A behavioral model for projecting the labor force participation rate

Various factors, including economic cycles, wages, school enrollment, and marital status, affect the participation of different groups of workers in the labor force; a behavioral model that accounts for these variables yields results similar to those obtained from the current BLS model used to project the labor force participation rate

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Economic growth depends primarily on changes in two factors: the growth of the labor force and changes in labor force productivity. The entry of large numbers of baby boomers into the U.S. labor market, coupled with the rapid increase in women's labor force participation rates during the 1970s and 1980s, resulted in a sizable increase in the supply of the labor force and contributed considerably to the economic growth of that period. Consequently, of the 3.2-percent annual rate of growth of gross domestic product (GDP) over that period, 2.5 percent was attributable to labor force growth and 0.7 percent resulted from changes in labor productivity.[1] Growth in labor productivity, however, has been considerably greater since then. During the 1991–2001 period, out of the 3.1-percent annual growth of GDP, 1.2 percent was the result of labor force growth and the remaining 1.9 percent was attributable to rising productivity growth. More recently, out of the 2.7-percent growth of GDP over the 2002–09 timeframe, the labor force grew at a rate of 1.0 percent while productivity growth was 1.7 percent.[2] Because the growth of the labor supply has such a significant impact on economic growth, projecting the size and composition of the labor force is a major task in macroeconomic forecasting.

The Bureau of Labor Statistics (BLS, the Bureau) publishes medium-term, or 10-year, labor force projections every 2 years. The Bureau takes a long-term view by assuming a long-run full-employment economy in which unemployment is frictional and not a consequence of deficient demand.[3] The projected labor supply in the BLS model is a product of two factors: the size and growth of the population, by age, gender, race, and ethnicity; and the future trend of labor force participation rates—that is, the percentages of the civilian noninstitutional population in various age, gender, race, and ethnic groups that are in the labor force.

By definition, labor force participation is a binary variable: an individual is either in the labor force or not in the labor force. That definition does not require a minimum number of hours of work for someone to be a participant in the labor force.

The BLS labor force projections are based on the U.S. Census Bureau's projections of the U.S. resident population. The population projections use alternative assumptions about

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three main factors that affect population growth: fertility, life expectancy, and net international migration. In the past, the Bureau of Labor Statistics has used the "middle series" population projection, which assumes mid-level values for the three factors and is considered by the Census Bureau to be the most likely path of future population change.[4]

In the first stage of the labor force projection process, the concept of the resident population is converted to that of the civilian noninstitutional population. The conversion takes place in four steps. First, children under 16 years are taken out of the total resident population. Second, the Armed Forces, broken down into different age, gender, race, and ethnic categories, are eliminated from totals in order to estimate the civilian population. Third, the institutional population is subtracted from the civilian population to estimate the civilian noninstitutional population.[5] Finally, the civilian noninstitutional population is benchmarked to the most recent annual average data for that population from the Current Population Survey (CPS).[6] The 2006–16 BLS labor force projection model has utilized the CPS participation rate series from 1970 to 2006 for 136 age, gender, race, and ethnic groups.

In the second stage of the projections, a nonlinear filter is used to smooth historical labor force participation rates for all age, gender, race, and ethnicity groups. The filter smooths the trend line by using, first, a running median of length 5, then one of length 3, and then a centerweighed moving average of length 3.[7] The smoothed data are then transformed into logits, also called the natural logarithm of the odds ratio or flogs (folded logs). Once the data are thus transformed, they are extrapolated linearly by regressing the flog of the rate against time and then extending the fitted series to or beyond the target year. When the series are transformed back into participation rates, the projected path is nonlinear. Participation rates that have been changing slowly will continue to change slowly, and the pattern will be linear. Participation rates that have been changing rapidly will continue to increase rapidly in the short run and then gradually decrease their rate of change.[8]

Next, projected labor force participation rates are reviewed for consistency. The time path, cross section in the target year, and cohort patterns of participation are all reviewed and, if necessary, modified. Finally, projected labor force participation rates are multiplied by the projected civilian noninstitutional population, yielding labor force projections for each age, gender, race, and ethnic group.[9]

In addition, the Bureau carries out periodic evaluations of its labor force projections. Comparisons of past BLS labor force projections with actual data enable the Bureau to identify the strengths and weaknesses in its projections process. The purpose of any evaluation is to find the sources of errors in past projections and to improve the accuracy of future projections.[10] On the basis of the 2005 independent study of BLS labor force projections, it was concluded that BLS estimates were more accurate than those obtained from a naïve model that was used as the standard of comparison for the 2000 labor force estimates.[11] The BLS projections also accurately predicted the structural changes that occurred in the labor force between 1988 and 2000.[12] In the most recent evaluation, the BLS 1996–2006 projection again outperformed the alternative, naïve model.[13]

In addition to the Bureau, several other public agencies, including the Congressional Budget Office and the Social Security Administration, project labor force participation rates and the labor force. Also, a number of private firms project participation rates and the labor force, either alone or in conjunction with their macroeconomic projections. In accordance with their priorities and their access to data sources, all of these organizations take into account different demographic, social, and economic factors and select different assumptions, methodologies, and models in their projections. In addition, their projection horizons vary from the short term to the very long term; the Social Security Administration, for example, projects 75 years into the future.

BLS labor force projections face uncertainties with regard to the two primary factors that are important to labor force change: population and participation. Although population growth generates most of the change in the labor supply, gradual changes in participation rates also make significant differences in the long run. Thus, the relevant questions become (1) Which participation trends are likely to continue into the future, and which may change? and (2) How do demographic changes, as well as structural and cyclical features of the economy, affect participation rates?

Labor force participation reflects the labor market behavior of different groups in the population. Changes in the overall labor force participation rate and in the rates of the various population groups are the result of a combination of the three factors mentioned in question (2) in the previous paragraph. Each of these factors—demographic changes in the population and structural and cyclical features of the economy—affects the participation rates of the different groups in various ways. A prime example of a demographic change affecting the labor force participation rate is the aging of the baby-boom generation. In the

year 2000, baby boomers were ages 36 to 54 years and were in the group with the highest participation rates. With the passage of every year thereafter, a segment of the baby-boomer population enters the 55-years-and-older age group and thus moves from a group with a high participation rate in the labor force into another age category with a much lower participation rate (a phenomenon called a negative demographic composition effect), causing the overall participation rate to decrease.

The U.S. labor market is currently experiencing a negative demographic composition effect. In contrast, the 1970s saw a positive demographic composition effect when baby boomers were increasingly joining the prime-age workforce, causing an increase in the labor force participation rate.

Among the structural changes to the U.S. economy are long-term changes in tastes, preferences, educational attainment, and technology. The rise in school attendance in the past two decades is a structural change that has left a permanent mark on the labor market.

Cyclical changes in participation rates happen in response to business cycles and are generally short-term phenomena. Labor force participation rates usually increase during economic expansions and decline in economic downturns. Historically, cyclical factors have had the largest impact on the labor force participation of youths. Interestingly, a structural change has the potential to exaggerate or ease a cyclical effect. For example, the rising school attendance of youths, a structural change, strengthened the impact of the recession of 2001, a cyclical effect. This combination of structural and cyclical changes depressed youth participation rates to a new low at the time. At one time or another, a combination of demographic, structural, and cyclical changes has affected the overall participation rate, as well as the participation rates of different age, race, gender, and ethnic groups in the past.

The standard BLS labor force projection model is based on an extrapolation of past participation rates after a process of numerical smoothing and filtering. Such a model incorporates demographic factors, but does not directly take into account the behavioral aspects, economic factors, structural changes, and dynamic conditions of the labor market.

The desirability of a model-based approach in which economic and social factors determine participation in the labor force has been raised frequently as a topic of interest. To pursue that interest, this article develops a behavioral model that uses and tests variables other than trends in labor force participation rates to project such rates for selected age groups over the 2006–16 timeframe.[14] The projected participation rates obtained are then compared with their counterparts in the standard BLS projection model for the 2006–16 timeframe in order to highlight differences between the two approaches. Finally, for a comparative evaluation of the accuracy of the projections produced by both models, projected participation rates obtained from each model are compared with actual CPS data for 2007–09. (Note that 2006 data are historical data in both models. In addition, actual data for 2007, 2008, and 2009 were used only for purposes of comparison and not as input data in the projection model.)

Specifications of the behavioral model

The behavioral model discussed next uses a set of economic and demographic variables to explain why participation rates for specific groups of the population change over time.[15] These explanatory variables were used for all or some of the selected age groups and gender groups. The final specification for each group was decided on the basis of a model that was empirically consistent with both economic theories and current empirical studies on labor force participation and that also resulted in coefficients which were statistically significant.

General level of economic activity. The state of the job market is a key variable that affects the decisions of individuals to participate in the labor force. During economic expansions, there is a higher demand for labor; thus, participation rates generally increase for all groups. During economic contractions, by contrast, there is less hiring and less demand for labor; consequently, the labor force participation rate decreases.

To capture the impact of the general level of economic activity and the stage of the economic cycle on participation rates, the change in the ratio of total employment to total population (the employment-population ratio) is used as an independent variable.[16] This variable, which tends to move in a direction opposite that of the unemployment rate, closely reflects the ups and downs of aggregate demand and expansionary or recessionary phases of the business cycle and is thus a good proxy for aggregate demand in measuring the economic cycle.[17]

Note that the general level of economic activity also affects participation rates in part through changes in the number of discouraged workers. During recessions, the number of discouraged workers increases. By definition, discouraged workers are persons who are not in the labor force, but who want and are available for a job and who have looked for work sometime in the 12 months prior

to their being interviewed for the CPS (or since the end of their last job if they held one within those 12 months), but who are not currently looking because they believe that there are no jobs available or that there are none for which they would qualify. In 2009, the number of discouraged workers was more than 3 times the number in 2000. As economic conditions improve and discouraged workers find jobs and reenter the job market, the labor force participation rate begins to show some cyclical recovery and increases.

The wage effect. In addition to the general level of economic activity, wages are a determining factor in changes in the labor force participation rate.[18] The wage variable used in the model presented here is total wages paid at the macrolevel, not wages paid to the various age and gender groups. Nor does it include reservation wages and the expenses associated with joining the labor force or the cost of forgone home production.[19] Economic theories suggest that the decision to participate in the labor market is an economic choice whereby individuals rationally decide how to allocate time between work and leisure, with the objective of optimizing their total resources. An individual participates in the labor market on the basis of the expected return from working compared with the expected satisfaction acquired from not working.[20]

When individuals are confronted with a wage increase, two factors affect their decisions about allocating time between work and leisure: the income effect and the substitution effect. The decision depends on which effect is dominant. The income effect of a wage increase results in an increase in the demand for all goods and services, including leisure. A higher demand for leisure will lead to lower participation in the labor market. The substitution effect of an increase in wages has the opposite effect, by increasing the opportunity cost for leisure, resulting in reduced demand for leisure and higher participation in the paid labor market. However, in many instances, income and substitution effects may lead to reduced work hours and not necessarily increase or decrease participation. In general, the net impact of income and substitution effects will determine the effects of wages and other wage-induced factors on the individual's participation in the labor market.

The income and substitution effects of a wage increase for women are discussed in Claudia Goldin's numerous research publications on the role of women in the labor market.[21] Goldin states that the increased labor force participation rate for women was the most significant change in labor markets during the 20th century. She divided the period from the late 19th century to the present into three "evolutionary" and one "revolutionary" period, with the following different substitution and income effects:

1. In the first period, from the late 19th century to the 1920s, the negative income effect from an increase in the husband's income greatly exceeded the positive substitution effect from an increase in the wife's earnings.
2. The second phase, from 1930 to the 1950s, was a transition era. As work for women became more accepted by both society and their husbands, and as opportunities for part-time work increased, the income effect declined. At the same time, the substitution effect rose substantially. As the real wage for women rose, the margin of change was participation, not hours.
3. The third phase, which Goldin calls the "roots of the revolution," was from 1950 to the mid- or late 1970s. In this phase, the female labor supply was rather elastic. The large increase in final demand with the expansion of part-time work led to a considerable increase in the participation rate of married women. The income effect continued its decline and the substitution effect increased.
4. The final phase, which Goldin calls the "quiet revolution," started in the 1970s and is continuing to the present. In this phase, women born in the late 1940s and who were teenagers in the mid-1960s began to perceive that their adult lives would differ substantially from those of their mothers' generation. The income and substitution effects of the labor supply changed once again, and no longer was women's labor supply highly elastic. Indeed, it was influenced even less than before by the husband's earnings.

School enrollment. School attendance dampens youth participation rates. The current downward trend in the labor force participation of teenagers ages 16 to 19 years and young adults ages 20 to 24 years has been attributed primarily to increasing school attendance among these age groups.[22] One work on this subject found that school enrollments have increased by roughly 25 percent since 1985, mostly from an increase in summer school enrollments.[23] The increase in the number of students enrolled at different education levels is considered a structural change with a long-term impact on the participation rate of teenagers, young adults, and, ultimately, the overall labor force.

Women's marital status. Since the 1950s, the labor force participation rate of women has increased steadily, reaching a peak of 60.0 percent in 1999. This strong growth was caused by rising participation of different groups of women in the labor force, including single women, a group that consists of widowed, divorced, separated, and never-married women. Historical data show that, as the share of single women in the population increases, the labor force participation rate of all women increases. Single women, including divorced women, spend more time in the labor market than married women do because of the absence of the husband's income.[24] In this model, the share of single women in the total female population has been used as a variable explaining the long-term change in women's participation rates.

Lagged participation rates and time trend. These two variables are respectively used to capture the effects of the short- and long-term patterns of change in participation rates. The lagged participation rate emphasizes the aggregate cyclical effects and picks up any trend effects not captured by other explanatory variables. The time trend, by contrast, reflects more of the long-term structural movements.

The model. The general specification of the behavioral model is

$$\text{LFPR}_t = f(\text{LEP}_t, W_t, M_t, E_t, T),$$

where

LFPR_t = Labor force participation rate at time t,
LEP_t = Logarithm of change in employment-population ratio
= Logarithm of employment-population ratio at time t minus logarithm of employment-population ratio at time $t-1$
$= \log(\text{EMP}_t/\text{POP}_t) - \log(\text{EMP}_{t-1}/\text{POP}_{t-1})$,

in which

EMP_t = Employment at time t,
POP_t = Total population at time t,
EMP_{t-1} = Employment at time $t-1$,
POP_{t-1} = Total population at time $t-1$,
W_t = Total wages,
M_t = Marital status,
E_t = Education and school attendance,
T = Time trend, reflecting the long-term trend

Data Sources

The time-series data used to estimate the model's coefficients range from 1970 to 2006 and constitute 36 observations in total. This timeframe was selected, first, to correspond with the 2006–16 BLS labor force projections published in the November 2007 *Monthly Labor Review* and, second, to provide projected values for 2007, 2008, and 2009, for which actual data are currently available. Historical labor force participation rates are from CPS annual averages from 1970 to 2005. The population projections utilized in the behavioral model are based on the Census Bureau's projection of the resident population, the same data series used in the computation of the civilian noninstitutional population in the BLS labor force projections for 2006–16.[25]

Employment data used in the estimation of the logarithm of future employment-population ratios (variable LEP in the model) were obtained from the 2006–16 BLS macroeconomic projections of the U.S. economy.[26] Historical data on the employment-population ratio were derived from the CPS. The projected values for the model's wage variable W_t were estimated from the wage variable used in the 2006–16 projections from the BLS macromodel.[27]

The historical share of single women in the total female population was estimated from the CPS data. Future values of the share of single women were extrapolated on the basis of past trends. Future values for men's and women's school enrollment data were based on projection data from the National Center for Education Statistics for the 2006–16 period.

Estimation

The method of ordinary least squares was used to estimate the model's equations. The model was run repeatedly, using various independent variables and a lagged dependent variable for different age and gender groups. The final specification for each group was decided on the basis of four factors: the availability of data, compatibility with economic theory, the statistical significance of the coefficients, and the goodness of fit of the regressions. All of the variables were transformed into natural logarithms so that the growth in the variance over time would not overwhelm the model. The log-linear nature of the model affords a comparison of the magnitudes of the coefficients, which represent the elasticity of labor force participation with respect to changes in the explanatory variables. Using the estimated equations, BLS analysts projected labor

force participation rates to 2016 on the basis of projected values, or assumptions about the future values, of the independent variables.

Projections were made for 10 population groups consisting of the following five age groups of men and five age groups of women:

- Teenagers: 16- to 19-year-olds
- Young adults: 20- to 24-year-olds
- Those in the prime ages: 25- to 54 year-olds
- The older age group: 55- to 64-year-olds
- The oldest age group: 65 years and older

Regression results for the model are given in table 1 and discussed in more detail next.

Teenagers (16- to 19-year-olds). Changes in the level of economic activity represented by the overall employment-population ratio had the largest impact on the participation rates of both male and female teenagers. In general, the participation rates of teenagers increase during economic expansions, decline in economic downturns, and are extremely dependent on economic cycles. It is teenagers' lack of experience and skills, as well as the fact that a large proportion of them work part time, that makes this group vulnerable and more at risk of being laid off during recessions. As was expected, the estimates produced by the model showed positive, statistically significant coefficients for the changes in (the logarithm of) the teenage employment-population ratio (LEP).

In addition to the rise and fall in the level of economic activity, increases in school enrollment lower the participation rate of teenagers. In recent years, increases in school attendance and enrollment at the secondary and college levels—especially increasing rates of enrollment during the summer months—have had a large impact on the declining teen participation rate.[28] The rising enrollment rates led to an increase in the share of students in the total population of 16- to 19-year-olds, another reason the participation rate of teenagers has been decreasing. Economic theory suggests that teenagers turn to schooling when the labor market is weak and, at the same time, the opportunity cost of school enrollment is low while the return from investment in education is high.[29] Consistent with other research on this subject,[30] the behavioral model showed a negative impact of school enrollment on youth participation rates. However, the estimates obtained point to a lower elasticity for this variable, and the coefficient is not statistically as significant as the effect of changes in the employment-population ratio. By contrast, the coefficient of the trend factor, reflected in the lagged value of the labor force participation rate, was positive and statistically significant.

Young adults (20- to 24-year-olds). For this age group, the change in (the logarithm of) the employment-population ratio (LEP), along with wages and the lagged dependent variable, yielded the best fit and produced statistically significant coefficients. As with teens, the labor force participation rates of young adults who were enrolled in school were lower than those of their counterparts who were not in school. Although school enrollment rates for both teens and young adults have increased substantially over the past several decades, enrollment rates for 20- to 24-year-olds, not surprisingly, are lower than those for 16- to 19-year-olds, because many in the former group have already completed their formal education.[31] School attendance for this age group turned out not to be statistically significant and was omitted from the final specifications. It appears that, although schooling is a significant factor in delaying the entry of young adults into the workforce, once they do enter the workforce, higher wages play a stronger role, both in absorbing these individuals into the labor market and in keeping them there. The coefficient of the wage variable was negative for 20- to 24-year-olds. There are two views on the sign of this variable. On one view, the curve designating the supply of labor, like most other supply curves, should rise in relation to wages. That is, an increase in wages results in both higher income and increases in the consumption of all goods and services, including leisure, which is time not spent in the labor market. Therefore, the income effect of a wage increase can lead to less work and more leisure time, resulting in a lower labor force participation rate. On the other view, the substitution effect plays a role and suggests an opposite outcome, namely, that an increase in wages increases the opportunity cost of leisure time, leading to less demand for leisure and more time spent working.[32] This outcome would yield a higher participation rate. The net result of these two factors—income and substitution effects—will decide the sign of the wage variable. For young adults, it seems that the income effect is greater than the substitution effect, leading to a negative coefficient for wages as an explanatory variable.

Prime ages (25- to 54-year-olds). Of all age groups, 25- to 54-year-olds have the strongest ties to the labor market. The participation rate of men of these ages was 93.4 percent in 1990, 91.6 percent in 2000, and 89.4 percent,

Table 1. Regression results from the behavioral model

Age group	Constant	Logarithm of employment-population ratio	Logarithm of wage	Logarithm of school enrollment	Logarithm of lagged dependent variable	Trend	Logarithm of share of single women	R^2	Auto-regressive AR(1) result
16 to 19 years									
Men.....	0.316590	2.166528 (4.72)	–	–0.026908 (0.81)	0.960388 (13.97)	–	–	0.968188	–
Women..	.424009	1.8889721 (4.41)	–	–.024202 (–1.08)	.928673 (11.22)	–	–	.947721	–
20 to 24 years									
Men.....	.597093	.385658 (6.12)	–.006399 (–4.2)	–	.875761 (19.02)	–	–	.967237	–
Women..	.316898	.39202 (3.18)	–.007332 (–1.76)	–	.939467 (21.83)	–	–	.9793	–
25 to 54 years									
Men.....	4.201151	–	.054081 (3.62)	–	–	–.004532 (6.24)	–	.98962	.98962
Women..	2.086541	–	.135303 (2.82)	–	–	–	.37347 (2.09)	.94889	–
55 to 64 years									
Men.....	.379050	–	.024435 (2.50)	–	.879639 (13.28)	–.021799 (1.74)	–	.98313	–
Women..	.067075	–	.020965 (3.92)	–	.943514 (28.80)	–	–	.991415	–
65 years and older									
Men.....	–.208864	–	.031327 (3.21)	–	.986187 (20.64)	–	–	.956004	–
Women..	–.148524	–	.031044 (3.46)	–	.960363 (16.63)	–	–	.991415	–

NOTE: *t*-statistics are shown in parentheses after the value. All results displayed are statistically significant at the 95-percent level of confidence. Dash indicates variable was omitted from regression because of statistical insignificance.

the lowest ever since records were kept, in 2009. The labor force participation rate of women was 74.0 percent in 1990, 76.7 percent in 2000, and 75.6 percent in 2009. The overall participation rate for this age group has trended downward over the past decade, falling from a peak of 84.1 percent in 1998 to 82.6 percent in 2009. The prime-age workforce is the least sensitive to economic downturns, compared with other age groups.

For men in the prime-age group, wages turned out to be a major determinant of their decisions to participate in the labor force. The coefficient of the wage variable was positive and statistically significant, indicating a positive correlation between wages and the participation rate of 25- to 54-year-old men. A trend variable was added to the model to include the impact of all other factors besides wages affecting the long-term decline in the participation rate of men in the prime-age group. The trend variable could identify factors such as the shift seen over the past couple of decades from workers' participation in so-called defined benefit pension plans, which encourage early retirement, to defined contribution plans, which might prolong the working years. Also included in this variable are factors such as increases in Social Security disability benefits. A study by David Autor and Mark Duggan reviewed changes in the labor force participation rate of the less skilled labor force between 1984 and 2000 and concluded that the liberalization of the disability program during that timeframe could explain the role of disability benefits in lowering the participation rate of the nonelderly at the time.[33]

Because men in this age group have the highest participation rates and the strongest ties to the labor market, the employment-population ratio did not yield satisfactory results and was omitted from the final equation for the group.

Women in the 25- to 54-year age group increased their labor market participation significantly during the latter

half of the 20th century. In 1950, the women's participation rate was 35.0 percent. After reaching an all-time peak of 76.8 percent in 1997, the rate dropped to 75.6 percent in 2009. Even with the drop, the rate posted an increase of 40.6 percentage points over 60 years. A large part of this increase reflects a generational shift, as women of the baby-boom generation participated in the labor force at a rate significantly higher than their predecessors did.[34]

The increase in the women's participation rate, specifically for the 25- to 54-year age group, applies to all subgroups of women: women who have never been married, married women, and married women with children less than 6 years of age. However, single women, a group that includes divorced, widowed, and separated women, as well as women who have never married, contributed significantly to the rapid expansion of women's participation rates. Single women have high labor force participation rates compared with those of other groups of women. In fact, the participation rate of single women in the labor market is as strong as the participation rate of their male counterparts.

As the share of single women in the female civilian noninstitutional population has increased (from 35 percent in 1950 to 50.1 percent in 2009), their participation rate also has increased substantially.[35] Several factors have been responsible for the increase in the percentage of single women. First, women remain single more often, and marry later in life, than they used to, which is why the median age at first marriage has increased by 4.3 years since 1970, to 25.3 in 2003.[36] In addition, college-educated women marry 2 years later, on average, than the rest of the female population, so, given that the number of college-educated women has risen over the past several decades, the median age at first marriage has risen as well. In addition, among those women ages 25 to 44 years, single mothers with children increased their participation rate in the labor force, especially after the passage of the Federal Welfare Reform Act in 1996.

Moreover, divorce rates rose sharply, doubling between the mid-1960s and the mid-1970s. Afterward, the divorce rate peaked in the late 1970s and has been on a decline since then, from a high of 22.8 divorces per 1,000 married couples in 1979 to 16.7 in 2005.[37] In addition, women have higher life expectancies than men, a factor that, over time, increases the number of single women in the older age groups in the labor force. Finally, between 1994 and 2005, the participation rate of unmarried mothers who were high school dropouts rose by 13.3 percentage points. It is possible that this rate of increase in the labor force participation rate of single mothers with low levels of educational attainment was due in large part to the stringent work requirements of welfare reform legislation enacted during the 1990s.[38]

In the behavioral model, the regression on the share of single women in the total civilian noninstitutional population of women resulted in a strong positive, statistically significant coefficient for the female prime-age group. In addition, their rise in wages has been a factor encouraging higher participation among women: according to one study, as wages rise, women tend to delay marriage and have fewer children, thus increasing their participation in the labor force.[39] The substitution effect affects the participation rate of women in a positive fashion, whereas the income effect does so in a negative way. Most research points to the dominance of the substitution effect of a wage increase for women, leading to an increase in the participation rate.[40]

In the model, the wage variable was positively correlated with the participation rate of women in the prime-age group whereas the trend factor had a negative coefficient.

Older workers (55- to 64-year-olds). The wage variable for men in this age group had a positive coefficient, indicating that higher wages encourage more participation from older men. The long-term trend had a negative effect on participation rates of the group, while the short-term trend, reflected in the lagged participation rate, had a positive effect. The results are consistent with the historical data. The labor force participation rate of men in the 55- to 64-year age group was 83.0 percent in 1970, declined to 66.0 percent in 1995, and then increased to 70.2 percent in 2009. All coefficients in the equation of this group were statistically significant, and the regression had a correlation coefficient of 98.0 percent.

The labor force participation rate of women in the 55- to 64-year age group has increased substantially since 1970, when it stood at 43.0 percent. The group posted a 49.2-percent rate in 1995, after which it saw its participation rate accelerate, reaching an all-time high of 60.0 percent in 2009. As with men in the same age group, total wages and the lagged dependent variable showed the best results, with a positive effect on the participation rate. However, the effect of the long-term trend was not statistically significant for women and was consequently omitted from the equation for women in the 55- to 64-year age group.

Oldest age group (65 years and older). The labor force participation rate of the 65-years-and-older age group is the lowest of all age groups, for both men and women. How-

ever, because of reasons such as (1) a scheduled increase in the Social Security retirement age to 67 years, (2) the effect of various policies meant to discourage retirement at earlier ages and before the full retirement age, (3) the trend of opting out of defined benefit pension plans and toward defined contribution pension plans, and (4) the long-established incentive to keep employer-based health insurance, the labor force participation rates of older men and women have been on the rise since the late 1990s. The participation rate of men in this age group rose from 16.3 percent in 1990 to 21.9 percent in 2009. The participation rate of women in the group was 8.6 percent in 1990 and increased to 13.6 percent in 2009.

The regressions for both men and women in the 65-years-and-older group had the best fit with statistically significant coefficients when wages and the lagged participation rates were used as explanatory variables. The regression had a correlation coefficient of 97.0 percent for men and 92.0 percent for women.

Comparing the two models

The behavioral model's equations were used to project labor force participation rates for each of the selected age groups and for men and women over the period 2006–16. Projected values for the explanatory variables were obtained from various sources, as described in the previous section. The behavioral model timeframe of 2006–16 is the same as the BLS timeframe for its labor force participation rate projections. In what follows, the participation rates projected by the behavioral model are compared with the BLS projections, and both models' projections are then compared against the actual 2007, 2008, and 2009 participation rate annual averages from the CPS.

Overall and age- and gender-grouped labor force participation rates. The overall participation rate projected by the behavioral model shows a decline of 0.7 percentage point, from 66.1 percent in 2007 to 65.4 percent in 2016. (See chart 1 and table 2.) This result is consistent with most projections, including those from the BLS model, which projects slow growth for both the overall participation rate and the total labor force in the coming years. In the Congressional Budget Office's projection for the 2010–20 timeframe, for example, shifts in the age composition of the population and the aging of the labor force are expected to dampen overall participation rates, causing the labor force to grow by just 0.7 percent over the next decade.[41] The most recent BLS projections for the 2008–18 timeframe also point to a declining overall participation rate, as well as a labor force growth of 0.8 percent.[42] Other research confirms the slowdown in labor force growth, but projects little or no decline in the aggregate labor force participation rate over the next decade.[43]

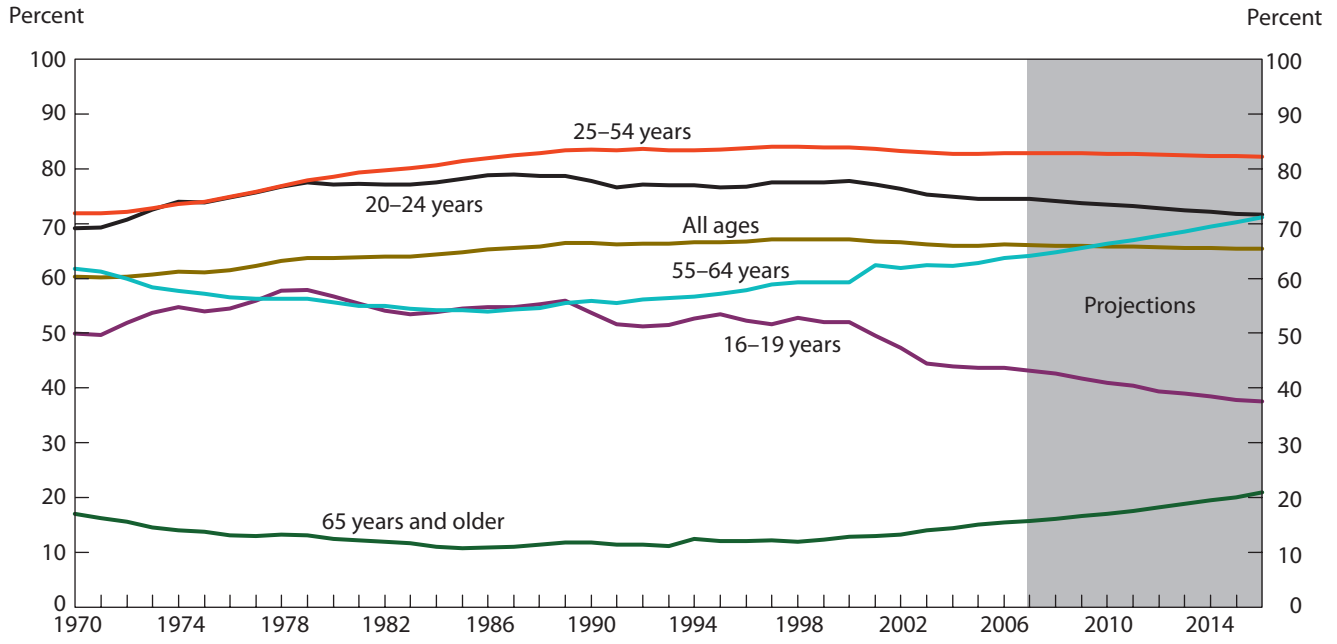
According to the 2006–16 BLS model, the overall labor force participation rate was projected to be 66.2 percent in 2007 and 65.5 percent in 2016. The same 0.7-percentage-point drop in the overall labor force participation rate as is projected by the behavioral model suggests that the difference in the magnitude of the projected overall labor force participation rates between the two models is negligible, remaining relatively flat over the projection period. The participation rates of men and of women show slightly wider gaps between the two models.

The participation rate of men in the behavioral model is projected to be 73.2 percent in 2007, decreasing gradually to 71.8 percent in 2016. (See chart 2 and table 2.) The men's rate in the BLS model is 73.5 percent in 2007, declining to 72.3 percent in 2016. The behavioral model projects the women's labor force participation rate to be 59.5 percent in 2007 and remain relatively flat thereafter, dipping slightly to 59.4 percent in 2016. (See chart 3 and table 2.) The labor force participation rate for women in the BLS model shows a similar pattern, falling from 59.4 percent in 2007 to 59.2 percent in 2016.

Although overall participation rates from both models are almost identical and the gaps in the rates for all men and for all women in the two models are negligible (see chart 4), the projected values for men and women of some age groups differ between the models:

- The two models project identical or very close values for both male and female teenagers and young adults, but are farther apart as regards the labor force participation rates of both men and women of prime and older age groups.
- For women in the prime-age group, the projected values of both models are close and the differences are small. However, the behavioral model projected a 0.2-percent decline in the labor force participation rate of these women over the 2007–16 timeframe, whereas the BLS model projected a 0.5-percent increase. For men in the prime-age group, the BLS model projected increasing participation rates from 2007 to 2016, whereas the behavioral model showed a decreasing trend.
- The greatest differences between the two models are for women in older age groups. Both models pro-

Chart 1. Overall labor force participation rates, by age group, behavioral model, 1970–2006 and projected 2007–16



jected significantly higher labor force participation rates in 2016 than in 2007; however, the behavioral model projected a significantly higher participation rate for women 55 to 64 years, and a significantly lower rate for women 65 years and older, compared with the BLS model over the 2007–16 timeframe.

- For older men, the gap between the two models is high for those in the 55- to 64-year age group and widens over time, from 0.2 percent in 2007 to 3.1 percent in 2016.

Comparison of the two models with actual data. The projected values for the selected age and gender groups in the behavioral model over the 2006–16 timeframe are quite comparable to the BLS labor force participation rate projections over the same timeframe. However, as just discussed, there are some variations in the projected participation rates for some age groups between the two models. The best way to evaluate the resulting projections from the two models is to compare both with the actual annual average participation rates in 2007, 2008, and 2009, for which data are currently available from the CPS. Note that the actual labor force participation rates for 2007–09 were not used in the estimates of the behavioral model; therefore, comparing actual CPS data from 2007, 2008, and 2009 with the projections obtained from that model shows how accurately the model projects labor force participation rates and how it compares with the current BLS model in respect of accuracy. (See chart 5.)

A comparison of projected labor force participation rates for 2006–16 from the behavioral model, on the one hand, and the current BLS model, on the other, with actual participation rates from the CPS for 2007, 2008, and 2009 is presented in table 3. In addition, table 4 shows, for each of the two models, the absolute value of the difference of the overall, men's, and women's participation rates, for the different age groups, and the actual data for 2007, 2008, and 2009. For each age group and each year, the boldface number denotes the more accurate projection between the two models (the smaller of the two values).

The actual overall labor force participation rate for both 2007 and 2008 was 66.0 percent. In 2009, the rate declined by 0.6 percentage point, to 65.4 percent. The BLS projection for 2007 was 66.2 percent, whereas the behavioral model projected 66.1 percent. (See table 3.) Both

Table 2. Labor force participation rates, behavioral model and BLS projections, by age group and gender, 2007–16

Year	All ages		16 to 19 years		20 to 24 years		25 to 54 years		55 to 64 years		65 years and older	
	BLS	Behavioral	BLS	Behavioral	BLS	Behavioral	BLS	Behavioral	BLS	Behavioral	BLS	Behavioral
Total												
2007	66.2	66.1	43.0	43.2	74.3	74.5	83.1	82.9	63.9	64.1	16.3	15.7
2008	66.2	66.0	42.5	42.6	74.0	74.2	83.2	82.9	64.3	64.8	17.0	16.1
2009	66.2	66.0	42.0	41.8	73.7	73.8	83.3	82.9	64.4	65.5	17.7	16.6
2010	66.2	65.9	41.3	41.0	73.3	73.5	83.4	82.8	64.6	66.3	18.2	17.1
2011	66.1	65.9	40.7	40.4	73.0	73.2	83.4	82.8	64.8	67.0	18.8	17.6
2012	66.0	65.7	40.0	39.4	72.8	72.8	83.5	82.6	65.3	67.8	19.5	18.2
2013	66.0	65.6	39.5	39.0	72.7	72.5	83.5	82.5	65.7	68.6	20.1	18.8
2014	65.8	65.5	38.9	38.5	72.5	72.2	83.6	82.4	66.1	69.5	20.7	19.5
2015	65.7	65.4	38.2	37.9	72.2	71.9	83.6	82.3	66.4	70.3	21.2	20.1
2016	65.5	65.4	37.5	37.6	71.8	71.7	83.6	82.2	66.7	71.2	21.7	20.9
Men												
2007	73.5	73.2	42.9	43.0	79.1	79.5	90.8	90.4	69.7	69.5	21.7	20.7
2008	73.5	73.0	42.3	42.4	78.7	79.3	91.0	90.3	69.7	69.9	22.5	21.3
2009	73.4	72.8	41.7	41.3	78.4	78.9	91.1	90.2	69.6	70.2	23.2	21.9
2010	73.4	72.7	41.0	40.5	78.0	78.6	91.2	90.0	69.5	70.6	23.8	22.5
2011	73.3	72.6	40.3	39.7	77.7	78.4	91.3	89.9	69.5	71.0	24.4	23.2
2012	73.1	72.4	39.6	38.7	77.5	78.0	91.3	89.8	69.7	71.4	25.1	24.0
2013	72.9	72.2	38.9	38.1	77.2	77.8	91.3	89.6	69.9	71.9	25.7	24.8
2014	72.7	72.0	38.3	37.5	77.0	77.6	91.4	89.5	70.0	72.3	26.2	25.7
2015	72.5	71.9	37.5	36.8	76.7	77.3	91.4	89.3	70.1	72.7	26.7	26.6
2016	72.3	71.8	36.8	36.4	76.4	77.2	91.3	89.2	70.1	73.2	27.1	27.6
Women												
2007	59.4	59.5	43.1	43.1	69.4	69.4	75.5	75.6	58.5	59.0	12.2	11.9
2008	59.4	59.5	42.7	42.7	69.2	69.1	75.6	75.7	59.2	60.1	12.8	12.2
2009	59.4	59.5	42.2	42.2	68.9	68.7	75.6	75.7	59.6	61.1	13.4	12.6
2010	59.4	59.6	41.7	41.7	68.5	68.3	75.7	75.8	60.0	62.2	14.0	12.9
2011	59.5	59.6	41.1	41.1	68.2	67.9	75.7	75.7	60.5	63.3	14.6	13.3
2012	59.4	59.5	40.5	40.5	68.1	67.4	75.8	75.7	61.2	64.5	15.2	13.7
2013	59.4	59.5	40.0	40.0	68.1	67.1	75.8	75.6	61.8	65.6	15.8	14.2
2014	59.4	59.4	39.5	39.5	67.9	66.8	75.9	75.5	62.4	66.8	16.4	14.6
2015	59.3	59.4	38.9	38.9	67.6	66.4	75.9	75.4	63.0	68.0	17.0	15.1
2016	59.2	59.4	38.3	38.3	67.2	66.1	76.0	75.4	63.5	69.3	17.5	15.6

projections were extremely close to the actual rate, with the behavioral model projections closer by 0.1 percent. The behavioral model projected exactly the actual 66.0-percent rate for 2008, while the BLS model overestimated the rate by 0.2 percent. In 2009, with all the recessionary forces at work in the labor market, the actual participation rate stood at 65.4 percent; the BLS projection was 66.2 percent, the behavioral model 66.0 percent.

The actual participation rate for men was 73.2 percent in 2007, 73.0 percent in 2008, and 72.0 percent in 2009. The BLS model projected 73.5 percent in 2007, 73.5 percent in 2008, and 73.4 percent in 2009. The behavioral

Chart 2 **Men's labor force participation rates, by age group, behavioral model, 1970–2006 and projected 2007–16**

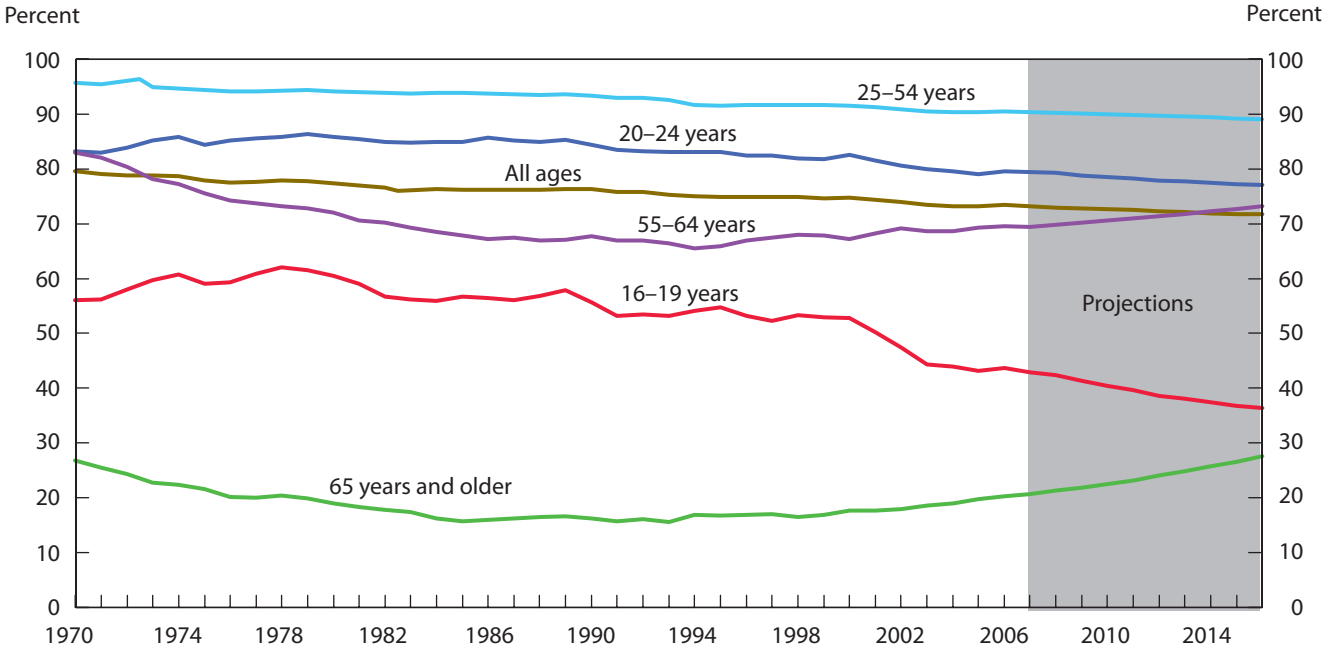


Chart 3. **Women's labor force participation rates, by age group, behavioral model, 1970–2006 and projected 2007–16**

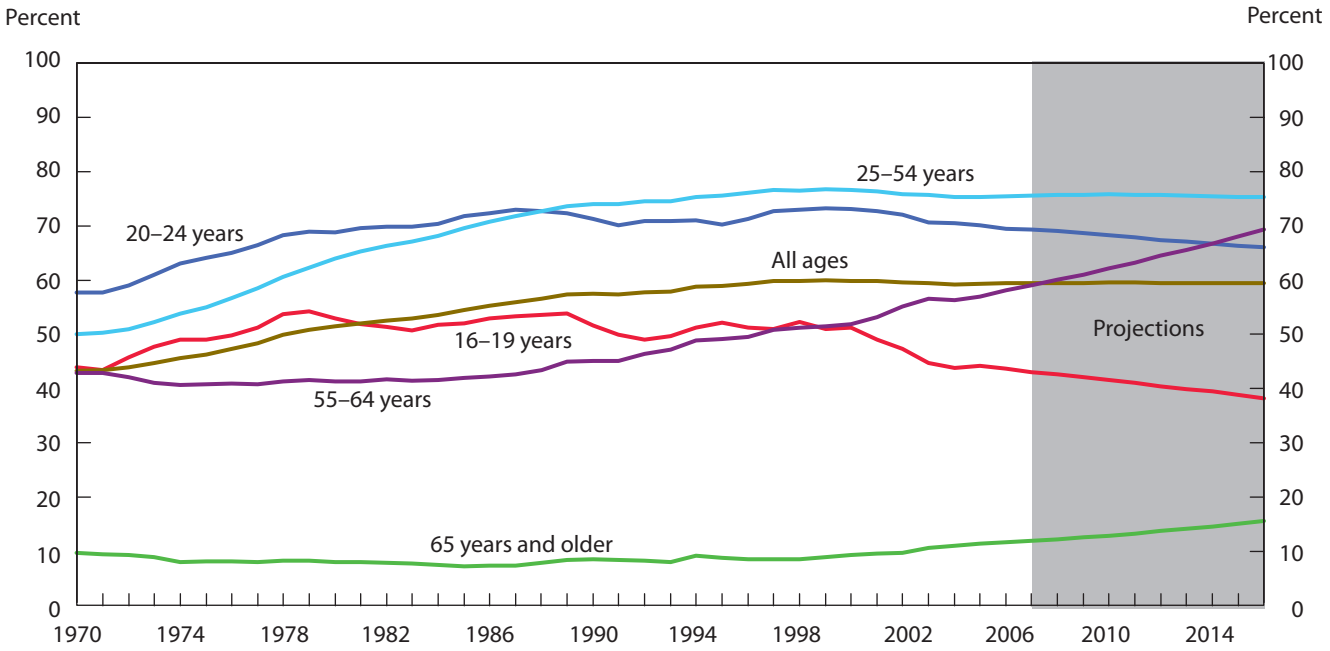
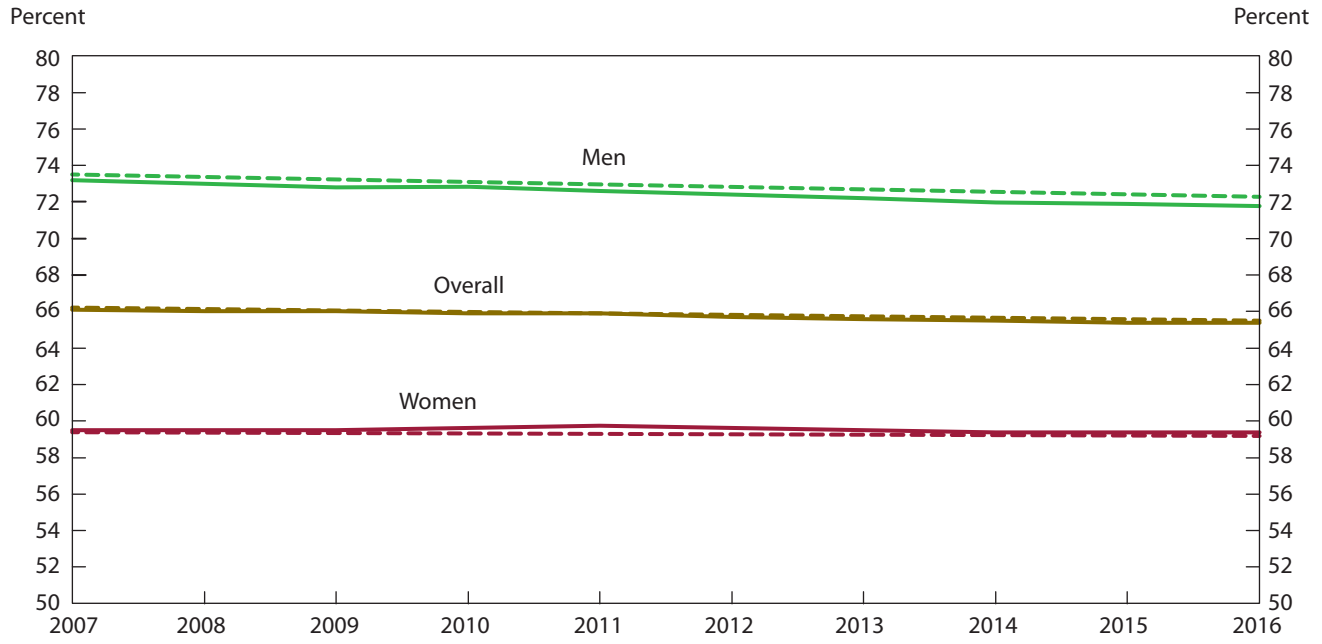


Chart 4. Labor force participation rates, behavioral model and BLS model, projected 2007–16



NOTE: Behavioral model, solid lines; BLS model, dashed lines.

model correctly projected both the 73.2-percent rate in 2007 and the 73.0-percent rate in 2008. However, the behavioral model overprojected the 2009 rate by 0.8 percent. (See table 3.)

The actual participation rate for women was 59.3 percent in 2007, 59.5 percent in 2008, and 59.2 percent in 2009. The BLS projection was 59.4 percent for the 3 consecutive years, while the behavioral model projected 59.5 percent for the same 3 years. (See table 3.)

For all the age groups from 20 to 54 years, both models' projections were very close to the actual participation rates in 2007, 2008, and 2009. However, larger differences appear both between each model's projections and the actual rates and between the projected values of the two models, for the teenage group of 16- to 19-year-olds and the 65-years-and-older age group. Because the prime-age attachment to the labor market has always been high and relatively stable, both the BLS model and the behavioral model were successful in projecting the trend of that age group's participation rate. But projections for the younger and older cohorts have missed the actual values mainly because of significant changes that have occurred in recent years in the participation rates of the two groups. Between the two models, the BLS model projected the participation rates of the older labor force more accurately. (See table 3.)

The participation rate of the teenage group has been declining significantly over the past several decades. The Bureau projected a participation rate of 43.0 percent for this age group in 2007, and the behavioral model projected a rate of 43.2 percent; both models overprojected the actual participation rate, which was 41.3 percent. Both models also overprojected the actual participation rates of 40.2 percent and 37.5 percent in 2008 and 2009, respectively.

The actual participation rate of the 55- to 64-year age group was 63.8 percent in 2007, 64.5 percent in 2008, and 64.9 percent in 2009. The BLS projection for 2007 was 63.9 percent, only slightly higher than the actual rate. The behavioral model's estimation of 64.1 percent overestimated the actual rate by 0.3 percent. The BLS projection for 55- to 64-year-olds for 2008 was 64.3 percent, a 0.2-percent underprojection, whereas the behavioral model overprojected the rate at 64.8 percent. Again in 2009, the BLS projection of the participation rate for the 55- to 64-year age group was more on target than the behavioral model's projection, albeit only slightly. (See table 3.)

Chart 5. **BLS and behavioral model labor force participation rate projections compared with actual rates, by age group, 2007, 2008, and 2009**

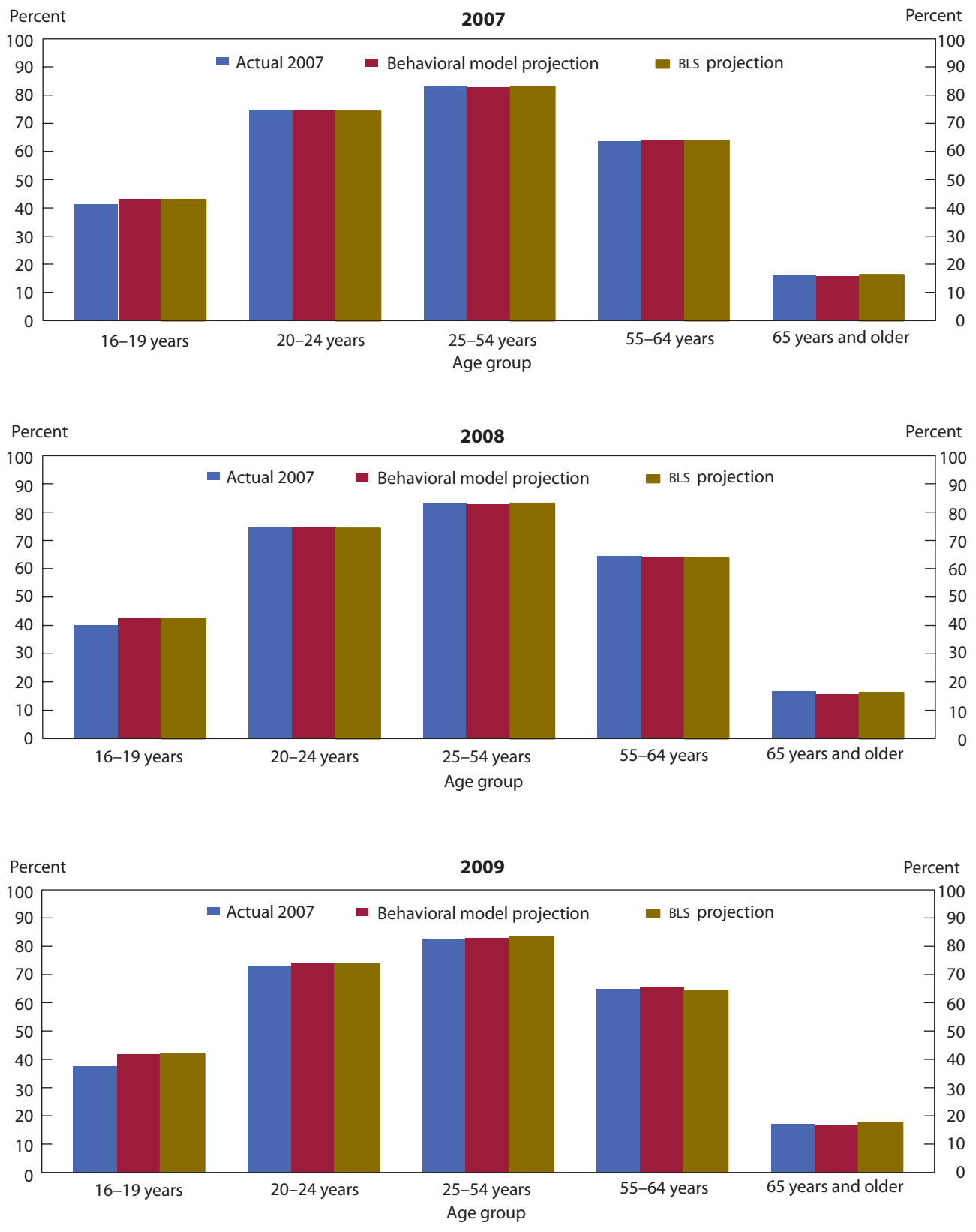


Table 3. Labor force participation rates, behavioral model and current BLS model, by age group and gender, 2007, 2008 and 2009

Age group	2007			2008			2009		
	Actual	Behavioral model	Current BLS model	Actual	Behavioral model	Current BLS model	Actual	Behavioral model	Current BLS model
Total									
16 years and older	66.0	66.1	66.2	66.0	66.0	66.2	65.4	66.0	66.2
16–19 years	41.3	43.2	43.0	40.2	42.6	42.5	37.5	41.8	42.0
20–24 years	74.4	74.5	74.3	74.4	74.2	74.0	72.9	73.8	73.7
25–54 years	83.0	82.9	83.1	83.1	82.9	83.2	82.6	82.9	83.3
55–64 years	63.8	64.1	63.9	64.5	64.8	64.3	64.9	65.5	64.4
65 years and older	16.0	15.7	16.3	16.8	16.1	17.0	17.2	16.6	17.7
Men									
16 years and older	73.2	73.2	73.5	73.0	73.0	73.5	72.0	72.8	73.4
16–19 years	41.1	43.0	42.9	40.1	42.4	42.3	37.3	41.3	41.7
20–24 years	78.7	79.5	79.1	78.7	79.3	78.7	76.2	78.9	78.4
25–54 years	90.9	90.4	90.8	90.5	90.3	91.0	89.7	90.2	91.1
55–64 years	69.6	69.5	69.7	70.4	69.9	69.7	70.2	70.2	69.6
65 years and older	20.5	20.7	21.7	21.5	21.3	22.5	21.9	21.9	23.2
Women									
16 years and older	59.3	59.5	59.4	59.5	59.5	59.4	59.2	59.5	59.4
16–19 years	41.5	43.4	43.1	40.2	42.9	42.7	37.7	42.2	42.2
20–24 years	70.1	69.4	69.4	70.0	69.1	69.2	69.6	68.7	68.9
25–54 years	75.4	75.6	75.5	75.8	75.7	75.6	75.6	75.7	75.6
55–64 years	56.6	59.0	58.5	59.1	60.1	59.2	60.0	61.1	59.6
65 years and older	12.6	11.9	12.2	13.3	12.2	12.8	13.6	12.6	13.4

Overall, it seems that, at this level of aggregation of age and gender, the behavioral model provides projections that are comparable to, and consistent with, those obtained from the standard BLS model of participation rate projections and that also are very close to actual labor force participation rates. The behavioral model can be extended to include age, gender, race, and ethnic groups at levels of disaggregation that are similar to those used in the current BLS projections model.

THIS ARTICLE HAS PRESENTED A BEHAVIORAL MODEL of the U.S. economy that measures the impact of a selected number of economic and behavioral variables on labor force participation rates. The variables selected include, besides a measure of change in the overall level of economic activity, the wage rate, school enrollment, past trends of participation rates, and the share of single women in the total female population. The projections of participation rates generated by this model turned out similar, and in some cases identical, to the projections produced by the current BLS model. Further, comparisons of the projections obtained from the behavioral model with actual data showed that the projections were, by and large, as accurate as those obtained from the current BLS model in comparison to actual data. This similarity in results may be explained by the fact that, although the two models differ in their method of estimation, both depend to some extent on the extrapolation of past trends. In the current BLS model, the smoothed trend of historical participation rates is regressed on a time variable and the time is extended to project future participation rates. In the behavioral model, the coefficients that are generated are based on the past correlation of participation rates with explanatory variables. If future values of independent explanatory variables are assumed to be the continuation of past trends, then the behavioral model could result in projections similar to those of the current BLS model. The difference between the two models, however, is that in a

Table 4. **Absolute value of difference of actual labor force participation rate and projected value, behavioral model and current BLS model, by age group and gender, 2007, 2008, and 2009**

Age group	2007 difference of—		2008 difference of—		2009 difference of—	
	Actual and behavioral	Actual and current BLS	Actual and behavioral	Actual and current BLS	Actual and behavioral	Actual and current BLS
Total						
16 years and older..	**0.1**	0.2	**0.0**	0.2	**0.6**	0.8
16–19 years.....	1.9	**1.7**	2.4	**2.3**	**4.3**	4.5
20–24 years.....	.1	.1	**.2**	.4	.9	**.8**
25–54 years.....	.1	.1	.2	**.1**	**.3**	.7
55–64 years.....	.3	**.1**	.3	**.2**	.6	**.5**
65 years and older.	.3	.3	.7	**.2**	.6	**.5**
Men						
16 years and older..	.0	.0	**.0**	.5	**.8**	1.4
16–19 years.....	1.9	**1.8**	2.3	**2.2**	**4.0**	4.4
20–24 years.....	.8	**.4**	.6	.0	2.7	**2.2**
25–54 years.....	.5	**.1**	**.2**	.5	**.5**	1.4
55–64 years.....	.1	.1	**.5**	.7	**.0**	.6
65 years and older.	**.2**	1.2	**.2**	1.0	**.0**	1.3
Women						
16 years and older..	.2	**.1**	**.0**	.1	.3	**.2**
16–19 years.....	1.9	**1.6**	2.7	**2.5**	4.5	4.5
20–24 years.....	.7	.7	.9	**.8**	.9	**.7**
25–54 years.....	.2	**.1**	**.1**	.2	.1	**.0**
55–64 years.....	2.4	**1.9**	1.0	**.1**	1.1	**.4**
65 years and older.	.7	**.4**	1.1	**.5**	1.0	**.2**

NOTE: Boldface numbers denote the more accurate of the two models, where accuracy is defined by the smallest absolute difference between the actual and projected values. When the two models yield the same number, neither number is in boldface.

change assumptions about the future values of independent variables, such as the unemployment rate, and obtain different projected values, whereas in a purely extrapolation-based model the past always dictates the future.

The model presented here is an exercise to test the effects of behavioral variables on projections of the labor force participation rate. The model could be extended to include not only other possible explanatory variables, but also age, race, gender, and ethnic groups at more detailed levels of aggregation. □

Notes

[1] *The Budget and Economic Outlook: Fiscal Years 2010 to 2020* (Congressional Budget Office, January 2010) (see especially p. 39), **http://www.cbo.gov/ftpdocs/108xx/doc10871/01-26-Outlook.pdf** (visited Mar. 7, 2010).

[2] *Ibid.*, p. 39.

[3] For further information, see "Employment Projections," chapter 13 in *BLS Handbook of Methods* (U.S. Bureau of Labor Statistics, 1999), **http://www.bls.gov/opub/hom/homch13_a.htm** (visited Feb. 7, 2010).

[4] All of the information on the Census Bureau's interim population projections presented in this article is from "U.S. Population Projections: 2008 National Population Projections" (U.S. Census Bureau, no date), **http://www.census.gov/population/www/projections/2008projections.html** (visited Jan. 7, 2010). The article uses the 2008 National Population Projections released on August 14, 2008. The 2009 National Population Projections are a supplemental series to the 2008 series and provide various results based on different assumptions regarding international migration; all other methodological considerations and assumptions, including assumptions about mortality and fertility, are the same as those used in the 2008 National Population Projections. The 2009 series is useful for analyzing possible outcomes due to different levels of net international migration. The 2008 series, however, remains the Census Bureau's recommended series for data users.

[5] The projections of the Armed Forces and institutional population

according to age, gender, race, and ethnicity for 2008–18 are based on the Census Bureau's estimations.

[6] The CPS is a personal-interview survey conducted monthly by the Census Bureau for the Bureau of Labor Statistics. The sample consists of about 60,000 households selected to represent the U.S. civilian noninstitutional population 16 years and older.

[7] For more information, see Paul F. Velleman, "Definition and comparison of robust nonlinear data smoothing algorithms," *Journal of the American Statistical Association*, September 1980, pp. 609–15.

[8] See Howard N Fullerton, Jr., "Notes on BLS labor force projections model," unpublished manuscript (U.S. Bureau of Labor Statistics, 2000).

[9] For further information, see "Employment Projections" in *BLS Handbook of Methods*; H. O. Stekler and Rupin Thomas, "Evaluating BLS labor force, employment, and occupation projections for 2000," *Monthly Labor Review*, July 2005, pp. 46–56, **http://www.bls.gov/opub/mlr/2005/07/art5full.pdf** (visited Aug. 9, 2010); and Howard N Fullerton, Jr., "Evaluating the BLS labor force projections to 2000," *Monthly Labor Review*, October 2003, pp. 3–12, **http://www.bls.gov/opub/mlr/2003/10/art1full.pdf** (visited May 7, 2010).

[10] See Stekler and Thomas, "Evaluating BLS labor force."

[11] A naïve model assumes that the growth of the labor force in the next 10 years will equal that of the previous 10 years.

[12] See Fullerton, "Evaluating the BLS labor force projections"; and Ian D. Wyatt, "Evaluating the 1996–2006 employment projections," *Monthly Labor Review*, September 2010, pp. 33–69, **http://www.bls.gov/opub/mlr/2010/09/art3full.pdf** (visited Oct. 8, 2010).

[13] See Wyatt, "Evaluating the 1996–2006 employment projections."

[14] The behavioral model presented here has benefited from a similar model set forth by Dan Schrier in "British Columbia labor force participation rate model" (BC Stats, Ministry of Finance and Corporate Relations, Government of British Columbia, June 2000).

[15] *Ibid.*

[16] See Julius Shiskin, "Employment and unemployment: the doughnut or the hole?" *Monthly Labor Review*, February 1976, pp. 3–10.

[17] See Carol Boyd Leon, "The employment-population ratio: its value in labor force analysis, *Monthly Labor Review*, February 1981, pp. 36–45, **http://www.bls.gov/opub/mlr/1981/02/art4full.pdf** (visited Oct. 10, 2010).

[18] See Gary Becker, *The Economic Approach to Human Behavior* (Chicago, University of Chicago Press, 1976).

[19] By definition, the reservation wage is the lowest wage at which a worker would be willing to accept a particular type of job. A job offer involving the same type of work and the same working conditions, but at a lower wage, would be rejected by the worker.

An individual's reservation wage may change over time, depending on a number of factors, such as changes in the individual's overall wealth, marital status, or living arrangements; the length of time the person is unemployed; and health and disability issues.

[20] Becker, *The Economic Approach*; see also Gary Becker, *A Treatise on the Family* (Cambridge, MA, Harvard University Press, 1980).

[21] See, for example, Claudia Goldin, "The Quiet Revolution That Transformed Women's Employment, Education, and Family," Richard T. Ely Lecture, published in *American Economic Review*, May 2006, pp. 1–21, **http://www.economics.harvard.edu/faculty/goldin/files/GoldinEly.pdf** (visited Sept. 3, 2010).

[22] See Abraham Mosisa and Steven Hipple, "Trends in labor force participation in the United States," *Monthly Labor Review*, October 2006, pp. 35–57, **http://www.bls.gov/opub/mlr/2006/10/art3full.pdf** (visited Aug. 10, 2010). Besides their own finding regarding the connection between falling teenage labor force participation and increasing school attendance, Mosisa and Hipple cite the work of other researchers who have come to the same conclusion.

[23] David Aaronson, Kyung-Hong Park, and Daniel Sullivan, "Explaining the Decline in Teen Labor Force Participation," *Chicago Fed Letter*, no. 234 (Chicago, Federal Reserve Bank of Chicago, January 2007).

[24] Reuben Gronau, "Leisure, Home Production, and Work—the theory of allocation of time revisited," *Journal of Political Economy*, December 1977, 1099–1123.

[25] See Mitra Toossi, "Labor force projections to 2016: more workers in their golden years," *Monthly Labor Review*, November 2007, pp. 33–52, **http://www.bls.gov/opub/mlr/2007/11/art3full.pdf** (visited June 3, 2010).

[26] For a detailed discussion of the projection of the U.S. economy, see Betty W. Su, "The U.S. economy to 2016: slower growth as boomers begin to retire," *Monthly Labor Review*, November 2007, pp. 13–32, **http://www.bls.gov/opub/mlr/2007/11/art2full.pdf** (visited Apr. 9, 2010).

[27] *Ibid.*

[28] Katie Kirkland, "Declining teen labor force participation," *Issues in Labor Statistics*, Summary 02–06 (U.S. Bureau of Labor Statistics, September 2002). (See also Steven Hipple, "Labor force participation during recent labor market downturns," *Issues in Labor Statistics*, Summary 03–03 (U.S. Bureau of Labor Statistics, September 2003).)

[29] See Aaronson, Park, and Sullivan, "Explaining the Decline."

[30] See Mosisa and Hipple, "Trends in labor force participation."

[31] *Ibid.*

[32] See Melody Sheehan, *The Effect of Real Wage Rates on Female LFPR*, vol. V (La Crosse, WI, University of Wisconsin, 2002).

[33] See David H. Autor and Mark G. Duggan, "The rise in disability recipiency and the decline in unemployment," NBER working paper 8336 (Cambridge, MA, National Bureau of Economic Research, 2001).

[34] *CBO's projection of the Labor Force* (Congressional Budget Office, September 2004).

[35] See "Table A1. Marital Status of People 15 Years and Over, by Age, Sex, Personal Earnings, Race, and Hispanic Origin, 2009" (U.S. Census Bureau, January 2010), **http://www.census.gov/population/socdemo/hh-fam/cps2009/tabA1-all.xls** (visited July 7, 2010).

[36] See "Table MS-2. Estimated Median Age at First Marriage, by Sex: 1890 to Present" (U.S. Census Bureau, Sept. 15, 2004), **http://www.census.gov/population/socdemo/hh-fam/tabMS-2.pdf** (visited May 17, 2011).

[37] See Betsey Stevenson and Justin Wolfers, "Marriage and Divorce: Changes and Their Driving Forces," *Journal of Economic Perspectives*, spring 2007, pp. 27–57.

[38] Mosisa and Hipple, "Trends in labor force participation." The Personal Responsibility and Work Opportunity Reconciliation Act of 1996 changed the Nation's welfare system into one that requires work in exchange for time-limited assistance. The bill contains strong work requirements, a performance bonus to reward States for moving welfare recipients into jobs, State maintenance-of-effort requirements, comprehensive child support enforcement, and supports for families moving from welfare to work, including increased funding for childcare and guaranteed health care coverage. These changes encourage single mothers to enter the labor force. (For more information on the impact of welfare reform, see *The National Evaluation of the Welfare-to-Work Grants Program: Final Report* (Princeton, NJ, Washington, DC, and Cambridge, MA, Mathematica Policy Research, Inc., September 2004); and Robert

F. Schoeni and Rebecca M. Blank, "What Has Welfare Reform Accomplished? Impacts on Welfare Participation, Employment, Income, Poverty, and Family Structure," Working Paper No. 7627 (Cambridge, MA, National Bureau of Economic Research, March 2000).)

[39] See Becker, *A Treatise on the Family*.

[40] Jacob Mincer, "Labor Force Participation of Married Women," in National Bureau of Economic Research, *Aspects of Labor Economics* (Princeton, NJ, Princeton University Press, 1962), pp. 63–106.

[41] *The Budget and Economic Outlook*, p. 39.

[42] See Mitra Toossi, "Labor force projections to 2018: older workers staying more active," *Monthly Labor Review*, November 2009, pp. 30–51, **http://www.bls.gov/opub/mlr/2009/11/home.htm** (visited Apr. 3, 2010).

[43] See Kenneth J. Matheny, "Trends in the Aggregate Labor Force," Federal Reserve Bank of St. Louis *Review*, July/August 2009, pp. 297–309.