Changes in Behavioral and Characteristic Determination of Female Labor Force Participation, 1975–2005

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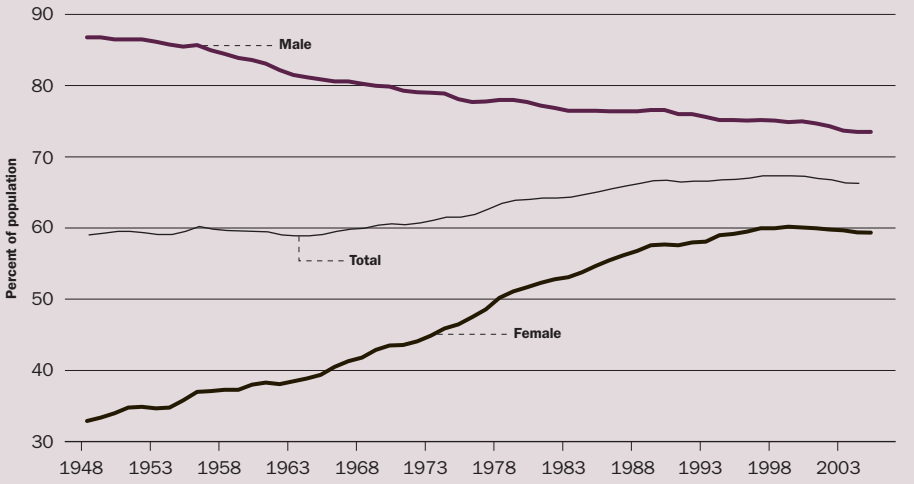
Since the late 1940s the percent of the male population participating in the labor force has steadily declined while female labor force participation has steadily increased (see Figure 1). A variety of factors have been found to have contributed significantly to the decline in male labor force participation: the institution of Social Security in 1935; its expansion to include disability insurance and Medicaid; and the Revenue Act of 1942, which granted tax incentives for firms to establish private pension plans (for example, see Burtless and Moffitt 1984; Cremer, Lozachmeur, and Pestieau 2004; Gruber 2000; and Lumsdaine, Stock, and Wise 1997). These policies provided men greater incentives both to claim a work-inhibiting disability and to retire earlier from the labor market. Another explanation for the decline in male labor force participation among all age groups is the increase in female labor force participation. With labor supply decisions often made in a household (husband-wife) setting, the increase in family income from more wives working provides an income effect incentive for husbands to decrease their labor supply.

The rise in female labor force participation has several explanations as well. A major determinant is the stream of biotechnological advancements that have provided women greater control over and timing of childbearing decisions since the 1940s (see Bailey 2004). This greater flexibility, along with advancements in household technologies (such as the introduction of the dishwasher and the microwave oven), has afforded women greater freedom and time to increase their educational attainment, providing yet another reason to devote more time to the labor market (see Goldin 1995). Further, changing social attitudes about the role of women and the appropriateness of women (and wives) working have increased job opportunities and, thus, incentives for women to enter the labor market (see Rindfuss, Brewster, and Kavee 1996).

While the ongoing decline in male labor force participation and the long-lived rise in female labor force participation have received much attention over the years,

Figure 1
Labor Force Participation Rates over Time, 1948–2005



Source: Bureau of Labor Statistics; data for 2005 are the average for the first three quarters.

more recent changes in the trend of labor force participation among women since the mid-1990s beg further scrutiny. The growth in female labor force participation began to flatten out in 1997 and has been declining since 2000. The purpose of this article is to dissect the changes in labor force participation decisions that have taken place among women aged twenty-five to fifty-four over the past thirty years.[1]

Identifying the factors contributing to observed changes in labor force participation trends over time (particularly those affecting the recent decline) may help anticipate future changes in those trends. An important component of policymakers' expectations regarding productivity or output potential of the United States, and thus appropriate policy action, is the formation of expectations regarding available labor input, or the size of the workforce.[2] The results in this article suggest that the decline in female labor force participation rates between 2000 and 2005 was not entirely a response to a predictable change in macroeconomic conditions or to demographic changes. Consequently, a reversal is not obviously forthcoming or likely to be easily predictable.

Bradbury and Katz (2005) seem to have made the only investigation of the potential sources of the recent decline in female labor force participation; they identify the decline as being concentrated among more highly educated married women with young children.[3] The analysis in this article delves deeper to disentangle changes in characteristics from changes in behavior, with given characteristics, of women over a long period of time. The results suggest that while changes in both observed characteristics and behavior have contributed to the decline in female labor force participation since 2000, unobserved—and thus unpredictable—changes are the largest contributors. The analysis also indicates that while the higher average unemployment rate in 2005 has put downward pressure on the labor supply of women, if the unemployment rate were to regain its 2000 level, women's labor force participation rate (keeping everything else at its 2005 level) would still be significantly lower than it was in 2000.

Theoretical and Empirical Construct

The labor-leisure choice model assumes that a person chooses a combination of hours of leisure and income (or an aggregate consumption bundle) in order to maximize utility. There is a trade-off between leisure and income in that consumption of more leisure (less work) results in less income. This utility maximization problem has a corner solution in which the person chooses to consume the maximum number of leisure hours possible (work zero hours).[4] The decision to work (or participate in the labor market) boils down to the evaluation of what the market is willing to pay a person for his or her time relative to the value that person's time generates (in terms of additional utility) when consumed as leisure. This labor force participation decision can be expressed mathematically as

$$(1)\ W_i - MRS_{i,H=0} \begin{cases} > 0 \Rightarrow LFP = 1 \\ \leq 0 \Rightarrow LFP = 0 \end{cases},$$

where W_i is the market wage that person i can earn in the market, $MRS_{i,H=0}$ is person i's reservation wage (the utility gained at zero hours of work), and LFP is a binary choice variable that is equal to 1 if the person is a labor force participant and equal to 0 if the person is not in the labor force.

This theoretical construct translates into an operational estimation framework by assuming that the difference between a person's market wage and reservation wage can be represented by a linear function of observable characteristics about that person and an unobservable random component:

$$(2)\ I_i^* = W_i - MRS_{i,H=0} = \beta_0 + \beta_1' X_{W,i} + \beta_2' X_{R,i} + \varepsilon_i = \begin{cases} > 0 \Rightarrow LFP = 1 \\ \leq 0 \Rightarrow LFP = 0 \end{cases}.$$

$X_{W,i}$ is a vector of observable characteristics that determine what wage person i could expect to earn in the market. One of the most important human capital characteristics determining labor market earnings is the woman's education level. Labor market experience is also important and will be proxied by age. Age squared is also included as a regressor to capture the concavity of the experience/age-labor force participation profile. Because living with a disability increases the cost (ceteris paribus) of participating in the labor market and may reduce the market wage available (see Hotchkiss 2003, chap. 3), a variable indicating the amount of disability income being received (if any) is also included as a regressor. The current labor market condition

1. While the behaviors of younger and older women deserve their own analyses, this article focuses on the change in labor force participation of the women who make up the bulk of the female labor force: those twenty-five to fifty-four years of age. The women in this age group made up roughly 68 percent of the female labor force in 2005. Kirkland (2002) has concluded that an increased emphasis on schoolwork (rather than working while attending school) has contributed significantly to the decline in teen labor force participation. DiNatale (2005a) attributes the rise in older women's labor force participation to the decline in retirement portfolios in 2001 and to better health care and longevity.
2. Bradbury (2005) explores the implication of the lower labor force participation for assessing production slack in the economy.
3. DiNatale (2005b) provides a much more cursory glance at the decline in labor force participation among working-aged women.
4. There is another corner solution in which the person chooses to work the maximum number of hours possible, but this solution is considered practically infeasible.

is also important in determining the value of entering the labor market; as the probability of obtaining a job declines, the expected value of the market wage declines. The state unemployment rate will serve as a proxy for current labor market conditions.

$X_{R,i}$ is a vector of observable characteristics that determine the value of person i's time out of the labor market. Factors that are expected to affect the value of a woman's time out of the labor market include whether she is married, how many children she has, and the amount of income she has access to in the absence of her earnings (nonlabor income, including any spousal earnings). In addition to the X variables already discussed, indicators for the woman's race are included to capture any differential labor market returns experienced across racial groups (for example, as a result of discrimination) and cultural or social differences that might affect the marginal valuation of time spent out of the labor market.

This analysis suggests that while changes in observed characteristics and behavior have contributed to the decline in female labor force participation since 2000, unobserved—and thus unpredictable—changes are the largest contributors.

ε_i is the random component, and assuming that $\varepsilon_i \sim N(0, 1)$ means that the parameter coefficients in equation (2) are determined via maximum likelihood (ML) probit estimation.[5]

Data and Estimation Strategy

The previous theoretical construct indicates that changes in observed labor force participation rates can arise from three sources. One source is change in characteristics. For example, a woman's characteristics may change by her having children (which would be expected to raise her reservation wage, ceteris paribus) or by her attaining more education (which would raise her expected market wage). These changes in characteristics would be reflected in changes in the Xs. While the unemployment rate is not a characteristic of the woman making the labor force participation decision per se, it is a characteristic of the environment in which the decision is made.

A second source of change is a change in behavior—a change in the way a woman's characteristics translate into her observed labor market participation decision. These changes will be reflected in changes in the estimated parameter coefficients, given a specific set of characteristics. Changes in parameter coefficients in a labor force participation equation can be thought of as reflecting changes in the marginal utility generated by the characteristics. For example, if the additional utility from participating in the labor market as a married woman increases (say, as the result of a decrease in relative market returns for men), then the parameter coefficient on the marriage indicator variable will increase. Or, if discriminatory behavior against women declines, the labor market return to a college degree might increase, raising the marginal utility from participating in the labor market for a woman with a college degree. This change would manifest itself in an observed change in behavior among college women (greater labor force participation) and a larger positive parameter coefficient on the college degree indicator variable. A change in the responsiveness to labor market conditions can also affect observed labor force participation. A change in responsiveness will be reflected through a change in the estimated parameter coefficient associated with the state unemployment rate.

The third source for change in labor force participation decisions is the force of unobservables. Innumerable factors enter into a woman's decision to participate in the labor market that are not observed and manifest themselves in the estimated intercept term. These factors might include changes in women's preferences not captured by

observables or changes in the labor market structure or institutions that affect the labor market valuation of human capital characteristics and thus the market wage. Unfortunately, this third source does not typically result in transparent policy implications.

The March Current Population Survey (CPS) from the Bureau of Labor Statistics (BLS) is used to evaluate changes in labor force participation behavior of women between the ages of twenty-five and fifty-four. The data cover the years 1976 through 2005, with the analysis focusing on the period 2000 through 2005. These data are used for two primary reasons. First, the BLS uses these data to estimate and report the labor force participation rate. Second, the data provide a consistent, long-running, and large sample on which to obtain parameter estimates. These data are cross-sectional, so separate labor force participation equations will be estimated for each year to "decompose" the changes in the labor force participation rate into changes in behavior (differences in estimated parameter coefficients across years) and changes in characteristics (differences in regressor values across years).[6]

Results

The 1994–2005 period. Table 1 presents sample means and estimated parameter coefficients from the ML probit labor force participation estimation for the years 2000 and 2005. This table provides the first clues about how changes in characteristics and behavior (ceteris paribus) have affected labor force participation decisions between 2000 and 2005. For example, women in 2005 were slightly more likely to have at least a college degree than they were in 2000. Given that more education increases the returns to supplying labor, this increase in education raises the probability of being in the labor force. However, the responsiveness of labor force participation to education declined slightly from 2000 to 2005. In other words, education (both college and high school) was providing less of a pull into the labor market in 2005 than in 2000, and this factor put downward pressure on labor force participation decisions.

Furthermore, the higher average state unemployment rate in 2005 put downward pressure on labor force participation; the negative parameter coefficient in 2000 on the state unemployment rate translates into a 1.9 percentage point decline in labor force participation for every 1 percent increase in the unemployment rate.[7] But women were also apparently less sensitive to labor market conditions in 2005 (evidenced by the smaller negative parameter coefficient), meaning that a higher unemployment rate had less of an effect on labor force participation in 2005 relative to the effect it would have had in 2000; this smaller parameter coefficient translates

5. In a model of labor force participation of women, it might be prudent to model that decision jointly with that of her spouse (if married); for example, see Hotchkiss, Kassis, and Moore (1997). In the present article, it is assumed that labor supply decisions are made at an individual, rather than family, level, and the labor supply of other family members enters into a woman's labor force participation decision in the form of higher nonlabor income. A joint labor force participation analysis will be the subject of future research.
6. An alternative strategy might be to construct a synthetic panel of cohorts to determine whether the observed behavior is the result of collective changes within a certain group of women. A typical cohort definition is based on year of birth. The additional information that cohort identification might provide to the analysis was explored, but it was determined that, except for those older than fifty-five years, group behavior did not vary significantly across the sample time period. All analyses are performed using the March supplement weight because this is the only weight that is valid since 2002 and because some of the regressors come from the supplemental part of the survey. The results are essentially unchanged if the analyses are performed unweighted.
7. This marginal effect is calculated for every woman and then averaged across the sample.

Table 1
Sample Means and Maximum Likelihood Probit Estimates for 2000 and 2005, Women Aged Twenty-five to Fifty-four

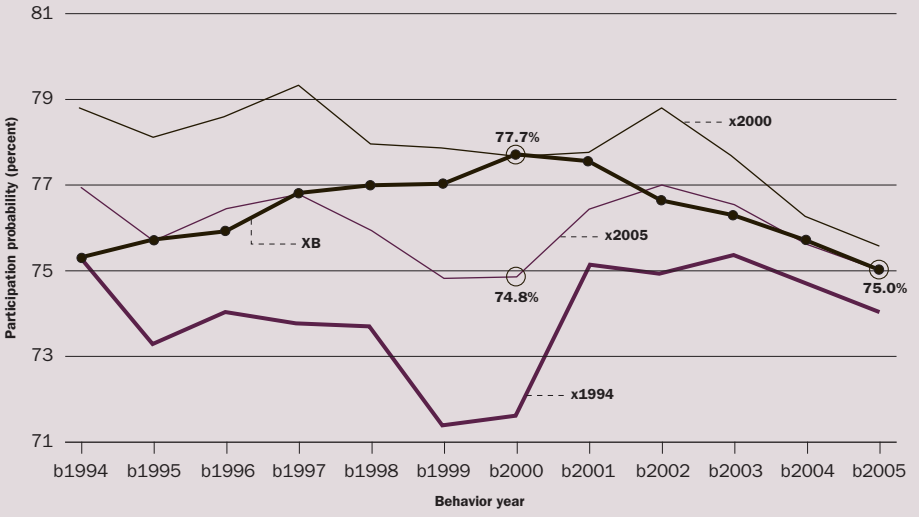
	Weighted sample means		Dependent variable = probability of labor force participation	
Characteristic	**2000**	**2005**	**2000**	**2005**
Age	**39.4**	**39.7**	0.0501 (0.0125)	0.4723 (0.0101)
Age squared	**1,618.43**	**1,649.56**	–0.0007 (0.0002)	–0.0006 (0.0001)
# children YT 6	0.285	0.293	–0.3661 (0.0163)	–0.3168 (0.0128)
# children aged 6–18	0.729	0.718	–0.0654 (0.0102)	–0.0385 (0.0081)
Married, spouse present	**63.4%**	**62.6%**	–0.1188 (0.0231)	–0.1122 (0.0190)
High school graduate	**60.9%**	**58.9%**	0.6763 (0.0275)	0.6236 (0.0230)
College degree or more	**28.2%**	**30.4%**	1.0051 (0.0327)	0.9695 (0.0264)
Nonlabor income (per yr.)	$43,496	$43,047	–0.0028 (0.0002)	–0.0022 (0.0001)
Hispanic	**5.4%**	**7.3%**	–0.1795 (0.0430)	–0.2115 (0.0287)
Black	13.4%	13.3%	0.0166 (0.0309)	0.0165 (0.0244)
Disability income (per yr.)	$68.20	$67.57	–0.0001 (0.00002)	–0.0001 (0.00002)
State unempl. rate	**4.45%**	**5.79%**	–0.0698 (0.0110)	–0.0109 (0.0077)
Intercept	—	—	–0.0091 (0.2418)	–0.3897 (0.1988)
N	29,718	46,862		

Notes: Means in bold are significantly different from one another at least at the 95 percent confidence level across years. All parameter coefficients are significantly different from one another across years except for the coefficients on black. All coefficients are significantly different from zero at least at the 95 percent confidence level except black and intercept (2000) and black and the state unemployment rate (2005). All dollar values are inflated to 2004 values using the consumer price index.

into a 0.3 percentage point decline in labor force participation for every 1 percent increase in the unemployment rate.

To determine how much of the observed decline in labor force participation among women is due to changes in characteristics and behavior (parameter coefficients), labor force participation in each year is simulated using a common set of parameter coefficients. For example, the average probability of women in 2005 participating in the labor market is calculated assuming the women in that year behaved as women did in, say, the year 2000. The deviation in the simulated labor force participation (using 2005 women's characteristics and 2000 parameter coefficients) and

Figure 2
Actual and Simulated Labor Force Participation of Women Aged Twenty-five to Fifty-four, 1994, 2000, and 2005



Notes: The "x" corresponds to which year characteristics and the "b" corresponds to which year parameter coefficients (betas) are used in the calculation of the average predicted labor force probability. "XB" means that the characteristics and parameter coefficients for the same year are used to construct the labor force probability.

the actual labor force participation in 2005 indicates how much of the observed difference in labor force participation between 2000 and 2005 was due to changes in behavior and how much was due to changes in characteristics. This decomposition technique is subsequently described in more detail.

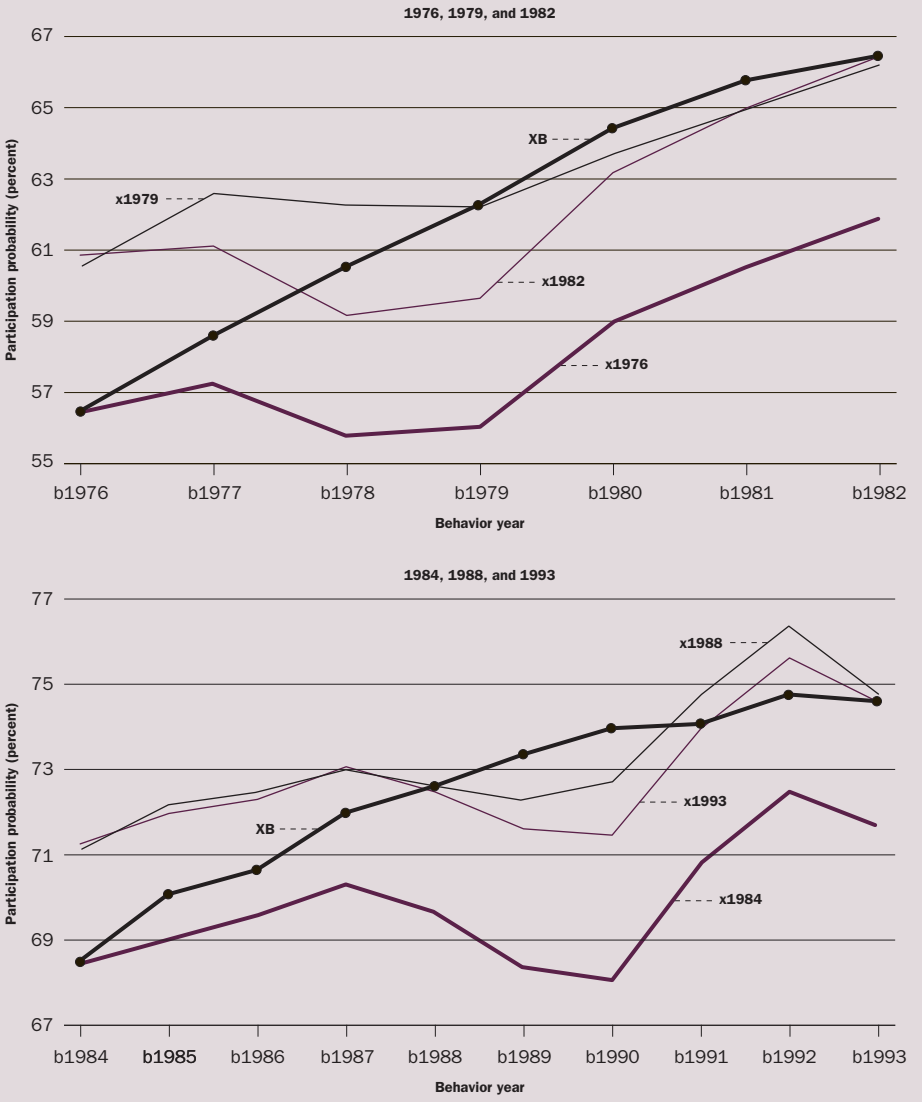
Figure 2 plots selected results from this simulation exercise. First, separate probit models were estimated for each year between 1994 and 2005 in order to generate year-specific parameter coefficients ($\hat{\beta}^t$).[8] These year-specific parameter coefficients were then combined with each year's sample characteristics (X_i^t) to simulate the expected labor force participation decision of women in each year, given the behavior across different years.

The line labeled "XB" reflects the labor force participation predicted for each year's sample of women, given their own parameter coefficients (the average across i of $\Phi(X_i^t\hat{\beta}^t)$ for the sample of women in year t, where Φ is the standard normal cumulative distribution function). This sample average probability of participating in the labor market is analogous to the population labor force participation rate. The line labeled "x1994" reflects the predicted labor force participation for the 1994 sample of women in each year (t), assuming that they behaved as the women in year t behaved (this is the average across i in year t of $\Phi(X_i^{1994}\hat{\beta}^t)$). The line labeled "x2000" is the average of $\Phi(X_i^{2000}\hat{\beta}^t)$, and the line labeled "x2005" is the average of $\Phi(X_i^{2005}\hat{\beta}^t)$.

The distance between two lines reflects differences in the characteristics of women holding the responsiveness to those characteristics (or behavior) fixed. For

8. The comparison goes back only to 1994 in this figure since a major CPS questionnaire change in 1994 has been shown to have changed the classification of female labor force participants. Analyses of earlier years are subsequently explored.

Figure 3
Actual and Simulated Labor Force Participation of Women Aged Twenty-five to Fifty-four, 1976–93



Notes: The "x" corresponds to which year characteristics and the "b" corresponds to which year parameter coefficients (betas) are used in the calculation of the average predicted labor force probability. "XB" means that the characteristics and parameter coefficients for the same year are used to construct the labor force probability.

example, the vertical distance between the x1994 line and the x2000 line measures the difference in predicted labor force participation between 1994 and 2000 that is accounted for by differences in women's characteristics in those two years. Moving along any of the lines shows how the labor force participation decisions of any one sample of women would have changed given the estimated parameter coefficients across the years; this pattern indicates the importance of changes in behavior across the years in determining labor force participation.

Comparing the predicted and simulated labor force participation probabilities shows that the bulk of the decline in predicted labor force participation between 2000 and 2005 derived from a change in characteristics rather than a change in behavior. In other words, from 2000 to 2005 characteristics changed in such a way as to reduce labor force participation from 77.7 percent to 74.8 percent (a 2.9 percentage point decline, holding behavior constant at 2000 values). Furthermore, behavior changed in such a way as to put upward pressure on labor force participation from 74.8 percent (2005 women behaving like 2000 women) to 75.0 percent (a 0.2 percentage point increase). These influences resulted in a net decline in labor force participation between 2000 and 2005 of 2.7 percentage points.[9] Labor force participation decreased slightly over the entire 1994–2005 time period by 0.2 of a percentage point. Over this entire time period, characteristic changes alone would have increased predicted labor force participation by 1.7 percentage points, while behavioral changes alone would have reduced labor force participation by 1.9 percentage points. In other words, between 1994 and 2005 the characteristics of women (for example, fewer children, less likely to be married, more likely to be a college graduate) put upward pressure on labor force participation, but behavioral changes added downward pressure.

The movements of labor force participation rates of men and women since the late 1990s have taken more parallel, rather than converging, paths.

The 1970s and 1980s. The results for the 1994–2005 time period are in sharp contrast to the changes observed for women during the 1970s and 1980s. Figure 3 depicts the same simulation described above for different year groups: 1976 to 1982 and 1984 to 1993.[10] Two main observations are worth highlighting from these graphs. First, both sets of years saw a much stronger impact on labor force participation from both characteristic changes (movement between the lines) and behavioral changes (movement along each line). Second, the slowing in the impact of both characteristic and behavioral changes is evident in the early 1990s.[11]

Table 2 summarizes the changes depicted in Figures 2 and 3. The first column of numbers shows the net change in labor force participation rates, the second column shows how labor force participation would have altered from changes in characteristics only (holding coefficients constant), and the third column shows how labor force participation would have altered from changes in behavior only (measured by differences in parameter coefficients). For the 1970s and 1980s, both behavior and characteristics changed in such a way as to put upward pressure on labor force participation, with changes in behavior contributing the most to the net change over the

9. The algebraic decomposition of the net change in the expected labor force participation between year t and year $t-k$ is expressed as $\Phi(X_i^t\hat{\beta}^t)-\Phi(X_i^{t-k}\hat{\beta}^{t-k})=[\Phi(X_i^t\hat{\beta}^t)-\Phi(X_i^t\hat{\beta}^{t-k})]+[\Phi(X_i^t\hat{\beta}^{t-k})-\Phi(X_i^{t-k}\hat{\beta}^{t-k})]$. The decomposition can be performed using different endpoints as the base case. Here the latter year (t) is used as the point of reference. Generally, the conclusions are essentially the same, even if some of the details of the decomposition may vary, if the earlier year is used as the point of reference.
10. The analyses for these earlier years differ from the 1994–2005 analysis only in that there is no regressor for disability income; this variable is not available in the CPS until 1989. The analysis does not start earlier than 1976 because a person's nonlabor income is not calculable (without matching respondent records) prior to this survey year. Also, 1983 is excluded because of erratic estimation results.
11. Sample means and estimated parameter coefficients for select years are contained in the appendix (Table A1).

Table 2
Net Changes in Predicted Labor Force Participation and the Contribution of Changes in Behavior and Characteristics, Women Aged Twenty-five to Fifty-four

Year span	Net change in predicted labor force participation (percentage points)	Portion of net change accounted for by changes in characteristics (percentage points)	Portion of net change accounted for by changes in behavior (percentage points)
1976–82	+10.0	+4.4	+5.6
1984–93	+6.1	+2.8	+3.3
1994–2005	–0.2	+1.7	–1.9
2000–05	–2.7	–2.8	+0.1

periods.[12] In the 1990s, however, while characteristic changes (for example, higher educational attainment, less marriage, fewer children) continued to put upward pressure (albeit by a smaller amount) on labor force participation, behavioral changes more than offset those characteristic changes by contributing downward pressure.

Comparison with men. One interpretation of the observed recent decline in female labor force participation is that women are losing ground in their efforts to compete with men and to make comparable contributions to the labor market (for example, see Bradbury and Katz 2005). An alternative interpretation, given that the labor force participation rate of men has been declining steadily for decades (see Figure 1), is that women have achieved as much parity regarding labor force participation decisions as they and their partners want and that the same forces driving labor force participation of men downward are now acting upon those decisions of women. For example, the income effect of rising real wages may now dominate the substitution effect for women. One way to explore how similar the recent experience of women is to that of men is to perform the same analysis described previously for samples of men over the same time periods and to compare those results to those obtained for women. Table 3 decomposes the net changes in male labor force participation across different time periods into the contributions made by changes in characteristics and changes in behavior.

The first thing to notice in this table is that behavioral changes have consistently contributed downward pressure and have been largely responsible for the decline in the labor force participation of men over each period. While women's behavior changed through the 1970s and 1980s to provide upward pressure on labor force participation, their behavior changed in the 1990s to resemble the changes occurring in men's behavior across all periods, putting downward pressure on participation decisions. By contrast, however, characteristic changes of men continued to push participation downward, while the characteristics of women continued to contribute positively to their labor force participation (except in just the most recent years). The net result is that the movements of labor force participation rates of men and women since the late 1990s have taken more parallel, rather than converging, paths.

Which characteristics? The bulk of the decline in labor force participation rates among both men and women between 2000 and 2005 is accounted for by changes in characteristics. The difference in average characteristics between 2000 and 2005 in Table 1 suggests which characteristic changes might have been most influential in lowering women's labor force participation between these two years.[13] Specifically, declines in characteristics positively influencing labor force participation or increases

Table 3
Net Changes in Predicted Labor Force Participation and the Contribution of Changes in Behavior and Characteristics, Men Aged Twenty-five to Fifty-four

Year span	Net change in predicted labor force participation (percentage points)	Portion of net change accounted for by changes in characteristics (percentage points)	Portion of net change accounted for by changes in behavior (percentage points)
1976–82	–0.14	–0.04	–0.10
1984–93	–1.26	–0.12	–1.14
1994–2005	–1.48	–0.11	–1.37
2000–05	–1.78	–1.54	–0.24

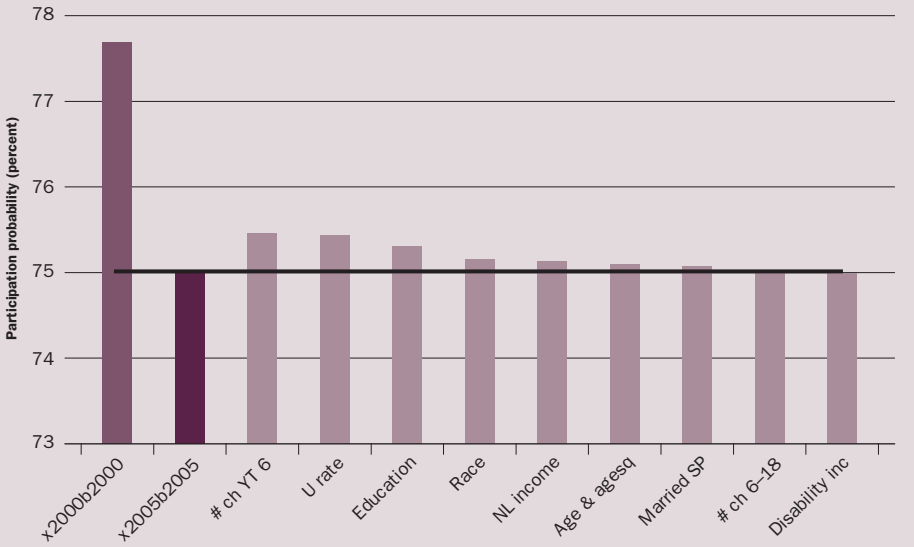
in characteristics negatively influencing labor force participation are candidates. These would include the declines in the percent of high school graduates and of blacks, the increases in number of children younger than six years and the percent of Hispanics, and the rise in the unemployment rate.

Figure 4 simulates the hypothetical question, What would the average probability of labor force participation have been in 2005 if women's characteristics indicated on the horizontal axis equaled the average for women in 2000 (holding all other characteristics at their 2005 levels)? This simulation shows that the most important characteristics contributing to the decline in the labor force participation rate between 2000 and 2005 are the rise in the number of children under age six and the unemployment rate.[14] However, even if the unemployment rate were to regain its 2000 level of 4.5 percent, women's labor force participation would rise (keeping all other characteristics at their 2005 levels) only to 75.4 percent, which is still 2.3 percentage points below the labor force participation rate for women in 2000.

Which behaviors? The results in Table 2 indicate that the combined behavioral changes between 2000 and 2005 among women put a slight upward pressure on their labor force participation decisions. But some behavioral changes individually contributed to the lower observed labor force participation in 2005. The estimation results for 2000 and 2005 in Table 1 show that those variables on which the estimated coefficients became less positive or more negative are the candidates for having lowered labor force participation. For example, the smaller positive coefficient on both the high school and college education dummy variables means that education had less of a pull into the labor market for women in 2005 than it did in 2000. Other factors that lowered the predicted labor force participation for women include being Hispanic, being black (very slightly), the impact of disability income (very slightly), and the intercept term. In contrast, between 2000 and 2005 predicted labor force participation increased (ceteris paribus) among women who are married, have children, have more nonlabor income, and face stronger local labor market conditions (the state unemployment rate).

12. Blau and Kahn (2005) document and investigate the source of changes in hours of work among women between 1980 and 2000. They also identify behavioral changes as the major contributor over that time to changes in hours of work.
13. The sample means and estimated parameter coefficients for men for selected years are presented in the appendix, Table A2.
14. However, the sample mean numbers of children under age six are not significantly different from one another in 2000 and 2005 (see Table 1).

Figure 4
Simulated Labor Force Participation Probabilities for Women with 2005 Characteristics

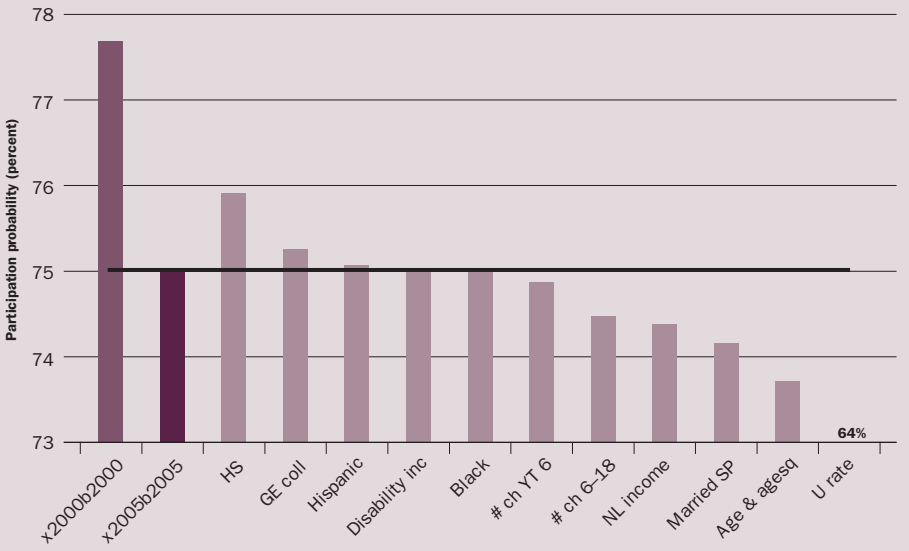


Notes: Characteristics are for 2005 except for that characteristic along the horizontal axis. Predicted labor force participation probabilities are calculated for each woman and then averaged across the sample. The simulation asks the question, What would the average probability of labor force participation have been in 2005 if women's characteristics indicated on the horizontal axis equaled the average for women in 2000?

Figure 5 plots the predicted labor force participation rate in 2000 and in 2005 for women along with simulated 2005 labor force participation that would result from changing one coefficient at a time. The hypothetical is, What would the average probability of labor force participation have been in 2005 if women's behavior matched that in 2000 with regard to the characteristics indicated along the horizontal axis (keeping all other behavior at its 2005 level)? For example, if college graduates responded in 2005 as they did in 2000, leaving everything else about 2005 women and their behavior unchanged, the labor force participation rate would have been 75.3 percent instead of the actual 75 percent. (The combined effect of 2000 behavior among both high school and college graduates would have resulted in a labor force participation rate of 76.2 percent.) Regarding women's response to labor market conditions, if women in 2005 were as sensitive to changes in the unemployment rate as they were in 2000, the labor force participation rate would have actually been only 64 percent in 2005.

Like changes in characteristics, no single observed behavioral change or combination of behavioral changes can account for the full 2.7 percentage point drop in the participation rate from 2000 to 2005. The reason is that behavioral changes unexplained by observed factors are largely responsible for the observed decline in labor force participation rates. These unexplained behavioral changes manifest themselves in the estimate of the intercept term. Replacing the estimated 2005 intercept term with that estimated for 2000 (leaving all other parameter coefficients and characteristics at their 2005 values) results in a predicted labor force participation rate of 85 percent. Unfortunately, there is no way to know exactly what the intercept term is capturing.[15]

Figure 5
Simulated Labor Force Participation Probabilities for Women with 2005 Behavior



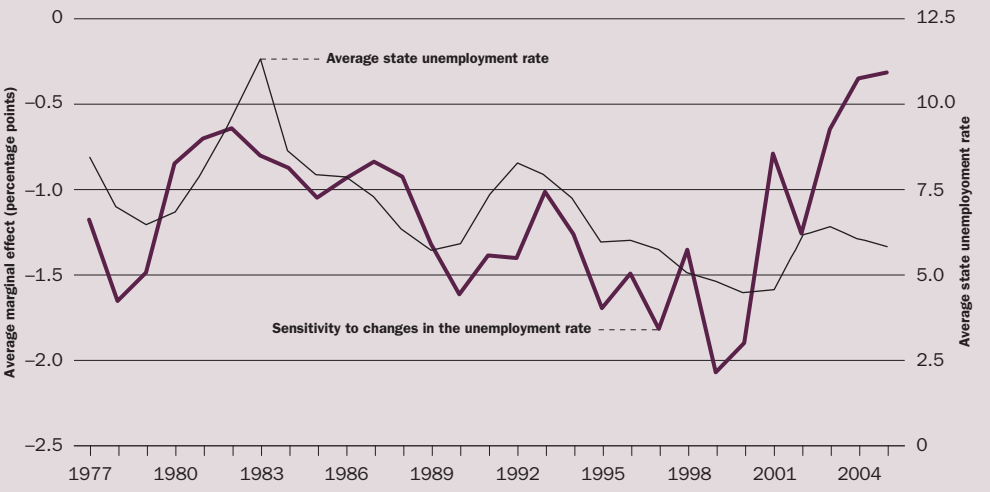
Notes: Behaviors are for 2005 except for that behavior along the horizontal axis. Labor force participation probabilities are calculated for each woman and then averaged across the sample. The simulation asks the question, What would the average probability of labor force participation have been in 2005 if women's behaviors indicated on the horizontal axis equaled the average for women in 2000?

Some studies have demonstrated that labor force participation rates have fallen particularly dramatically among college-educated, married women (for example, Bradbury and Katz 2005). Certainly, highly educated women are more likely to marry highly educated men (Hotchkiss and Pitts 2005; Neal 2004; Herrnstein and Murray 1994) and would therefore likely feel more secure in leaving the labor market (with their husband's higher earning power and lower probability of unemployment). This observation suggests that the interaction of some of the regressors (for example, education and marriage) may help reduce some of the intercept's explanatory power. Several alternative specifications and interactions were explored, resulting in practically no change in the results. Also, recall that the nonlabor income measure includes a woman's spouse's earnings (if she is married). Therefore, it seems that any change in preferences between 2000 and 2005 that may be reflected in the estimates of the intercept term of the regression is not particularly correlated with changes in behavior related to marriage, children, or educational attainment.

A closer look at labor market conditions. The conclusion from the preceding two sections is that no single observable characteristic or behavioral change would

15. With unobservable factors making such a large contribution to observed behavior, a natural question is how well the model fits the data. Comparing actual (reported by the BLS) labor force participation rates for women aged twenty-five to fifty-four, deviations of the average predicted labor force participation in each year range from 0.02 to 0.4 of a percentage point with the median deviation at 0.1 of a percentage point. The large contribution of the intercept term does not imply a poor fit of the model; it just means there are deviations in labor force participation probabilities across time that cannot be identified through changes in observed characteristics.

Figure 6
Average Marginal Effect of a 1 Percentage Point Change in the Unemployment Rate on the Probability of Participating in the Labor Market, Women Aged Twenty-five to Fifty-four, 1977–2005



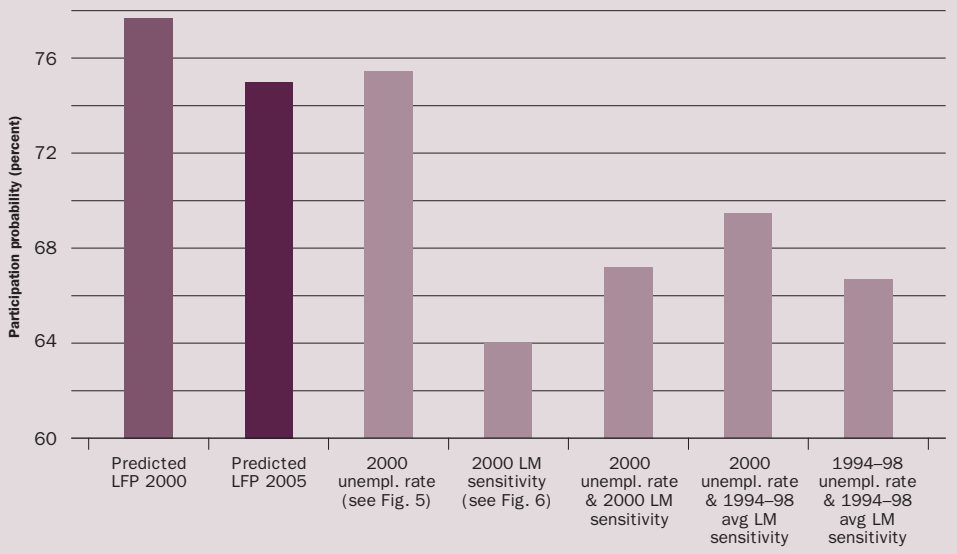
Notes: Each year's marginal effect is calculated using parameter coefficients generated from estimation of maximum likelihood probit models of labor force participation separately for each year. In each year the marginal effect is calculated separately for each observation and then averaged across the sample to obtain the average marginal effect. A marginal effect of –2.0, for example, means that a 1 percentage point increase in the unemployment rate will decrease the probability of participating in the labor market by 2 percentage points.

overwhelm the influence of the change in unobservables between 2000 and 2005 in order to return the labor force participation rate of women to the level seen in 2000. Two of the most dramatic differences between these years, however, include the higher unemployment rate and the lower sensitivity to labor market conditions in 2005 relative to 2000. Looking more closely at the sensitivity to labor market conditions, Figure 6 plots the average marginal effect of a 1 percentage point change in the state unemployment rate on the probability of participating in the labor force in each year from 1977 to 2005.[16] On the secondary axis the figure also plots the average of the state unemployment rate in each year.

A few striking observations can be made from Figure 6. First, as expected, the marginal effects are always negative; an increase in the unemployment rate reduces a woman's likelihood of participating in the labor market.[17] Second, the years 1999 through 2005 were unique for women relative to earlier years. In no other years was women's sensitivity to labor market conditions as strong as in 1999 and 2000. And in no other years was women's sensitivity weaker than in 2004 and 2005. These years were also notable for their relatively low (1999 and 2000) and relatively high (2004 and 2005) average state unemployment rates. These observations lead to the third observation that labor market sensitivity tends to be countercyclical, demonstrating less sensitivity (smaller negative number) during years of higher unemployment rates.

What would be the impact on 2005 labor force participation if both the unemployment rate and labor market sensitivity returned to their 2000 levels? Figure 7 plots the actual labor force participation rates in 2000 (77.7 percent) and in 2005 (75 percent), plus what the labor force participation rate would be assuming 2005 characteristics and behavior, except for changing the unemployment rate or women's sensitivity to labor market conditions. The first simulation is the same as that in Figure 5: a 75.4 percent

Figure 7
Average Predicted Labor Force Participation (LFP) in 2000 and 2005 and Simulated LFP Assuming 2005 Characteristics, Except as Noted, Women Aged Twenty-five to Fifty-four



Note: Labor force participation is predicted for each woman in the 2005 sample and then averaged across the sample.

labor force participation rate if only the unemployment rate returned to its 2000 level. The second simulation is what is seen in Figure 6: a 64 percent labor force participation rate if only the responsiveness of women to changes in the unemployment rate returned to its 2000 level. The third simulation indicates that if both the unemployment rate and women's labor market sensitivity returned to their 2000 levels, the labor force participation rate would be 67.2 percent.

Because both the low unemployment rate and strong labor market sensitivity in 2000 are unique, assuming a return to the environment and behavior that existed that year may not be realistic. To illustrate what might be a more reasonable future path of labor force participation rates for women, Figure 7 presents two additional scenarios. The first assumes the low 2000 unemployment rate but applies a 1994–98 average labor market sensitivity. Under this scenario, the labor force participation of women (assuming other factors remain at their 2005 values) would be 69.4 percent, still below the 75 percent labor force participation rate of 2005. The second, even more conservative, scenario assumes a 1994–98 average unemployment rate and average labor market sensitivity. In this case, labor force participation would be only 66.7 percent.

While both the influence of current labor market conditions and the responsiveness of women to those conditions are relatively strong, the simulations in Figure 7

16. States were not all individually identified in the CPS until 1977. The earlier analyses average the unemployment rates for those states that were combined in 1976. Also, throughout this article the state unemployment rate for March was used. The results are nearly identical if a lagged unemployment rate (for example, February) was used.
17. The model structure assumes a symmetric labor force participation response to increases and decreases in the unemployment rate.

are consistent with the earlier conclusion that even significant changes among observable factors will not overcome the gap that emerged between labor force participation rates in 2000 and 2005.

Conclusions

After decades of consistent increases, the labor force participation of women began to flatten out in the late 1990s and decline after 2000. This article investigates the changes in the labor force participation rate among women aged twenty-five to fifty-four that have occurred over the past thirty years. For each decade between 1975 and 2005, the changes in labor force participation rates are decomposed into the portions explained by changes in either women's characteristics or women's behavior across each decade. Characteristics that have traditionally pushed women out of the labor market (number of children, being married, low education) have declined each decade, but by smaller and smaller amounts. More influential than changing characteristics, however, has been changing behavior, pulling women into the labor market for any given set of characteristics. The rate of change in behavior has also declined over the past thirty years. Indeed, behavioral change between 1994 and 2005 had a direct negative influence on the observed decline in the labor force participation rate during these decades.

Since 2000, the labor force participation behavior of women appears to be moving in parallel to that of men albeit with a significant gap in labor force participation rates that may not ever close.

Special attention is given to the unprecedented 2.7 percent decline in the labor force participation rate between 2000 and 2005, which can be explained by changes in both behavior and characteristics, with weaker labor market conditions in 2005 being one of the characteristics providing the greatest downward pressure. However, if the unemployment rate had been at the 2000 level of 4.5 percent in 2005 (holding everything else at 2005 levels), the labor force participation rate of women would still have been 2.3 percentage points lower than in 2000. Other characteristic changes that contributed to the decline in female labor force participation included a lower percent of high school graduates, a greater percent of Hispanic women, and women having more children under the age of six, on average.

Among observable behavioral changes, the largest contributor to the labor force participation rate decline between 2000 and 2005 was the weaker pull of education into the labor market. The lower probability of Hispanic and black women participating in the labor market in 2005 and the stronger push of disability income on women out of the labor market also contributed to the decline. One behavior that changed quite dramatically between 2000 and 2005 was women's sensitivity to labor market conditions. In 2000 a 1 percentage point drop in the unemployment rate (ceteris paribus) would have led to an increase in labor force participation of 1.9 percentage points, whereas the same drop in the unemployment rate in 2005 would have led to only a 0.3 percentage point increase in the labor force participation rate. The combined impact of the labor market returning to its average 1994–98 conditions and the average sensitivity to those conditions would result in a labor force participation rate of 66.7 percent, lower than in 2005.

While changes in specific, observable behavior and characteristics can be identified as contributing to the decline in female labor force participation since 2000, it is important to realize that there remains one key determinant of labor force participation decisions about which the analysis in this article has little to say—that is, unobservable,

or unexplained, behavior. Even though clearly observable factors have worked to reduce female labor force participation, other observable factors have been working to increase it. For example, women's responses to changes in nonlabor income, marriage, children, and labor market conditions have provided less of a push out of the labor market in 2005 than in 2000. Taking into account the impact of all observable characteristics and behavioral changes between 2000 and 2005, it is the change in unobservable factors that has had the strongest impact on the decline in labor force participation rates over this period. The large role that unobservables play in the determination of labor force participation is not unique to the 2000–05 period, nor is it unique to women.

The presence of unobservables is not very satisfying or informative from a policy perspective. Nonetheless, their large role in the determination of labor force participation rates suggests that a rebound of the labor market to the environment that existed in 2000 is not likely to cause female labor force participation to rebound to 2000 levels without changes in unobservable factors that cannot be predicted. The pull of college education into the labor force apparently began to weaken for women in the late 1990s but has slowed in its decline. Also, the push for women out of the labor force caused by marriage and children continues to weaken, as does the push resulting from higher nonlabor income. Indeed, it is striking how, since 2000, the labor force participation behavior of women appears to be moving in parallel to that of men albeit with a significant gap in labor force participation rates that may not ever close. Further investigation of how labor force participation decisions are made in a family context and how these joint (spousal) decisions have changed over time is the next obvious step in the ongoing scrutiny of the declining labor force participation rates of women.

Appendix
Additional Tables

Table A1
Sample Means and Maximum Likelihood Probit Parameter Estimates (and Standard Errors) for 1977, 1984, and 1994, Women Aged Twenty-five to Fifty-four

	Weighted sample means			Dependent variable = probability of labor force participation		
Characteristic	**1977**	**1984**	**1994**	**1977**	**1984**	**1994**
Age	38.3	37.4	38.3	0.0503 (0.0110)	0.0687 (0.0110)	0.0818 (0.0117)
Age squared	1,545.65	1,474.06	1,535.84	–0.0008 (0.0001)	–0.0011 (0.0001)	–0.0012 (0.0002)
# children YT 6	0.323	0.338	0.329	–0.5585 (0.0160)	–0.4924 (0.0149)	–0.4911 (0.0148)
# children aged 6–18	1.090	0.816	0.739	–0.0925 (0.0075)	–0.1318 (0.0089)	–0.1230 (0.0096)
Married, spouse present	75.8%	69.5%	64.5%	–0.2669 (0.0234)	–0.1567 (0.0228)	0.0333 (0.0232)
High school graduate	59.9%	63.0%	63.7%	0.4497 (0.0203)	0.6114 (0.0225)	0.7597 (0.0254)
College degree or more	14.8%	19.5%	23.7%	0.8041 (0.0297)	1.0166 (0.0301)	1.1540 (0.0318)
Nonlabor income (per yr.)	$43,384	$38,103	$37,566	-6.6×10^{-6} (3.0×10^{-7})	-5.5×10^{-6} (3.0×10^{-7})	-4.5×10^{-6} (3.1×10^{-7})
Hispanic	2.0%	3.1%	4.7%	0.0721 (0.0630)	–0.0914 (0.0501)	–0.1867 (0.0393)
Black	11.1%	11.9%	12.9%	0.1189 (0.0295)	0.0615 (0.0301)	–0.06181 (0.0292)
Disability income (per yr.)	—	—	$60.82	—	—	-5.1×10^{-5} (0.0000)
State unempl. rate	8.46%	8.51%	7.18%	–0.0344 (0.0048)	–0.0281 (0.0040)	–0.0449 (0.0063)
Intercept	—	—	—	0.2711 (0.2110)	–0.1732 (0.2097)	–0.6303 (0.2269)
N	30,187	32,984	33,411			

Notes: All means across years are significantly different from one another at least at the 95 percent confidence level except age, age squared, and number of children younger than six (1977 versus 1994); and number of children younger than six, high school graduate, and nonlabor income (1984 versus 1994). The parameter coefficients are all significantly different from one another at the 95 percent confidence level. All parameter coefficients are significantly different from zero at least at the 95 percent confidence level except for the coefficient on Hispanic and the intercept (1977 and 1984) and married, spouse present (1994). All dollar values are inflated to 2004 values using the consumer price index.

Table A2
Sample Means and Maximum Likelihood Probit Parameter Estimates (and Standard Errors) for 1977, 1984, 2000, and 2005, Men Aged Twenty-five to Fifty-four

	Weighted sample means				Dependent variable = probability of labor force participation			
Characteristic	**1977**	**1984**	**2000**	**2005**	**1977**	**1984**	**2000**	**2005**
Age	38.2	37.4	39.4	39.6	0.1144 (0.0174)	0.1026 (0.0163)	0.0263 (0.0172)	0.0557 (0.0140)
Age squared	1,541.75	1,467.60	1,617.29	1,639.64	–0.0016 (0.0002)	–0.0015 (0.0002)	–0.0006 (0.0002)	–0.0009 (0.0002)
# children YT 6	0.345	0.338	0.273	0.272	0.0503 (0.0288)	–0.0131 (0.0264)	0.1224 (0.0333)	0.0911 (0.0280)
# children aged 6–18	0.939	0.673	0.593	0.570	0.0068 (0.014)	–0.0090 (0.0161)	0.0686 (0.0187)	0.0899 (0.0161)
Married, spouse present	78.4%	70.1%	62.2%	59.9%	0.6289 (0.0375)	0.6372 (0.0346)	0.5041 (0.0328)	0.5586 (0.0289)
High school graduate	51.7%	55.2%	58.7%	57.4%	0.4369 (0.0324)	0.5328 (0.0324)	0.5251 (0.0343)	0.36153 (0.0300)
College degree or more	23.1%	26.5%	29.2%	29.6%	0.6520 (0.0436)	0.7957 (0.0418)	0.9313 (0.0430)	0.7012 (0.0370)
Nonlabor income (per yr.)	$17,104	$18,895	$25,646	$25,448	-7.9×10^{-6} (5.5×10^{-7})	-6.4×10^{-6} (5.3×10^{-7})	-3.6×10^{-6} (3.6×10^{-7})	-2.9×10^{-6} (2.7×10^{-7})
Hispanic	1.8%	2.8%	5.0%	7.1%	–0.4292 (0.0911)	–0.5172 (0.0675)	–0.1937 (0.0603)	–0.2512 (0.0390)
Black	9.5%	10.2%	11.6%	11.1%	–0.2230 (0.0441)	–0.2693 (0.0432)	–0.3309 (0.0398)	–0.3297 (0.0323)
Disability income (per yr.)	—	—	$100.63	$89.79	—	—	–0.0001 (-1.5×10^{-5})	-9.0×10^{-5} (-1.1×10^{-5})
State unempl. rate	8.4%	8.5%	4.4%	5.8%	–0.0135 (0.0084)	–0.04514 (–0.3912)	–0.0485 (0.0157)	–0.0552 (0.0107)
Intercept	—	—	—	—	–0.7469 (0.3340)	0.0064 (–0.3912)	0.8426 (0.3413)	0.2407 (0.2748)
N	27,698	30,216	27,874	42,138				

Notes: All means across years are significantly different from one another at least at the 95 percent confidence level except number of children younger than six (1977 versus 1984) and number of children younger than six, high school graduate, college degree or more, nonlabor income, and black (2000 versus 2005). The parameter coefficients are all significantly different from one another at the 95 percent confidence level. All estimated parameter coefficients are significantly different from zero at least at the 95 percent confidence level except for the coefficients on children younger than six, children aged six to eighteen, and the state unemployment rate (1977); children younger than six, children aged six to eighteen, and the intercept (1984); age (2000); and the intercept (2005). All dollar values are inflated to 2004 values using the consumer price index.

REFERENCES

Bailey, Martha J. 2004. More power to the pill: The impact of contraceptive freedom on women's labor supply. Vanderbilt University, photocopy, April.

Blau, Francine D., and Lawrence M. Kahn. 2005. Changes in the labor supply behavior of married women: 1980–2000. NBER Working Paper 11230, March.

Bradbury, Katharine. 2005. Additional slack in the economy: The poor recovery in labor force participation during the business cycle. Federal Reserve Bank of Boston Public Policy Briefs 05-2.

Bradbury, Katharine, and Jane Katz. 2005. Women's rise: A work in progress. Federal Reserve Bank of Boston *Regional Review* 14, no. 3:58–67.

Burtless, Gary, and Robert A. Moffitt. 1984. The effect of Social Security benefits on the labor supply of the aged. In *Retirement and economic behavior*, edited by Henry J. Aaron and Gary Burtless. Washington, D.C.: Brookings Institution.

Cremer, Helmuth, Jean-Marie Lozachmeur, and Pierre Pestieau. 2004. Social Security, retirement age, and optimal taxation. *Journal of Public Economics* 88, no. 11:2259–81.

DiNatale, Marisa. 2005a. More on labor force participation. *DismalScientist*, March 8. <www.economy.com/dismal/pro/article.asp?cid=12672> (March 14, 2005).

———. 2005b. On labor force participation rates. *DismalScientist*, February 1. <www.economy.com/dismal/pro/article.asp?cid=11688> (March 14, 2005).

Goldin, Claudia. 1995. The U-shaped female labor force function in economic development and economic history. In *Investment in human capital*, edited by T. Paul Schultz. Chicago: University of Chicago Press.

Gruber, Jonathan. 2000. Disability insurance benefits and labor supply. *Journal of Political Economy* 108, no. 5:1162–83.

Herrnstein, Richard J., and Charles Murray. 1994. *The bell curve: Intelligence and class structure in American life*. New York: Simon and Schuster.

Hotchkiss, Julie L. 2003. *The labor market experience of workers with disabilities: The ADA and beyond*. Kalamazoo, Mich.: W.E. Upjohn.

Hotchkiss, Julie L., Mary Mathewes Kassis, and Robert E. Moore. 1997. Running hard and falling behind: A welfare analysis of two-earner families. *Journal of Population Economics* 10, no. 3:237–50.

Hotchkiss, Julie L., and M. Melinda Pitts. 2005. Female labour force intermittency and current earnings: Switching regression model with unknown sample selection. *Applied Economics* 37, no. 5:545–60.

Kirkland, Katie. 2002. Declining teen labor force participation. *Issues in labor statistics*, Summary 02-06, September.

Lumsdaine, Robin L., James H. Stock, and David A. Wise. 1997. Retirement incentives: The interaction between employer-provided pensions, Social Security, and retiree health benefits. In *The economic effects of aging in the United States and Japan*. Chicago: University of Chicago Press.

Neal, Derek. 2004. The measured black-white wage gap among women is too small. *Journal of Political Economy* 112, no. 1, part 2:S1–S28.

Rindfuss, Ronald R., Karin L. Brewster, and Andrew L. Kavee. 1996. Women, work, and children: Behavioral and attitudinal change in the United States. *Population and Development Review* 22, no. 3:457–82.