paid, 3) the number returns, and 4) the total
number of taxable returns.[18] Given this information, I follow Gouveia and

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[16]Data Source: Internal Revenue Service, Statistic of Income Division, Individual In-
come Tax Returns (Publication: 1304).

[17]In the paper I only consider married households who file their taxes jointly. The
reason is that the tax code is designed to discourage married individuals to file separately.
Married people who file separately face tax brackets with a width equal to one half the
width applied to those who file jointly (both in 1980 and 1990). Consequently, filing
individually when married entails a tax penalty. For instance, about 95 percent of the
married filers in 1992 filed taxes as jointly (General Accounting Office (1996)).

[18]The adjusted gross income is equal to taxable income plus the itemized deductions or

Strauss (1994) and calculate average income levels and average taxes paid for each income bracket, and find the *effective* average tax rate for income bracket i as:[19]

$$average\ tax\ rate_i = \frac{\left\{\frac{total\ amount\ of\ income\ tax\ paid}{number\ of\ taxable\ returns}\right\}_i}{\left\{\frac{total\ adjusted\ gross\ income}{number\ of\ returns}\right\}_i}. \tag{1}$$

Finally, to be able to compare the tax functions across years, I have to come up with a measure of income that can be compared across years as well. Therefore, I divide the income levels by mean married household income for each year.[20] Figure 2 shows the average tax rates calculated according to Equation (1).

Next, I fit the following equation to the data points,

$$\frac{\tau(I_i)}{I_i} = \eta_1 + \eta_2 \log(I_i) + \varepsilon_i, \tag{2}$$

where I_i is the normalized average income in the income bracket i, and $\frac{\tau(I_i)}{I_i}$ is the average tax rate paid in the income bracket i.

Table 7 shows the estimates for the years that I consider, and the resulting tax functions are shown in Figure 3. This figure indicates that there were

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standard deduction (which ever is bigger). For a tax payer the adjusted income might be very different than total income. For example alimony payments are not counted in the adjusted gross income, whereas they are counted in the total income. See Form 1040 U.S. Individual Income Tax Return for a list of all excluded income types.

[19]All the variables in Equation (1) are available for married couples for 1985 and 1990. For 1980, *number of taxable returns* is not available, so I assume that *the number of taxable returns* is equal to *the number of returns*.

[20]I get the mean married household income data from Census Bureau. Mean married household income was \$26171 in 1980, \$36350 in 1985, and \$47649 in 1990. Source: http://www.census.gov/hhes/income/histinc/inchhdet.html

Table 7: Tax Functions, Coefficients

Year	η_1	η_2	R^2
1990	0.1096	0.0592	0.98
	(0.004)	(0.003)	
1985	0.1214	0.0732	0.98
	(0.002)	(0.002)	
1980	0.1345	0.0971	0.99
	(0.004)	(0.003)	

Note: The terms in the parentheses are standard errors

significant reductions in the average tax rates between 1980 and 1990 for all types of taxpayers who earn more than mean married household income. Another statistic I am interested in is marginal tax rate. This statistic is important for various reasons. Most importantly, it directly affects the marginal benefit of supplying another unit of labor, therefore plays a critical role in the labor supply decision of an agent. Given the average tax function, I compute this statistic as,

$$\frac{\delta(\tau(I_i))}{\delta I_i} = (\eta_1 + \eta_2) + \eta_2 \log(I_i). \tag{3}$$

In Table 8 I report the average tax rates, the marginal tax rates, and the change in marginal tax rates for selected multiples of mean married household income. The first two panels of this table show the average and the marginal tax rates, and the last one shows the changes in the marginal tax rates. As it is evident in Panel C, the change in the marginal tax rates for high income earners is more than the lower ones from 1980 to 1990. More importantly there is a significant reduction in the marginal tax rates for all income levels

over the same period. Even for the people who earned half of the mean married household income, the marginal tax rates dropped by 22 percent.[21]

Although income taxes constitute the most significant part of total tax bill for many households, payroll taxes are not negligible. Furthermore, payroll tax schedule has also changed from 1980 to 1990. Therefore, in the current analysis I also consider payroll taxes to arrive at a more complete picture of total taxes on labor earnings. Workers have to pay payroll taxes proportional to their labor earnings up to a limit earning level (earning cap). Beyond that level, they don't have to pay payroll tax for their additional earnings. In 1980 workers were taxed at 6.13% up to 186 percent of mean labor income ($13918). By 1990, the tax rate was increased to 7.65% and the cap was increased to 197 percent of mean labor income ($26022).[22]

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[21]The effective tax rates might not capture the full cost of taxation if high taxes encourage households to incur costs to shelter their income from taxes. Between 1980 and 1990 the fraction of households that claimed standard reduction was roughly constant, 42 and 45% respectively. The fraction of households who itemized any contributions also remained constant at around 12%. Hence, although the current analysis does not capture the cost of tax sheltering, there does not seems to be much change in such activities between 1980 and 1990.

[22]Source for social security tax rates: http://www.ssa.gov/OACT/ProgData/taxRates.html. Source for nominal income cap values: http://www.ssa.gov/OACT/COLA/cbb.html. Mean labor income is from the author's calculations from CPS data.

Table 8: Tax Statistics (%)

Panel A

	Average Tax Rate		
Income	1980	1985	1990
0.5	7	7	7
1	13	12	11
2	20	17	15
3	24	20	17
5	29	24	20
10	36	29	25

Panel B

	Marginal Tax Rate		
Income	1980	1985	1990
0.5	16	14	13
1	23	19	17
2	30	25	21
3	34	28	23
5	39	31	26
10	46	36	31

Panel C

	% Change in The Marginal Tax Rate		
Income	80->85	85->90	80->90
0.5	-12	-11	-22
1	-16	18 -13	-27
2	-18	-14	-30
3	-19	-15	-31
5	-19	-15	-32
10	-20	-16	-33

4   The Economic Environment

Consider an economy populated with a continuum of married households of mass 1. Married households differ by age and labor market productivity (education) of their members.

Each member of the household is characterized by a given productivity level. Let $x(k, j)$ and $z(i, j)$ denote the age$-j$ labor productivity of a female of skill level k and a male of skill level i, respectively. I assume that $z(i, j)$ and $x(k, j)$ take a finite number of possible values in the sets Z and X, respectively. Suppose there are J different age groups and N different education groups in the economy, so that there are JN elements in sets X and Z. I assume that a husband and a wife have the same age. As a result, at any point in time, there are JN^2 different types of couples (by age and productivity of members) in the economy.

Agents value consumption, c, and dislike labor, h. Utility function of a household is sum of its members' utility functions, and is given by

$$u(c) + \nu(h^m) + u(c) + \nu(h^f) - \mu(h^m, h^f)q,$$

where h^m and h^f denote labor supply of the husband and the wife, respectively. When both members of a household supply labor, i.e. $\mu(h^m, h^f) = 1$, I assume that the household incurs a fixed utility cost $q \geq 0$. The households know their utility costs before making any decisions. The utility cost, as in Cho and Rogerson (1988), is meant to capture a utility loss due to joint work of two household members, originating from, for example, inconvenience for scheduling joint work, home production and leisure activities or spending less

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family time with children.[23] I assume q is randomly distributed according to a cumulative distribution function F.

Consider a j year old household with a type i male and a type k female. In this world, every individual is endowed with 1 unit of labor. When the male and the female works h^m and h^f hours, respectively, total earnings of the couple will be $I = z(i,j)h^m + x(k,j)h^f$. The households pay income tax and payroll tax. The tax function, $\tau(.)$, determines the income tax payment. The payroll tax payment is given by the function $\tau_p(.)$. Unlike the income tax, the payroll tax depends on the individual earnings of the members. I assume that tax revenue is simply wasted.

Each period households solve a static problem and decide on male's labor supply, h^m, female's labor supply, h^f, and on consumption, c. To simplify the analysis, I further assume that the husband is the primary earner.[24] The problem of a married household is then summarized as

$$\max\left\{\max_{\{c,h^m,h^f\}}\{2u(c)+\nu(h^m)+\nu(h^f)-\mu(h^m,h^f)q\},\max_{\{c,h^m\}}\{2u(c)+\nu(h^m)+\nu(0)\}\right\},$$

subject to

$$c = I - \tau(I) - \tau_p(z(i,j)h^m) - \tau_p(x(k,j)h^f)$$

where

$$I = z(i,j)h^m + x(k,j)h^f$$

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[23]Cogan (1981) finds that fixed costs of work are significant in determining the labor supply behavior married women. In a recent paper, Erosa, Fuster and Restuccia (2005) use a similar approach to model labor participation decisions.

[24]In about 99.9 percent of the households in 1980 and in about 96 percent of them in 1990, the husband had a higher labor market efficiency than his wife. Hence, this assumption is quite innocuous.

$$0 \leq h^m \leq 1, \quad 0 \leq h^f \leq 1, \; and \; c \geq 0,$$

and

$$\mu(h^m, h^f) = \begin{cases} 1 & if \; h^m h^f > 0 \\ 0 & otherwise \end{cases}.$$

As a last object, I denote $\psi(i, k, j)$ as the mass of age j, type (i, k) households. Since I assume that the mass of households is 1, the following holds

$$\sum_{j=1}^{J} \sum_{i=1}^{N} \sum_{k=1}^{N} \psi(i, k, j) = 1$$

Note that it is very straightforward to calculate aggregate statistics for this economy as I take wages, taxes, and distribution of agents as given and focus on the key endogenous variables: labor force participation decisions and hours worked.

5 Benchmark Economy

I calibrate the model using 1980 U.S. economy. I assume the economy consists of households that belong to one of the following four age groups ($J = 4$): 20-29, 30-39, 40-49, and 50-59. In order to calibrate the sets Z and X, I use the 1980 wage profiles from Table 3 in Section 2. I assume that there are 3 productivity types in the model economy, i.e. $N = 3$, corresponding to three educational groups in Table 3, i.e. less than high school, high school, and college. For each educational group I simply set the values of x and z to their corresponding values in Table 3.

Next I pin down $\psi(i, k, j)$, the distribution of households by the type and

by the age of the household. Table 9 shows the distributions for 1980 and 1990. I use 1980 values in the calibration of the benchmark economy.

In the benchmark economy, I use the following effective income tax function for 1980 (see Table 7)

$$\tau(I) = (0.0971 * log(I) + 0.1345)I,$$

and the following payroll tax function for 1980

$$\tau_p(I_{labor}) = \min(I_{labor}, 1.8609\bar{I}_{labor})0.0613,$$

where I is household income, I_{labor} is the individual labor income and $\bar{I}_{labor}$ is the average individual labor income in the economy.[25]

Next, I specify per period utility functions as

$$u(c) + v(h^m) = \log(c) - B^m \frac{(h^m)^{1+\sigma}}{1+\sigma}$$

for males and as

$$u(c) + v(h^f) = \log(c) - B^f \frac{(h^f)^{1+\sigma}}{1+\sigma}$$

for females, where c is the consumption, h^m and h^f denote the labor supply of a male and a female, respectively. $\frac{1}{\sigma}$ corresponds to Frisch elasticity of labor supply. I set $\sigma = 2$ so that the elasticity, 0.5, is within the range of micro estimates.[26]

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[25]The income cap for 1980 is 1.8609 multiple of mean labor income of same year. I find the mean labor income using CPS data, and I follow the same restrictions that I impose when I construct earning profiles.

[26]See Blundell and MaCurdy (1999), and Domeij and Floden (2006) for estimates of the Frisch labor supply elasticity.

Table 9: Distribution of Households By Education, By Age

1980							

Age:		1			2		
		Female			Female		
Male	$<hs$	hs	col		$<hs$	hs	col
$<hs$	0.0201	0.0219	0.0005		0.0242	0.0236	0.0008
hs	0.0207	0.1448	0.0115		0.0196	0.1333	0.0133
col	0.0007	0.0235	0.0250		0.0015	0.0438	0.0486
		3			4		
		Female			Female		
Male	$<hs$	hs	col		$<hs$	hs	col
$<hs$	0.0296	0.0229	0.0008		0.0474	0.0302	0.0013
hs	0.0173	0.0844	0.0063		0.0183	0.0728	0.0054
col	0.0015	0.0262	0.0202		0.0018	0.0220	0.0142
							Total:1.00

1990							

Age:		1			2		
		Female			Female		
Male	$<hs$	hs	col		$<hs$	hs	col
$<hs$	0.0103	0.0123	0.0003		0.0145	0.0171	0.0008
hs	0.0096	0.1066	0.0109		0.0145	0.1757	0.0278
col	0.0003	0.0122	0.019		0.0007	0.0415	0.0604
		3			4		
		Female			Female		
Male	$<hs$	hs	col		$<hs$	hs	col
$<hs$	0.0152	0.0177	0.0008		0.0200	0.0198	0.0009
hs	0.0123	0.1267	0.0164		0.0132	0.0825	0.0074
col	0.0010	0.0400	0.0478		0.0008	0.0233	0.0195
							Total:1.00

Finally, I assume that utility cost parameter, q, is distributed according to a gamma distribution with parameters $\alpha_{i,j}$ and $\beta_{i,j}$. Recall that i refers to the productivity of husbands and j refers to the age of the household. Thus conditional on the husband's productivity type and the household's age

$$q \sim F(q|i,j) = \int_0^q u^{\alpha_{i,j}-1} \frac{\exp(-u/\beta_{i,j})}{\Gamma(\alpha_{i,j})\beta_{i,j}^{\alpha_{i,j}}} du$$

where $\Gamma(.)$ is the Gamma function. By proceeding in this way, I exploit the information contained in the changes in the labor force participation of married females as their own market productivity increases with education (for a given husband type). This allows me to control the slope of the distribution function for utility costs.[27]

This procedure leaves us with *26* parameters to be determined, B_m and B_f, and 24 utility cost parameters. I select B_m and B_f to match the average working hours of married men and women. In particular, when B_m is 17.8 and B_f is 22, married working men in the model economy works on average 49.1 hours per week, while the same number for married women is 31.7. In the data married men work 49 hours per week, and married women work 32.4 hours per week on average. I parameterize the utility cost parameters $\alpha_{i,j}$ and $\beta_{i,j}$ so that the model mimics the labor force participation rates of females married to j-year old males with productivity type i. Hence, after calibrating 24 utility cost parameters the benchmark economy is consistent with 36 observations on participation rates of married women. Table 10 shows the participation rates in the data and in the benchmark economy.

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[27]Conditioning the distribution on the age of the household allows me to capture changes in factors like children growing old and/or leaving the household.

Aggregate female labor force participation is 57.2 in the data and 57.5 in the benchmark model. Table 11 reports the parameter values of $\alpha_{i,j}$ and $\beta_{i,j}$.

Table 10: Female Labor Force Participation By Educational Attainment of Members, By Age

Age:	Male	Data Female <hs	hs	col	Benchmark Female <hs	hs	col
	<hs	40.8	59.4	74.2	41.8	57.6	98.9
1	hs	43.7	61.7	80	57.7	61.7	80
	col	44.2	63.8	78.8	60.6	63.8	78.8
	<hs	48.9	61.7	73.5	48.9	61.7	77.7
2	hs	49.9	58.6	72.1	48.9	58.5	71.4
	col	48.4	50.7	60.7	43.8	50.7	60.7
	<hs	49.8	64	81.4	49.8	64	81.6
3	hs	50.9	63.7	81	50.8	63.7	80.6
	col	50.1	56.2	67	48.8	56.2	67
	<hs	41.2	54.4	73.9	41.2	54.4	73.5
4	hs	41.1	51.7	66.9	40.9	51.5	67.6
	col	36.6	45.2	57.9	37.4	45.2	57.9

Table 11: Parameters of Utility Cost Distributions

Age:	1		2		3		4	
	α	β	α	β	α	β	α	β
<hs	50.361	0.011	1.219	0.441	2.403	0.18	1.381	0.409
hs	2.987	0.1412	0.705	0.675	1.806	0.164	0.896	0.577
col	1.928	0.197	0.478	1.307	0.71	0.446	0.621	0.795

6   From 1980 to 1990

Recall that the participation rate for married females increased from 57.2 percent in 1980 to 70.2 percent in 1990. In this section I investigate the possible factors that may contribute to this increase. In particular, I consider: 1) the changes in the tax structure, 2) the changes in the composition of the married population in terms of educational attainment, 3) the changes in the earning profiles of the people in the economy.

To this end, I first simulate the model using the taxes, the earning profiles, and the distribution of households from 1990. The results are reported in Table 12. In the simulated 1990 economy 68.6 percent of the females participate in the market, an 11.1 percentage point rise from the benchmark economy. Hence, the model is successful in generating the rise in married female labor force participation that is observed in the data. Furthermore, the model is able to generate the patterns we observe for hours per worker for males and females from 1980 to 1990. The model implies a 2.2 hours per week increase for working females whereas its counterpart in the data is 3.6 hours per week. Hours of working males do not change significantly in the

data, which is consistent with the implications of the model. Table 12 also reports participation rates of females with different characteristics according to the 1990 data and the 1990 simulation. Although not as powerful as the predictions of the aggregate statistics are, the predictions for different types of females are also successful. The model is able to capture the pattern of the participation rates by age and by education. As in the data, the participation rate declines between ages 1 and 2, and between ages 3 and 4, whereas it increases between ages 2 and 3. Both in the model and data, the participation rate rises with education.

To decompose the increase in the female labor force participation that the model generates, I consider four alternative economies. These alternative economies differ from the benchmark economy in the following particular ways. In the first economy the taxes are changed to 1990 values whereas the wage profiles and the household distribution are kept at their 1980 values. In the second alternative economy, taxes are at their 1980 values, however, now the wage profiles and the household distribution are changed to their 1990 values. Similarly, in the third economy only the taxes and the household distribution are changed to 1990 values. In the final alternative economy only the taxes and the wage profiles are changed to their 1990 values.

The results from the first set of simulations are reported in Table 13 (*1990 Taxes* column). These simulations suggest that if people of 1980 had been taxed at 1990 tax levels, the female labor force participation would have been 60.2 percent. Given the 11.1 percentage points increase that the model implies from 1980 to 1990, this change accounts for about 24 percent of the total change. There are positive responses to lower taxes on the

Table 12: Simulation Results, 1990 Economy

	1990 Data	1990 Simulation[†]
Aggregate LFP (%):	70.2	68.6
Working hours of men (hrs/week):	49.8	48.5
Working hours of women (hrs/week):	36	33.9
LFP by Age (%)		
1	71.3	74.9
2	70.6	65.4
3	75.1	76
4	61.2	57.5
LFP by Education of Wife (%)		
$<hs$	51.8	56.6
hs	70.7	68.4
col	79.2	76

† 1990 Simulation economy is the one with parameters of the benchmark economy and the wages

, taxes, and household distribution of 1990.

intensive margin, too. Average weekly hours worked would be 49.7 for men
and 32.3 for women, respectively. According to the model, from 1980 to
1990, working women increase their labor by 2.2 hours per week. Hence,
taxes alone account for almost 27 percent of this change.

Table 14 shows by how much changes in taxes, wages, and distribution

Table 13: Alternative Economies

	Benchmark	1990 Taxes[†]	1990 Wages & Distribution[††]	1990 Taxes & Distribution[†††]	1990 Taxes & Wages[††††]
Aggregate LFP (%):	57.5	60.2	66.4	61.7	67
Working hours of men[§]:	49.1	49.7	47.7	49.6	48.5
Working hours of women[§]:	31.7	32.3	33.3	32.2	33.9
LFP by Age (%)					
1	62.2	66.9	71.6	67.6	73.4
2	57.1	58.7	63.9	60	64.1
3	60.5	63.2	73.6	66.1	74.1
4	48.9	50.9	55.5	52.9	56
LFP by Education of Wife (%)					
<hs	47.3	51.4	53.1	51.5	55
hs	58.2	61	66.2	61.2	68.6
col	68.8	70.5	74.5	70.1	76

§The unit of measurement is hours per week.

† The benchmark economy with 1990 taxes.

†† The benchmark economy with 1990 wages and household distribution.

††† The benchmark economy with 1990 taxes and household distribution.

†††† The benchmark economy with 1990 taxes and wages

account for the changes in labor force participation rates. Combination of all the three factors account for 100 percent of the predicted changes by the model (*1990 Simulation*). The table shows that taxes account for 37 percent of the rise in labor force participation of youngest females and 23 percent of the rise for the oldest females. An interesting observation from Table 13 and Table 14 is that a greater fraction of less productive females respond to the changes in taxes. 44 percent of the rise in participation of

females with an education less than high school is due to the decline in taxes, whereas the same number for the college graduate females is 24 percent. One would expect a finding contrary to this one given that the decline in marginal tax rates are larger for higher income households. The declines in marginal tax rates for households with females with less than high school education, for households with high school graduate females, and for households with college graduate females are 6.2, 6.6, 7.4 percentage points, respectively.[28] Hence, there are no big differences in terms of decline in taxes that these households experience. Since the pool of females who are out of labor force are larger among less productive females, a larger fraction of them respond to the changes in taxes. The participation rates for females with less than high school education and for females with college education are 47.3 percent and 68.8 percent in the benchmark economy.

The second alternative economy is same as the benchmark economy except the wage profiles and the household distribution. A comparison of this alternative economy and the benchmark economy tells us how much the changes in wages and the changes in distribution account for the rise in the participation rate. This will allow us to treat the unaccounted part as being accounted for by the changes in taxes. *1990 Wages & Distribution* column of Table 13 reports the statistics from the second alternative economy. The aggregate participation rate is 66.4 percent. Hence, the changes in wage profiles and the household distribution together account for about 80 percent of the rise in the participation rate (see Table 14). This finding gives us a lower bound on the role of taxes in the rise of the participation rate. Accordingly,

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[28]These tax statistics are for households with two earners and are average values.

I conclude that the changes in taxes from 1980 to 1990 account for no less than 20 percent and no more than 24 percent of the rise in the participation rate.

Table 14: Decomposition of Changes in Female Labor Force Participation, 1980 to 1990

	1990 Simulation[†]	1990 Taxes[††]	1990 Wages & Distribution[†††]	1990 Taxes & Distribution[††††]	1990 Taxes &Wages[†††††]
Aggregate LFP (%):	100	24	80	38	86
LFP by Age (%)					
1	100	37	74	43	88
2	100	19	82	35	84
3	100	17	85	36	88
4	100	23	77	47	83
LFP by Education of Wife (%)					
$<hs$	100	44	62	45	83
hs	100	27	78	29	102
col	100	24	79	18	100

† 1990 Simulation economy is the one with parameters of the benchmark economy and the wages, taxes

, and household distribution of 1990.

†† The benchmark economy with 1990 taxes.

††† The benchmark economy with 1990 wages and household distribution.

†††† The benchmark economy with 1990 taxes and household distribution.

†††††The benchmark economy with 1990 taxes and wages.

Next, I simulate the economy with 1990 taxes and 1990 household distribution, but with 1980 wages. *1990 Taxes & Distribution* column in Table 13 reports the outcome of this exercise. The results here reflect the combined

effect of the changes in taxes and the educational composition of the economy. In this economy, the female labor force participation is 61.7 percent. Table 14 shows that changes in taxes and educational composition of the economy together account for about 38 percent of the rise in aggregate participation rate. Adding the change in the distribution results in a 1.5 percentage points increase in the participation rate. A comparison of second and fourth columns in Table 13 helps us understand why we observe such an increase. The labor force participation rates with different education levels are almost same in these two economies. Hence, the effect on the aggregate participation rate is due to the change in educational composition of the economy (not due to the change in age composition). As Section 2 documents, the fraction of college graduate females increased and the fraction of females with less than high school education decreased from 1980 to 1990. Therefore, the weight of college graduate females, who have high participation rates, increased in the calculation of the aggregate participation rate. The positive effect of the change in educational composition are observed for households at all ages. Finally, this simulation implies that the men work 49.6 hours per week on average, and the women work 32.2 hours per week on average.

The final simulation shows the effects of a change in the tax scheme together with a change in earning profiles. I report the results in *1990 Taxes & Wages* column of Table 13. The female labor force participation is now 67 percent. Together with the other simulations, this exercise suggests that the changes in wages account for bulk of the increase in labor force participation rate of married women. Table 14 reports that 86 percent of the increase in participation rate is accounted for by the changes in wages and taxes. In

addition, the changes in wages have the biggest role in the change in working hours of married women. In this economy, hours for men and women are 48.5 hours per week and 33.9 hours per week, respectively.

A striking observation from Table 14 is that changes in wages account for a larger share of the increases in participation rates of high school graduate and college graduate females compared to females with less than high school education. Note that taxes alone account for 44 percent, 27 percent and 24 percent of the changes in the participation rates for females with less than high school education, high school graduate females, and college graduate females, respectively. On the other hand taxes and wages together account for 83 percent, 102 percent, and 100 percent of the changes for these females, respectively. The fact that gender gap improved more for the highly educated females during 1980s is the main reason behind this observation (see Section 2).

7   Other Decades

The rise in the labor force participation of married women in the second half of 20th century has been studied extensively in the recent literature. The current paper contributes to this literature by studying the role of the changes in income tax code during 1980's on the rise in labor force participation rate in the same period. Given the longer term changes in the participation rate, the following question arises naturally: What role do taxes play in the change in labor force participation rate of married females in the other decades?

The married female labor force participation rates for 1970, 1980, 1990,

and 2000 were 43.5 percent, 57.2 percent, 70.2 percent, and 70.4 percent, respectively.[29] Figure 4 shows the estimated marginal tax functions for 1970, 1980, 1990, and 2000.[30] Table 15 reports the estimates of tax function parameters for 1970 and 2000 (see Table 7 for 1980 and 1990 tax parameters). The marginal tax rates were at their highest level in 1980, and at their lowest level in 1990 for all shown income levels. Interestingly, the marginal tax rates for 1970 and 2000 are very similar. The marginal tax rates in 1970 are slightly higher for households with higher levels of income. After the Omnibus Budget Reconciliation Act of 1993, marginal tax rates increased to the levels in 2000.

<div align="center">

Table 15: Tax Functions, Coefficients

Year	η_1	η_2	R^2
1970	0.1205	0.0814	0.96
	(0.004)	(0.004)	
2000	0.1216	0.0733	0.99
	(0.003)	(0.003)	

Note: The terms in the parentheses are standard errors

</div>

The first exercise is to bring the calibrated 1980 economy to 1970.[31] Following the same steps as in the previous section, first, I simulate the 1970 economy using the parameters of the benchmark economy and the 1970 val-

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[29]Author's calculations from Census data.

[30]Again, I use IRS data to estimate the effective tax functions for 1970 and 2000. See Section 3 for the details of the estimation procedure.

[31]The data for the wage profiles and the household distributions for 1970 and 2000 are available upon request.

ues of the taxes, the wages, and the household distribution. Table 16 shows the statistics from 1970 data and simulated 1970 economy. Aggregate labor force participation of married women in the data is 43.5 percent, whereas the model implies 58.5 percent participation rate. There is a significant difference between the implication of the model and the data. One can observe similar differences in participation rates across different ages and education types. Hence, I conclude that changes in taxes, wages, and household distribution together do not account for the observed changes in participation rate from 1970 to 1980. This finding is consistent with the literature arguing that the factors that the current analysis is silent about are mostly responsible for the rise in the participation rate of married women since the 1950s. Some of the factors studied in the literature are cultural change (Fernández (2007)), technological change in home production (Greenwood, Seshadri, and Yorukoglu(2005)), and the introduction of birth control pills (Goldin and Katz (2002)).

Next, I investigate how changes in each factor separately affect the participation rate. Table 17 shows the results for alternative economies. In the first alternative economy, only taxes from the benchmark economy are changed to 1970 values (*1970 Taxes*), in the second one taxes and wages are changed to 1970 values (*1970 Taxes & Wages*), and in the last one taxes and household distribution are changed to 1970 values (*1970 Taxes & Distribution*). All these experiments show that none of factors studied in this paper were critical for the 14 percentage point rise in labor force participation rate of married women. Note that the *1970 Taxes* economy suggest that if people of 1980 were taxed at 1970 rates, the participation rate would have been 0.4

Table 16: Simulation Results, 1970 Economy

	1970 Data	1970 Simulation[†]
Aggregate LFP (%):	43.5	58.5
Working hours of men (hrs/week):	48.2	49.5
Working hours of women (hrs/week):	33.7	32.4
LFP by Age (%)		
1	43.8	60.8
2	38.7	56.4
3	47.2	65.6
4	44.2	48.7
LFP by Education of Wife (%)		
<hs	37.9	44.5
hs	44.4	61.5
col	54.8	75.5

† 1970 Simulation economy is the one with parameters of the benchmark economy and the wages, taxes

, and household distribution of 1970.

percentage points higher.

The second exercise is to simulate the 2000 economy (with taxes, wages, and distribution from 2000) and to decompose the changes in participation rate from 1990 to 2000. Once again, the parameters used in the following simulations are the parameters of the benchmark economy. Table 18 reports the statistics from the data and the 2000 Simulation. The labor

Table 17: Alternative Economies

	Benchmark	1970 Taxes[†]	1970 Taxes & Wages[††]	1970 Taxes & Distribution[†††]
Aggregate LFP (%):	57.5	57.9	60.1	56.8
Working hours of men (hrs/week):	49.1	49.6	49.4	49.8
Working hours of women (hrs/week):	31.7	31.9	32.5	31.9
LFP by Age (%)				
1	62.2	63.1	64.3	61.9
2	57.1	57.2	58.3	55.8
3	60.5	61.3	67.8	59.3
4	48.9	49.2	50.1	47.6
LFP by Education of Wife (%)				
<hs	47.3	48.4	45.7	48.1
hs	58.2	58.7	61	59.2
col	68.8	69.2	74	70.4

† The benchmark economy with 1970 taxes.

†† The benchmark economy with 1970 taxes and wages.

††† The benchmark economy with 1970 taxes and household distribution.

force participation rate in the simulated economy is 70.5 percent while in the data is about 70.4 percent. Hence, given the parameters of the calibrated 1980 economy, the model successfully generates the slow down in the rise of participation between 1990 and 2000.

Table 19 compares the following alternative economies: i) the economy with 1990 taxes, wages, and household distribution (*1990 Simulation*), ii) the economy with 1990 wages and household distribution, but with 2000 taxes (*2000 Taxes*), iii) the economy with 1990 distribution but with 2000 taxes and wages (*2000 Taxes & Wages*), iv) the economy with 1990 taxes, but with

Table 18: Simulation Results, 2000 Economy

	2000 Data	2000 Simulation[†]
Aggregate LFP (%):	70.4	70.5
Working hours of men (hrs/week):	49.7	47.3
Working hours of women (hrs/week):	37.6	34.2
LFP by Age (%)		
1	68.6	77.8
2	68.7	66.2
3	75	78.9
4	67.2	60.5
LFP by Education of Wife (%)		
<hs	46.3	55.9
hs	70.4	69.9
col	78.1	76.1

† 2000 Simulation economy is the one with parameters of the benchmark economy and the wages, taxes

, and household distribution of 2000.

2000 taxes and distribution (*2000 Taxes & Distribution*). The main finding from this exercise is that due to the rise in taxes after the Omnibus Budget Reconciliation Act of 1993, the labor force participation rate in 2000 is lower than what it would have been (70.5 vs. 71.5). Hence, the model implies that the rise in taxes is one of the reasons why we observe a reduction in the rise of participation rate of women during 1990's.

Table 19: Alternative Economies

	1990 Simulation[†]	2000 Taxes[††]	2000 Taxes & Wages[†††]	2000 Taxes & Distribution[††††]
Aggregate LFP (%):	68.6	67.3	69.8	68.1
Working hours of men (hrs/week):	48.5	48	47.4	48
Working hours of women (hrs/week):	33.9	33.5	34.1	33.5
LFP by Age (%)				
1	74.9	73.2	77	74
2	65.4	64.5	65.4	65.2
3	76	74.6	77.4	76.2
4	57.5	56.2	59.7	57.9
LFP by Education of Wife (%)				
<hs	56.6	54.7	56	55.3
hs	68.4	67.1	70.1	66.9
col	76	75.1	76	75.1

† 1990 Simulation economy is the one with parameters of the benchmark economy and the wages, taxes, and household distribution of 1990.

†† The benchmark economy with 2000 taxes, 1990 wages and household distribution.

††† The benchmark economy with 2000 taxes and wages, 1990 household distribution.

†††† The benchmark economy with 2000 taxes and household distribution, 1990 wages.

8 Conclusions

The 1980s witnessed two dramatic tax reforms that lowered tax rates for high income earners. During the same period, there were significant changes in the earnings of the workers in favor of women and college graduates. Moreover, the fraction of the college graduates in the population increased significantly. The combination of these factors altered work incentives for second earners, who are mostly women, in married-couple households. The labor force participation rate of married women increased by 13 percentage points between

1980 and 1990. At the same time market hours per married working women increased by about 4 hours per week. In this paper I build a static heterogeneous agents model with two-member households in which members decide whether to work or not, and if they do how much to work in the market. I use this model to evaluate the contribution of the changes in the individual income tax structure to the 13 percentage point rise in married female labor force participation. The simulations suggests that the change in the tax rates accounts for 20 to 24 percent of the increase in the participation rate of married women. Furthermore, the changes in the taxes account for about 27 percent of the rise in working hours of married women.

The current analysis can be extended in several dimensions. The model here is simple in order to undertake a clean decomposition analysis with labor supply, both at extensive and intensive margins, as the key endogenous variables. A natural extension is to consider a framework which allows for more realistic life-cycle elements such as capital accumulation, and child care spending. Guner, Kaygusuz and Ventura (2008) develop such a framework to study the aggregate and cross-sectional effects of hypothetical tax reforms for the U.S. economy. There are other government policies, besides taxes, that can only be studied within a framework that allows for two-earner households. Kaygusuz (2008) builds a life-cycle model with one and two-earner households to study the effects of the spousal and survivors' benefit provisions in the U.S. social security system and their interaction with the progressive calculation of the retirement benefits.

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Figure 1: Statutory Marginal Tax Rates (for married households filing jointly)
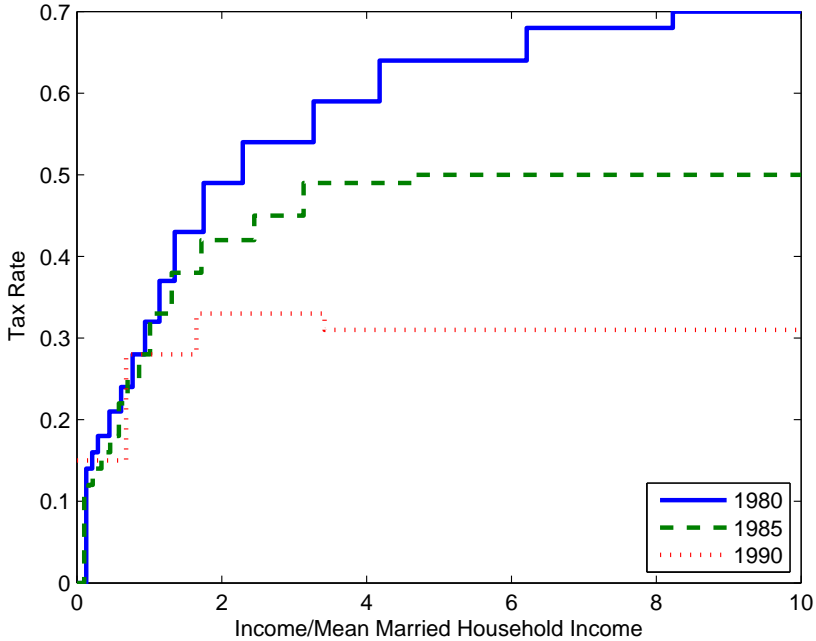
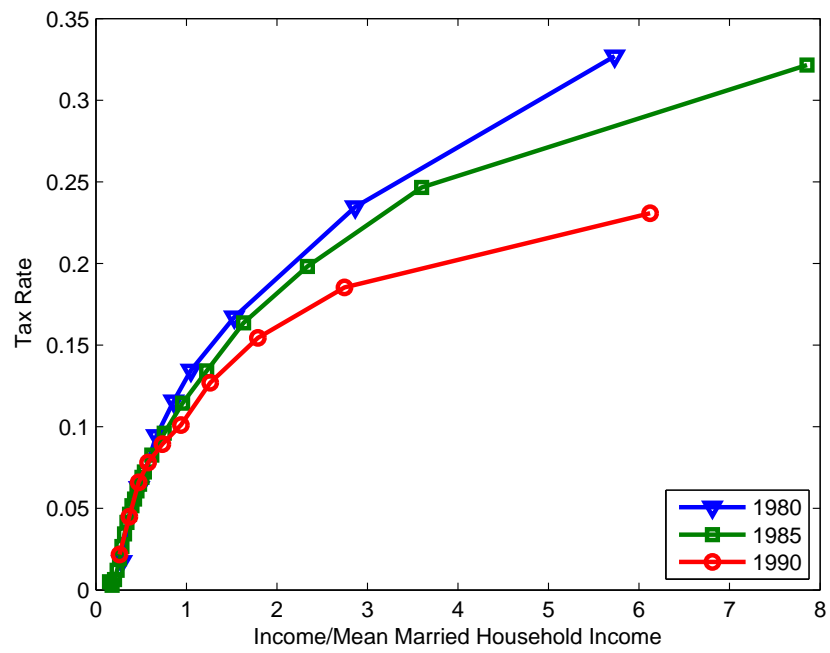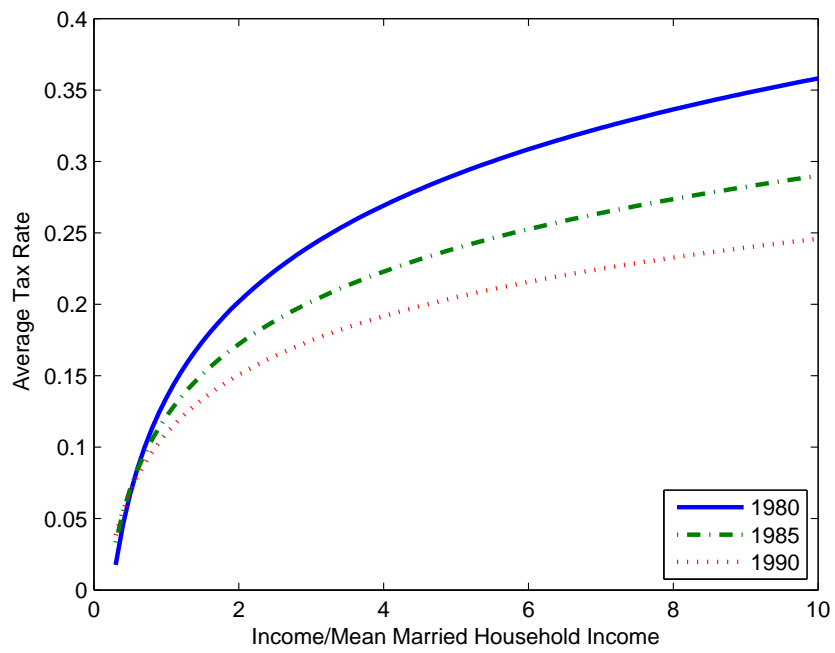Figure 2: Effective Average Tax Rates

Figure 3: Estimates of Average Tax Rates

Figure 4: Estimates of Marginal Tax Rates