The Recent Decline in Labor Force Participation and its Implications for Potential Labor Supply

Stephanie Aaronson, Bruce Fallick, Andrew Figura, Jonathan Pingle, and William Wascher

Division of Research and Statistics
Board of Governors of the Federal Reserve System

March 2006

Preliminary Draft

This paper was prepared for the Spring 2006 meeting of the Brookings Panel on Economic Activity. We are grateful to Leslie Carroll for superb research assistance and to George Perry, Dan Sichel, and especially Joyce Zickler for helpful comments. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Federal Reserve Board or other members of its staff.

The labor force participation rate is defined as the percentage of the working-age population reporting themselves as either working or actively looking for work. This statistic, which is constructed from data collected as part of the Current Population Survey (CPS) and is published monthly by the Bureau of Labor Statistics (BLS), is arguably the most prominent measure of the supply of workers to the U.S. economy. For much of the past four decades, the participation rate has trended up, rising from less than 60 percent in the early 1960s to more than 67 percent by the late 1990s. However, after having peaked at 67.3 percent in the first quarter of 2000, the labor force participation rate fell steadily to under 66 percent by early 2005 and has edged up only to just above 66 percent since then.

As shown in figure 1, such a decline in labor force participation is nearly unprecedented in the post-war economic experience. Although the upward trend in participation between the mid-1960s and the mid-1990s has occasionally been interrupted by relatively brief periods of little change, few episodes of persistent outright declines are evident in the data. Indeed, even after removing the upward trend from the earlier period (using, for example, an HP filter or a linear spline), the decline in the participation rate in recent years seems large and unusually protracted by historical standards.

A key question is whether the decline in the participation rate since 2000 primarily reflects cyclical forces—the tendency for individuals to withdraw from the labor force during periods of reduced job opportunities—or longer-lasting structural influences. Indeed, the answer to this question bears importantly on the interpretation of recent macroeconomic developments. If the weakness in participation since 2000 is largely cyclical in nature, the current unemployment rate could be understating the degree

of slack in the labor market to a significant degree—and perhaps overstating the potential upside pressures on wage and price inflation; moreover, the outlook for longer-term economic growth would be buoyed by a higher labor force trend.[1] If, instead, a significant portion of the decline is the result of structural developments in the labor market, the unemployment rate may be giving the appropriate signal of current economic slack, and the implications for the potential growth of the economy would be less optimistic.

From one standpoint, the cyclical story seems quite reasonable. The downturn in the participation rate lines up closely with the weakening in overall economic activity that began in early 2001. The declines in participation were spread widely across demographic groups. And, the drop in participation coincided with a deterioration of households' perceptions of labor market conditions. Moreover, the failure of the participation rate to rebound after the end of the recession could be a consequence of unusually weak labor demand in the subsequent economic recovery. However, this evidence is by no means definitive, and the persistence of the low level of the participation rate during the recent period of more rapid employment gains has led an increasing number of observers to question whether other factors might be at work as well.[2]

In this paper, we undertake a comprehensive review of recent developments in labor force participation and attempt to parse the recent decline into its cyclical and structural components. In particular, after a brief overview of the data we use in this paper, we examine the effects of changing demographics on the aggregate participation

[1] See, for example, Bradbury (2005).
[2] See, for example, Aaronson, Park, and Sullivan (2006), Himmelberg and McConnell (2006), and Toosi (2005).

rate and review the facts and past research on a number of other potential influences, including trends in human capital accumulation, relative wages, family structure, and income support programs. We then use a cohort-based model of the participation rate that attempts to account for these factors to estimate and project forward the underlying trend in the participation rate. Next, we compare the model-based results with distinct analyses of recent changes in labor force participation using state-level data, gross labor force flows, and information on the incidence and duration of labor force attachment. Finally, we report briefly on two other components of the aggregate supply of labor—the size of the working-age population and the length of the average workweek.

Several important findings emerge from our analysis. As one might suspect, our results suggest a role for both cyclical and structural factors in explaining the recent decline in the labor force participation rate. In particular, the hot economy of the late 1990s—perhaps coupled with new legislation that encouraged or required welfare recipients to enter the labor force—appears to have pulled additional workers into the labor market, thus raising the participation rate at the same time that it pushed the unemployment rate down to about 4 percent. As the economy turned down in early 2001, the participation rate dropped back and remained low, reflecting the extended period of employment declines and persistent lack of job opportunities that followed the recession.

However, important structural and demographic developments appear to have been at work as well. First, the aging of the baby boom cohort has been raising the share of the population in age groups for which participation rates have historically been much lower than for younger groups, and this compositional change has been putting downward pressure on the aggregate participation rate. Second, participation rates for

newer cohorts of adult women appear to have flattened out after more than three decades of steady rise, while new cohorts of men continue to be less inclined to participate in the labor market than their predecessors. Third, we find that teenagers and young adults are remaining in school longer and are reducing their labor force attachment whether in or out of school. Finally, and partially offsetting these other influences, individuals in older age groups are increasingly delaying retirement or reentering the labor force following retirement, a development that seems to reflect better health, longer life spans, and changes to Social Security rules.

On balance, the results suggest that most of the decline in the participation rate during and immediately following the 2001 recession was a response to business cycle developments. However, the continued decline in participation in subsequent years and the absence of a significant rebound in 2005 appears to reflect other more structural factors. Indeed, the current level of the participation rate is close to our model-based estimate of its longer-run trend level, suggesting that the current state of the labor market is roughly neutral for the participation rate. Finally, projections from the model suggest that many of these structural factors will continue to put downward pressure on the participation rate for some time, so that any future cyclical fluctuations in participation will take place around a declining trend. This continued downtrend, coupled with slower projected population growth and an apparent downtrend in the average workweek, suggests that trend growth of aggregate hours will slow further in coming years.

The Data

As indicated above, the official labor force statistics published by the BLS come from the Current Population Survey (CPS), a survey of roughly 110,000 individuals aged

16 and older in the civilian noninstitutional population that is conducted monthly by the Census Bureau. In this paper, we use these published data along with the underlying CPS micro data to analyze movements in labor force participation. We also use data from the Annual Demographic Supplements to the CPS, which are conducted in March of each year.

Because the CPS survey instrument has changed over time, we need to be cognizant of possible inconsistencies in the data. Most importantly for our purposes, in 1994, the Census redesigned the CPS and introduced computer-assisted interviewing techniques. A primary goal of the redesign was to reduce the potential for misclassification of an individual's labor force status by improving and clarifying the definitions of the labor force concepts and by revising the wording and sequencing of the questions (Polivka and Rothgeb, 1993).[3] The new questionnaire also better distinguishes between permanent and temporary layoffs and between active and passive job search behavior, in order to correctly identify unemployed individuals.

Research shows that the redesigned CPS identifies more individuals as being in the labor force than did the old survey. Parallel surveys that the BLS conducted before

[3] For instance, in the pre-1994 surveys, respondents were first asked "What were you doing for most of LAST WEEK?," and if the respondent did not answer "working" or "unable to work," they were asked "Did you do any work at all LAST WEEK, not counting work around the house?" As noted by Polivka and Rothgreb (1993), this question had the potential for failing to count as employed individuals who worked intermittently or from their homes, while categorizing as working people doing volunteer work. In the new survey, individuals are asked "LAST WEEK, did you do any work for pay?" and additional questions follow to capture unpaid work in a family business. Polivka (1996) also provides several examples of the outdated nature of the old questionnaire. For instance, in determining labor force status, interviewers were instructed to ask female respondents who appeared to be homemakers "What were you doing most of LAST WEEK---keeping house or something else?" Moreover, the response categories for questions concerning temporary absence from work did not include "child care problems" or "maternity/paternity leave." In addition, the meaning of certain terms has changed over time. The question on temporary absences, introduced in 1967 was "Did you have a job or business from which you were temporarily absent or on layoff LAST WEEK?" At the time, a layoff was understood to be a temporary spell of unemployment from which the individual expected to be recalled. However, by the late 1980s, the term had evolved to include a permanent separation from an employer.

and after the introduction of the new survey instrument indicated that the redesign raised the aggregate labor force participation rate by about 0.4 percentage point.[4] However, the effects of the redesign varied for different subgroups of the population; for example, the redesign significantly raised the measured participation rate of women aged 16 and over but lowered the measured participation rate of men in the 20 to 54 age range.[5]

Polivka and Miller provided multiplicative and additive factors that can be used to adjust the level of the participation rate so that it is comparable over time. Because these factors are constant, they simply shift up the series prior to 1994. The multiplicative factor allows for the possibility that the magnitude of the adjustment varies with the share of individuals in the labor market. However, the factors do not allow for the possibility that the impact of the redesign varies in response to other factors, such as the business cycle.

Unfortunately, we do not know much about how the effects of the redesign vary with the state of the labor market. The parallel survey covered only two years, during which the unemployment rate fell from 7.7 percent to 6.5 percent. In addition, while we might be able to infer the likely cyclical sensitivity of any single feature of the redesign from the change to the question itself, so many changes were made at once that the ultimate impact is difficult to discern.[6]

---

[4] In order to assess the impact of the automated collection procedure, a parallel CPS survey using the new procedure was conducted from July 1992 through December 1993. In addition, households in the parallel survey were interviewed using the old procedures from January 1994 through May 1994.

[5] See Polivka and Miller (1995).

[6] For example, the new survey was designed to better distinguish passive and active search methods. If the use of these methods varies over the cycle, then the impact of the survey on measured unemployment, and hence the participation rate, would vary in a predictable way. However, the actual impact of the revised questions is unclear. The revised unemployment sequence did do a better job of eliminating passive searchers, but it also expanded the pool of individuals asked the job search questions and increased the likelihood that a person reported multiple search activities, one of which could turn out to be active (Polivka and Rothgeb, 1993).

In the analysis described in this paper, we use the multiplicative factors to adjust the data from the basic monthly CPS prior to 1994, thus making the level of the series more consistent over time.[7] However, given the lack of information on the impact of the redesign on the cyclical behavior of the participation rate, we do not try to make any further adjustments. In contrast, we do not make any adjustments to the data from the March supplement. The Census did not redesign the CPS supplements in 1994, although interviewers did switch to the computer assisted techniques used for the basic monthly survey. And, although responses to the supplemental questions could have been influenced by changes to the basic survey, we do not know of any study that has explored this issue.

The Effects of Demographic Change on the Aggregate Participation Rate

Changes in the demographic structure of the U.S. population have been shown to have had important influences on a variety of labor market indicators.[8] In terms of the aggregate labor force participation rate, the most important demographic development now under way is probably the rising share of older Americans in the population; this development is a reflection of both the aging of the baby boom cohort and the significant increases in life expectancy that have occurred in recent decades. As shown in Table 1, the share of the population between ages 25 to 44 fell sharply between 1995 and 2005, while the share of the population between ages 45 and 64 increased. Moreover, the

[7] In addition to the 1994 redesign, the basic monthly CPS has been subject to a number of additional adjustments: the Census Bureau updated the population weights in 1989, 1997, 1999, 2000, 2003, 2004, and 2005 and introduced a new compositing procedure in January 1998. These changes primarily affect the level of labor force participation rather than the rate. Nonetheless, we have adjusted the data in order to make the data more comparable over time. Since 1967, the labor force participation rate with all adjustments made is about 0.1 percentage point lower than the participation rate adjusted only for the 1994 redesign.

[8] Examples include Perry (1971), Wachter (1977), Welch (1979), and Shimer (1998).

Bureau of the Census projects that the share of the population aged 65 and over will rise to nearly 17 percent by 2010.

The influence of this aging of the population on the aggregate participation rate arises because of the typical life-cycle patterns of labor force participation that are illustrated in figure 2. For men, the average participation rate in 2005 rises from about 40 percent for teenagers to close to 90 percent for those in their late twenties and early thirties. Participation rates then edge down by age 40 and drop off sharply beginning at about age 55. For women, the pattern is similar, albeit a bit less pronounced. Even for women, however, the average participation rate falls from about 65 percent for women between the ages of 55 and 59 to less than 10 percent for women ages 70 and above.

More formally, low-frequency movements in the aggregate participation rate can be decomposed into the influence of demographic changes in the population and the influence of changes in labor supply behavior within the various demographic groups. One useful decomposition of the aggregate labor force participation rate into the contributions of the participation rates and population shares of various demographic groups follows the identity:

$$R_t - \bar{R} = \sum_j [(\overline{R_j} - \bar{R}) * S_{j,t} + (R_{j,t} - \overline{R_j}) * \overline{S_j} + (R_{j,t} - \overline{R_j}) * (S_{j,t} - \overline{S_j})] \qquad (1)$$

where R denotes a participation rate, S denotes a population share, t indexes years, j indexes demographic groups, and overbars denote means over time. Thus, R_t is the aggregate participation rate in year t, $R_{j,t}$ is the participation rate of group j in year t, and R-bar and R_j–bar are, respectively, the mean of the aggregate participation rate and the group j participation rate over the sample period. In this way, the deviation of the aggregate participation rate in any year from its sample mean can be decomposed into the

contributions of the typical difference between each demographic group's participation rate and the overall rate, weighted by the group's population share; the deviation of each group's participation rate from its own mean, weighted by the group's average population share; and an interaction term, which turns out to be negligible. Changes over time in the first term can be interpreted as the contribution of changes in a group's population share to the evolution of the overall participation rate, and changes over time in the second term can be interpreted as the contributions of changes in the group's participation rate to that evolution.[9]

Table 2 presents the contribution of changes in each age group's population share to the overall change in the participation rate over various time periods. As shown in the bottom row of the first column, the overall change in the age distribution accounted for about 0.6 percentage point of the 2.86 percentage point rise in the aggregate participation rate between 1980 and 1995. Although changes in the size of particular age groups made sizable negative or positive contributions to the aggregate rate over this period, this demographic boost largely reflected the rising share of the population in their prime working years.

The second column, which shows these contributions over the past decade, indicates that the net effect of demographic change has reversed sign in recent years. In particular, the declining share of the population between the ages of 25 and 44, age

[9] An alternative decomposition is

$$R_t = \sum_j [\overline{R_j} * (S_{j,t} - \overline{S_j}) + (R_{j,t} - \overline{R_j}) * \overline{S_j} + interaction]$$

However, such a formula attributes a positive contribution to aggregate participation to any group whose population share rises, and a negative contribution to any group whose population share falls, regardless of whether the group's participation rate is above or below the average. In contrast, the formula used above takes into account that when the population share of one group rises, that increase necessarily means that the share of another group falls.

groups for which labor force participation tends to be high, put downward pressure on the aggregate participation rate between 1995 and 2005, and only about half of this effect was offset by an increase in the 45 to 54 year-old age group, which also has a relatively high participation rate. An increase in the share of 55 to 64 year olds also acted to reduce the aggregate participation rate over this period, although this contribution was roughly offset by a small decline in the weight of the 65 and over age category. In contrast, the effect of prospective changes in the age distribution is more clear-cut. Given Census projections of a decline in the relative size of the 25 to 34 and 45 to 54 age groups and an increase in the relative size of the 55-64 and 65+ age groups, demographics will contribute more negatively to the aggregate participation rate over the next five years.

To illustrate the size of the demographic effect relative to the actual changes in the participation rate, Figure 3 shows a constructed measure of participation that allows the aggregate participation rate to vary only with changes in the population weights—that is, holding age-sex participation rates constant at their 1995 levels. The dashed line shows the simulated participation rate extended through 2015 (based on the Census population projections), while the solid line shows the actual movements in the participation rate through 2005.

The figure indicates that much of the variability in the actual participation rate over this period, including the decline between 2000 and 2005, was due to movements in age-sex specific participation rates. Nevertheless, the importance of demographic shifts in the age structure of the population is clearly evident as well, especially after 2002. Moreover, demographic changes will likely be an increasingly important factor holding down the participation rate in coming years. Absent changes in the participation rates of

particular age-sex groups, the aging of the population implicit in the Census projections would reduce the aggregate participation rate nearly 1 percentage point further between 2005 and 2010 (column 3 of table 2).

Potential Sources of Changes in Participation Rates by Age and Sex

Although demographic change is one explanation for the declining participation rate, the above decomposition suggests that other forces have been at work as well. In particular, participation rates for specific age-sex categories have changed noticeably over time, and understanding the sources of these changes is important to our interpretation of the decline in the overall participation rate in recent years. Table 3, which reports participation rates for 28 different age-sex categories in selected years, illustrates some of the key patterns in the data. In this section, we highlight the most important of these long-run patterns and review some of the key facts and research on some of their likely determinants. We also discuss how the behavior of the participation rate in the recent economic downturn and recovery has differed from those in the past. We would emphasize that the discussion in this section is not intended to be exhaustive or rigorous, but rather illustrative of the types of considerations we took into account when formulating the model described in the subsequent section.

Youths

One important development contributing to the long-run participation rate trend has been the decline in the participation rates of youths since the late 1970s. As can be seen in the table, the participation rate for 16-19 year old males fell from 61 percent in 1977 to 43 percent in 2005, while that for 16-19 year old females fell from 52 percent to 44 percent over the same period. For both sexes, much of the decline occurred after

1995, and about one-half of the drop in the participation rate has occurred in the past five years. Labor force participation among 20-24 year olds has also fallen since 2000, although there is less evidence of a longer-run downtrend, especially for women (for whom it appears participation may even have risen through 2000).

Because schooling is an important activity for young people, the changing pattern of school enrollment is an obvious potential source of change in the labor force attachment of youths. In fact, the proportion of teenagers in school has risen from about 60 percent in the late 1980s to nearly 75 percent in 2005, while the school enrollment rate for 20-24 year olds has increased from about 20 percent to more than 30 percent over the past twenty years.[10] Viewed over the longer run, this increase in schooling likely reflects, at least in part, the ongoing influence of structural factors that have affected the school and work decisions of young persons since at least the late 1970s. For example, as is well known, the economic returns to education have increased significantly in recent decades, and it stands to reason that the persistence of this wider wage premium continues to be an important influence on youths' schooling choices. In addition, Aaronson, Park, and Sullivan (2006) note that tuition prices, net of grants and education tax benefits, have fallen, on balance, over the past decade, which coupled with the general expansion of community colleges, has made college attendance more accessible to a greater segment of the youth population. Regardless of its source, the fact that students are less likely to work than non-students points to rising enrollment rates as contributing factor to the decline in youth participation in recent years.

[10] An important contributor to the increase in enrollment for teenagers has been an increase in the proportion of teenagers enrolled in school during the summer. Of the approximately 15 percentage point increase in the enrollment rates of teenagers between the late 1980s and 2005, roughly 6 percentage points is attributable to the increase in schooling during the summer quarter of the year (June, July and August).

However, it is clear from the data that rising enrollment can account for only a portion of the recent weakness in the participation of youth. As shown in figure 4, participation rates of both enrollees and non-enrollees have also fallen in recent years, and a decomposition of the decline in participation into the contribution of the change in enrollment patterns (holding the participation rates of enrollees and non-enrollees constant) and the contributions of the change in enrollee and non-enrollee participation rates indicates that these within-group changes are at least as important as the increase in enrollment. For example, line 1 of Table 4 shows that 1.6 percentage points of the 8 percentage point drop in the labor force participation rate of teenagers between 2000 and 2004 can be attributed to the rise in school enrollment rates, while 5.1 percentage points reflected participation declines among enrollees and 1.4 percentage points owed to participation declines among non-enrollees. For 20-24 year olds, the contributions are more evenly spread: Of the 2.8 percentage point decline in the participation rate for this age group over that period, 0.8 percentage point reflects the increase in school enrollment rates, another 0.8 percentage point reflects the decline in the participation rate among students, and 1.2 percentage points is the result of the decline in the participation rate of non-enrollees.

Of course, in addition to boosting enrollment, increased returns to schooling may also have reduced the participation rate of enrollees as the rewards for engaging intensively in schooling became more pronounced. Alternatively, increases in family wealth may have decreased the incentives for enrolled youths to work. However, the historical behavior of enrollee participation shown in figure 4 suggests that these effects have not been particularly strong, at least up until recently.

Finally, low real wage levels for unskilled workers may have lessened the attractiveness of work for both enrollees and non-enrollees. In addition, Aaronson, Park, and Sullivan (2006) suggest the possibility that low-skilled women who entered the labor force in response to welfare reform may have crowded out jobs for inexperienced teenagers and young adults.[11] However, Aaronson et al. conclude that the decline in youth participation has been largely due increases in family wealth and higher returns to schooling rather than to factors related to the demand for labor.[12] Indeed, among 16 to 24 year olds not in the labor force, the share reporting that they "do not want job now" has risen steadily for the past decade, from below 80 percent in 1994 to about 86 percent in 2000, and to nearly 90 percent in 2005.

That said, some of the recent decline in the participation rates of youths is likely due to cyclical factors. Labor force attachment among young persons has typically been more sensitive to the business cycle than for other demographic groups, which is not surprising given that they have accumulated little work experience or career-specific education. Human capital theory suggests that individuals who are the least specialized in regard to market and nonmarket activities should be the most sensitive to changes in the relative returns of these activities.[13] In addition, the returns to the acquisition of both

[11] Previous literature has also found some substitutability between women and youths. See, for example Grant and Hamermesh (1981) and Berger (1983).

[12] In downplaying the contribution of labor demand to recent declines in teen participation, the authors note that teen wages relative to adult wages have changed little in the past two decades and that recent increases in employment in industries that employ significant numbers of teens has outpaced the national average. In 1999, the five industries that employed the most teens were eating and drinking places, grocery stores, miscellaneous entertainment and services, construction and department stores. The number of payroll jobs in these industries rose a combined 3.6 percent between 2000 and 2005, while employment outside of those industries fell.

[13] Becker (1993) showed that workers with greater firm-specific capital are less likely to leave a firm in response to temporary changes in demand. Analogously, individuals with greater market-specific capital/skills should be less likely to pursue non-market activities in response to a drop in the relative returns to market work. Indeed, Behabib, Rogerson, and Wright (1991) show that the change in market hours worked in response to a temporary change in market productivity should be positively related to the

education and experience are likely relatively high for youths, and, thus, it may be especially advantageous to substitute between these two forms of human capital acquisition in response to temporary changes in their relative costs or benefits. Indeed, Dellas and Sakellaris (2003) report evidence that school enrollment is negatively related to the state of the business cycle, although they also note that this cyclicality has diminished over time.[14] Nevertheless, the fact that enrollment itself responds cyclically makes distinguishing the long-run versus cyclical influences on participation more difficult.

The upper left panel of figure 5 graphs the quarterly participation rate of 16 to 24 year olds for four years since the last business cycle peak in the first quarter of 2001, along with the average participation path for four previous recessions. To provide a rough estimate of the cyclical component of participation, the data are detrended using a Hodrick-Prescott filter and indexed to their level at the peak.[15] The shading demarcates the maximum and minimum path of the detrended participation rate attained in any of the previous cycles in each quarter. As can be seen, the decline in the participation rate following the early 2001 business cycle peak was more prolonged than in any previous cycle and, relative to the peak, the participation rate was as low at its nadir as in any previous cycle. Moreover, the recovery has been weaker than in past experience. Even

---

elasticity of substitution between market and non-market work. Greater specific capital/skills (either market or non-market) should lead to a greater probability of a corner solution—devoting all of one's time to market or non-market work—and thus should be negatively related to the elasticity of substitution between market and non-market work.

[14] Although the most natural interpretation is that such cyclicality reflects variation in the opportunity cost of schooling, Dellas and Sakellaris also point out that the human capital model would predict procyclical enrollments if students are credit constrained or if the cost of schooling is also procyclical (e.g., if real net tuition is influenced by changes in asset returns from endowments).

[15] Of course, the decomposition between trend and cycle depends on the magnitude of the smoothing parameter chosen for the HP filter, and thus the results presented here are intended to be illustrative rather than a precise decomposition. We chose a high value for this parameter to prevent the filter from following the data too closely at the end of the sample.

in the weakest of the previous recoveries the participation rate of young people had fully recovered nineteen quarters after the peak. In the current episode it remains about 1 percent lower. Given the dispersion of the participation rate path in past cycles, it seems possible that some of the recent decline in the participation rate of youths reflects a stronger than usual cyclical response to the weak labor market in the early part of this decade. However, even apart from such a response, the HP filter shows a downward trend in youth participation in recent years.

Prime-age individuals

For the age categories that represent an individual's principal working years, the patterns of labor force attachment differ importantly by sex. As indicated in figure 6, for women between the ages of 25 and 54, participation rates rose fairly steadily between the early 1960s and the mid-1990s, but leveled off thereafter. For men in this age range, the participation rate has been trending down slowly for some time, and the movements in recent years appear to be a continuation of that trend rather than a break.

The increases in the participation rate of adult women likely reflected the evolution of numerous structural factors such as tastes, reproductive and contraceptive technology, wealth, education, social attitudes, and the development of the retirement, welfare, and financial systems. It seems likely that many of these changes were internalized into the behavior of new generations more easily than into the behavior of mature cohorts who had already made "sticky" choices (shifting the entire age profile up or down). However, some of these factors also worked their way into the decisions of individuals in mid-life, effectively altering the slope of the age profile as well.

Indeed, much of the change in the aggregate female participation rate appears to have resulted from progressively higher average participation rates of successive cohorts. For example, beginning in the mid-1960s and ending in the late 1970s, successive cohorts of 16-24 year old women had higher participation rates than their predecessors. Participation rates of successive cohorts of 25-34 year olds stopped rising about ten years later, in the late 1980s, while participation rates of 35-44 year olds arguably peaked in the late 1990s. This pattern suggests that the participation rate in each of these age groups at a given time is at least partly related to which birth cohort is passing through that age at that time.

Figure 7 illustrates this point more generally. Each line shows the participation rate of an age group over time. However, instead of the year of observation, the x-axis shows the birth year for the middle age of the group. In this way, the lines are shifted so that each birth cohort is vertically aligned with itself at different ages. Looking first at the "ball and chain" line, the participation rate of the 45-54 year old group appears to exhibit three rough inflections corresponding to the cohorts born around 1910, 1925, and 1945, in the vicinity of years 1960, 1975, and 1995. The first two of these inflections line up well with the 55 to 64 year old group (the dotted line). The cohort associated with the third inflection (those born around 1945) is not quite old enough to reflect that inflection in the older group. But that third inflection point can be seen when that cohort was 35-44 years old (the short dashed line). Similarly, the participation rate of the youngest age group (the solid line) flattens out around 1980, with the cohort born around 1960, and this same flattening can be seen in the long dashed when that cohort is 25-34 years old (long dashes). These coincidences suggest that birth cohort plays a significant role in

determining the pattern in participation of an age group over time, and that the evolving trend in the average labor force attachment of successive cohorts has been an important factor in the leveling off in the participation rate for adult women in recent years. From this standpoint, our analysis suggests that, going forward, we should not expect rising participation among adult women to offset a possible continued downtrend in participation for adult men.

Not all of the inflection points line up, of course. For example, the steep portion of the line for the 16-24 year old group begins around 1965, but the steep portion of the line for the 25-34 year olds begins well before this same cohort entered that age group. Clearly, there have been developments in participation that are not well represented by the aging of birth cohorts, and may, for example, be better described as changes in the shape of the age profile.

One factor that may influence both the average participation rate of a cohort as well as the shape of that cohort's age profile is educational attainment. For women, the percentage of individuals in a cohort with a high school degree and the percentage of individuals in a cohort with a college degree have both trended upward; indeed, more recent cohorts of women are now more likely than their male counterparts to have received a high school or college degree. As noted above, individuals are less likely to work when they are enrolled in school, and so we expect more educated cohorts to have relatively lower participation rates in their school-intensive years. Beyond the school ages, however, education increases the opportunities for and returns from employment, which has both substitution and income effects. The substitution effect would lead us to expect greater education to increase a cohort's participation. However, the higher

incomes available to cohorts with more education may make them more likely to retire earlier, or may enable more intermittent labor force attachment.

Three other observable factors seem particularly relevant to the level and age profile of women's participation rates. First, the presence of young children has tended, on average, to reduce the labor force participation of women, and thus changes in the prevalence of young children at different ages – reflecting changes in both the overall level and the timing of fertility – are likely to have changed the shape of the age profile of participation for women. In particular, over time women have increasingly tended to delay marriage and child bearing, which, by itself, might be expected to have depressed participation rates among women in their thirties and early forties. On the other hand, one may reasonably suspect that as societal attitudes and institutions have adapted to the increased frequency of working mothers, the influence of the presence of young children on the labor force participation of women at various ages would have changed over time. Indeed, of women with a child under age 6, the percentage in the labor force has increased from about 40 percent in the mid-1970s to more than 60 percent over the past decade.

Second, the data suggest that welfare reform may have had a noticeable influence on changes in the labor force attachment of single mothers over the past decade. As indicated in figure 8, the participation rate for single mother welfare recipients rose sharply towards that of single mother non-recipients in the late 1990s following the implementation of TANF and in conjunction with the improvement in labor market conditions. Since 2000, however, the participation rate has fallen more sharply for welfare recipients than for non-recipients, although they remain more likely to work than

prior to the reform. This pattern suggests that welfare reform may have increased both the level and cyclical sensitivity of women's labor force attachment.[16]

Third, the relative wages of women have generally increased since the early 1980s, reflecting, in part, a shift from the concentration of women in more traditional jobs to a greater variety of professional occupations as well as a reduction in discriminatory practices (Goldin, 2006). In addition to proxying for the draw of greater economic opportunities more generally, higher relative wages for women tend to shift the relative mix of labor supply within families from men to women.[17]

Turning to the role of cyclical factors, many adult women have acquired human capital specific to both market and nonmarket activities. Those with more market experience may find it worthwhile to remain in the labor market even in the face of negative demand shocks, while those for whom nonmarket work is more productive may choose to leave the labor force for at least some period of time. In addition, cyclical changes in family income may play a role in the participation rate decisions of women (the added worker effect). Thus, the aggregate cyclical response for women is not easily predictable from the theory. However, empirical research suggests that adult women, as a whole, are sensitive to changes in the relative returns of market work (Killingsworth and Heckman, 1986), and as can be seen in the upper right panel of figure 5, their

[16] Other policy changes, such as changes in marginal tax rates and the earned income tax credit, may also have affected women's labor supply. However, while some estimates indicate that women have relatively high (compared to men) elasticities of labor supply with respect to taxes (Hausman , 1985), the effects of tax reform are often not easy to see in the data. For example, in examining the impact of the 1981 and 1986 tax reforms, Bosworth and Burtless (1992) find evidence that the labor supply of women did increase relative to trend during the 1980s, but that the increase was greatest for low-income women who benefited little from the reforms. Similarly, the impact of the dramatic expansion of the earned income tax credit over the past two decades appears to have reduced the labor force attachment of married women, but to have increased the participation of single women with children (Eissa and Hoynes, 2004; Eissa and Hoynes, 2005).

[17] See, for example, Juhn and Murphy (1997), Devereaux (2004), Blau and Kahn (2005), and Mulligan and Rubinstein (2006).

participation rate appears somewhat procyclical, albeit much less so than for youths. Relative to earlier recessions, the participation rate of prime-age women declined more steeply just after the 2001 peak, and subsequently tended to hover a little below the average experience. Although not definitive, this pattern suggests that there is nothing particularly unusual about the cyclical behavior of women's labor force participation in recent quarters.

For men, the participation rate for individuals in their prime working years has declined, on balance, since the late 1970s, although it held steady during the strong labor market of the mid to late 1990s. After turning down again during the 2001 recession, it has been fairly flat since 2002.

One potentially important factor driving the long-term decline in labor force participation among men has been the declining real wage for low-skilled workers. For example, Juhn, (1992) finds that changes in wages can explain nearly all of the decline in participation of low-skilled men between the early 1970s and the late 1980s, while Welch (1997) argues that the decline in the participation of low-skill men relative to high-skill men corresponds closely to the decline in their relative wages.

By the 1990s, however, real wages for low-skilled men had stopped declining. At the same time, labor force participation among prime age males flattened out, and according to Juhn et al. (2002), the dispersion in participation across skill levels closed a bit. More recently, real wages have changed little since the end of the 2001 recession, which again seems consistent with the flat participation rate for the prime-age male group as a whole. However, despite the absence of any significant change in skill premiums in recent years, the participation rate among men with less than a high school education has

continued to rise, while the participation rate for men with more education has been falling. Thus, in the past few years, it seems that other factors have been driving the pattern of participation among prime age men.[18]

One possible influence, particularly for individuals toward the upper end of the 25-64 year-old age range, has been the various reforms to the Social Security Disability Insurance (SSDI) program and the increased generosity of SSDI benefits over time relative to declining or stagnating wages for low-wage workers. Numerous studies have reported a relationship between SSDI and the long-run downward trend in participation among men.[19] More recently Autor and Duggan (2003) have also shown that applications for SSDI are sensitive to labor demand shocks.

Even so, whether disability insurance has had an important negative influence on male participation rates in recent years is less obvious. The only major policy change in the past decade was a law designed to *increase* the labor force participation of SSDI beneficiaries (SSA, 2004).[20] In addition, although the proportion of the working-age population receiving SSDI has increased in recent years, the percentage of individuals giving disability as a reason for limited work has been fairly flat (figure 9), and the uptick in 2003 and 2004 only returned that ratio to the level of the mid-1990s.[21] Taken together,

---

[18] Changes in tax policy are unlikely to have had much of an impact on the participation of men over this time period. Studies of the effects of the 1981 and 1986 tax reforms generally found small effects for men (Bosworth and Burtless, 1992), and the impact of the tax cuts implemented in 2001 and 2002 also seems likely to be small. Similarly, the existing research suggests that the expansion of the earned income tax credit has had at most a small positive impact on male labor force participation (Eissa and Hoynes, 2004).

[19] See, for example, Parsons (1980), Bound (1989), Haveman, et al. (1991), and Bound and Waidmann (1992).

[20] In 1999 the "Ticket to Work and Work Incentives Improvement Act" was signed into law. Also, in 1997 Congress prohibited eligibility for individuals whose drug or alcohol addiction contributed to their impairment. This resulted in a one-time drop in recipiency, as such individuals were removed from the rolls (SSA, 2003).

[21] The large increase in self-reported disability between 1992 and 1993 may be a result of the CPS redesign. In addition, an analysis of the March CPS data matched across two years suggests that individuals who report that a disability prevented them from working a full year in the second year, also worked less in the

these data appear to point to an increase in the proportion of disabled individuals receiving benefits, rather than to an increase in the proportion of individuals with a work-limiting disability.[22]

In regard to cyclical influences on recent prime-age male participation rates, research suggests that adult male human capital is quite specialized and that their participation rates are relatively insensitive to temporary changes in the relative returns to market work (Pencavel, 1986). This can be seen in the bottom left panel of figure 5, which shows that, on average, the prime age adult male participation rate has been relatively flat following business cycle peaks and that this pattern varies little from cycle to cycle (the shaded area marking the minimum and maximum response is narrow). Nonetheless, the pattern following the most recent business cycle peak is a little different. Participation declined more steeply than usual early in the downturn---as was the case for women---and remained relatively low for several years. However, over the past year the participation rate for prime age men has moved back toward the average experience. It is difficult to say whether the participation rate path over the past few years represents a larger than normal cyclical response or whether we are failing to capture the downward trend in the participation rate. However, because the magnitude of the deviation is fairly small, particularly over the past year or so, most of the recent declines in adult male

---

first year. This finding combined with the fact that some individuals who report a disability are also in the labor force implies that the increase in reported disability does not translate one for one into decreases in labor force participation. The share of the disabled who participate in the labor market at least one week during the year has also declined from about 24 percent in 2000 to 20 percent in 2004, but this decline is too small to show through to the aggregate participation rate.

[22] Of course, if the income provided by SSDI is a work disincentive or if SSDI recipients tend to have more severe disabilities than non-recipients, an increase in the share of disabled individuals receiving DI benefits could be associated with a reduction in labor force participation even absent an increase in the share of individuals reporting a work-limiting disability. In fact, SSDI recipients are less likely to be in the labor force for at least one week during the year than are disabled individuals who do not receive SSDI (about 5 percent of SSDI recipients compared with about 30 percent of disabled nonrecipients). Nonetheless, given the low participation rate even among the disabled who are not SSDI recipients, the increase in recipiency is not enough to have a noticeable effect on the aggregate participation rate.

participation seem likely to have been a continuation of the structural declines of the post-War period.

Older individuals

Finally, participation rates for older individuals have been increasing over time. As indicated in Table 3, participation rates for older men held steady or declined between 1977 and 1995, and then moved up, with an especially sharp increase registered after 2000. For older women, the increase appears to have started somewhat earlier, but the general pattern is similar.

For both sexes, the labor force participation decisions of older persons hinge on the need and ability of the elderly to finance retirement. That is, cohorts in worse health or that are better positioned to retire at an earlier age would be expected to have lower rates of participation in the older age groups. Aside from educational attainment, which is likely to be associated with higher average levels of income and wealth for better educated cohorts, among the most important factors affecting the ability to finance retirement are the parameters of the Social Security program, the availability of private pension benefits, health, and life expectancy.[23]

In particular, in any forward looking model of labor supply in which workers do not rely entirely upon Social Security to finance their retirement, we would expect a longer expected lifespan to increase the number of years a person chooses to work, in order to save more for the longer expected retirement and to reduce the number of years of retirement that need to be financed. In addition, to the extent that life expectancy is correlated with better health more generally, older individuals would remain able to work

[23] For an overview of the economic influences on the labor force attachment of older individuals, see Burtless (1999) and Burtless and Quinn (2001). For an analysis of recent changes to social security programs and rules, see Loughran and Haider (2005).

longer into their lives. In this regard, life expectancy for men at age 65 has increased steadily over time and now stands at nearly 17 years. For women, life expectancy at age 65 leveled off in the 1980s and early 1990s, but it has since risen noticeably to more than 20 years.

Given the relatively large amounts of specialized human capital accumulated by older individuals, their labor supply decisions should be relatively immune to temporary changes in the returns to market work, and as the lower right panel of figure 5 shows, the labor force participation rate of older individuals is fairly flat during recessions. However, cyclical changes in wealth may contribute to cyclical changes in participation (though these changes would be countercyclical, rather than procyclical). Indeed, one explanation that is sometimes offered for the increase in the labor force participation of older persons following 2000 is that the decline in stock prices, especially relative to expectations formed during the long bull market, has led many older individuals to delay their retirement.

Several researchers have explored the role of wealth in retirement decisions.[24] Most of these studies do find that the unexpected shock to wealth associated with the stock market boom led to some additional retirements. However, as Coile and Levine point out, the impact on the aggregate participation rate was probably small, both because relatively few individuals have enough of their savings in stocks for the market movements to significantly affect their assets and because many of those that do have substantial wealth holdings are not on the margin in making their retirement decisions.[25]

[24] See, for example, Gustman and Steinmeier (2002), Coronado and Perozek (2003), Sevak (2005), and Coile and Levine (2006).

[25] None of these studies includes wealth held passively in defined benefit (DB) pension plans because the retirement benefits paid out from DB plans do not vary with the asset value of those plans. However, the

Given the apparent responsiveness of retirement to the stock market run-up in the 1990s, we might expect that some individuals have had to delay their retirement in light of the decline and subsequent low returns. But given the small share of the population that seems to be affected on the margin by these stock market fluctuations, this explanation seems unlikely to explain the recent rise in participation rates among the elderly.[26]

Putting the Pieces Together: A Cohort-Based Model of Labor Force Participation

Building on the discussion in the previous section, we have developed a model that attempts to account for the influences on participation of observed structural factors, unobserved structural factors, and cyclical factors. We assume that unobserved structural factors can be captured, at least in part, by the average participation rates of birth cohorts and the average age profile of participation. Because both the average participation rates and the age profiles of participation have historically been so different for men and women, we model participation separately by gender. Ultimately, the model attempts to expand upon the observable determinants of participation by using the actual history of each cohort's labor force attachment to inform us about its present and future attachment; in this way, the model combines into a coherent framework our knowledge of cohort behavior with known demographic changes.

---

recent stock market decline has reduced the solvency of many of these plans, and as many as 10 percent of all DB plans are now frozen (PBGC, 2005; Watson Wyatt, 2005), meaning that individuals are no longer accruing benefits in these plans (although in most cases the DB plans have been replaced with defined contribution plans). In addition, an individual's retirement decision could be influenced by a change in the asset value of a DB plan if that change were large enough to alter the perceived default probability of the plan, although these termination probabilities are still fairly low.

[26] In addition, according to data from the Survey of Consumer Finances, on average families that owned both corporate equity and a home experienced a decline in the value of their stock portfolio but a rise in the value of their home between 2001 and 2004. Indeed, given the sharp rise in housing prices in recent years, a broader measure of wealth that includes housing might imply less upward pressure on labor force participation than a measure based solely on stock market wealth. However, the extent to which individuals view housing wealth as a retirement asset is a subject of considerable debate (see, for instance, Venti and Wise, 2001).

The Basic Model

We assume that the labor force participation rate of men or of women of a particular age a in year t can be specified as

$LFPR_{a,t} = \alpha_a^{'} X_t^{\lambda_a^{'}} \beta_{b=t-a} \exp(\varepsilon_{a,t}^{'})$, or

$$\log LFPR_{a,t} = \log \alpha_a^{*} + \lambda_a^{*} \log X_t + \log \beta_{b=t-a} + \varepsilon_{a,t}^{*} \qquad (2)$$

where LFPR is the participation rate, α* is an age-specific fixed effect, λ* is a vector of age-specific coefficients, X is a vector of explanatory variables, including controls for the business cycle, β is a birth-year-cohort specific fixed effect, a, b, and t index age, birth year, and calendar year, respectively, ε* is an error term, and we have suppressed the gender subscripts.

This specification assumes that each birth-year cohort has a general propensity to participate in the labor force that is determined by the various unmeasured factors mentioned above. This propensity is quantified by β, the log of which can be viewed as a cohort-specific intercept. However, the members of different cohorts share a common baseline pattern of participation over the life cycle, being, for example, low when of school or retirement age and higher during prime earning years. This common baseline age profile is represented by the α*, which are assumed to be constant during the sample period.

For practical reasons, we wish to aggregate this up to the fourteen age groups for which participation rates are published by the BLS. Equation (1) does not aggregate easily, but we can approximate it by a set of fourteen estimating equations for each gender of the form

$$\log LFPR_{g,t} = \log \alpha_g + \lambda_g \log X_t + \frac{1}{n_g} \sum_{b=1919}^{1988} C_{g,b,t} \log \beta_b + \varepsilon_{g,t} \quad \text{g = 1 to 14} \quad (3)$$

where g indexes the age groups, t indexes the calendar year, and b indexes birth years. The $C_{g,b,t}$ are indicator variables that equal one if the corresponding cohort appears in that age-group equation at time t and n_g is the number of ages in age group g, and the α are now age group fixed effects. Meanwhile, X_t and β remain as previously defined. The coefficient vector (λ) varies by age group, while the cohort effects do not (that is, the cohort effects are constrained to be the same across all equations in which the cohort appears). The age effects (α) are constant (but see below). For each gender, the 14 equations are estimated simultaneously using a restricted least squares estimator with a White corrected covariance matrix.[27] Counting both the men and the women, we estimate 342 parameters in 28 equations.

Identification

The cross-equation constraints (i.e., the assumption that the cohort fixed effects are the same across age groups) identify the cohort fixed effects up to a scale factor. That is, the variation in the age effects over ages and in the cohort effect over birth years are well identified. However, the allocation of the overall level of the aggregate participation rate between the cohort effects and the age profiles requires an arbitrary normalization, and we chose to normalize to one the cohort effect for those born in 1969.

In addition, the youngest cohorts in our data do not present many observations from which to estimate their cohort effects. In order to mitigate the consequent sensitivity of these estimated cohort effects to the conditions that happened to be present in recent years, we constrained the cohort effects for the most recently observed cohorts

[27] See Greene and Seaks (1991) for a description of the estimator.

to evolve slowly.[28] For men, the oldest cohort so constrained is that born in 1978; for women, it is the cohort born in 1976.[29] In this way, we link the cohort effects of the youngest cohorts, who do not appear in many age groups or years in our sample period, to those of older cohorts who do appear in several age categories and in more than one stage of the business cycle. However, it remains an open question whether this constraint is adequate.

Business Cycle Controls

The business cycle is represented in the model by the deviation of employment in the nonfarm business sector from an estimate of its trend. The trend is derived from an HP filter, with the smoothness parameter set so that the trend tends to coincide with the actual level of employment when the unemployment rate was at the Congressional Budget Office's (CBO) estimate of the NAIRU. In this way, the model's "concept" of full employment is consistent with a level of the participation rate near its trend. In order to prevent endpoint bias in the HP filter from unduly affecting the estimate of trend employment in recent years, we assumed that trend employment increased at an annual rate of ½ percent after the fourth quarter of 2001, the last quarter in which the HP filter was equal to the actual level of employment.[30] We include the level of the deviation of employment from this trend, as well as two lags of this deviation.[31]

---

[28] More specifically, we constrain the change in the cohort effect between adjoining pairs of birth year cohorts to be the same for recent cohorts, under the assumption that individuals born a year or two apart should not be in noticeably different cohorts. The constraints are an attempt to limit the influence of the recent cycle on cohorts only observed during the recent downturn, while still allowing the cohort effects to rise or fall over time, but at a rate consistent with cohorts observed over a whole business cycle.

[29] Extending the constraint for men back to 1975 as well did not materially affect the results. We took advantage of this insensitivity to reduce the number of constraints and simplify the estimation procedure.

[30] We chose this growth rate to match the average change in employment from 2001:Q3 to 2005:Q4 because the unemployment rate in both quarters was 5 percent.

[31] Because of concerns about the endogeneity of the unemployment rate to changes in labor force participation and the potential for correlated measurement errors in the two series (which are derived from

Evolution of the Age and Cohort Profiles

The baseline age profile represented by the α parameters in equation (2) is assumed to be constant across time. It is intended to capture a basic pattern of life-cycle behavior, and the level of the age effect for any age group is identified by the labor force behavior of the cohorts that appear in that age equation during the sample period. Similarly, the cohort effects represented by the β parameters in (2) are assumed to be constant across time. They are intended to capture the basic propensity of a birth cohort to participate.

Of course, the actual life-cycle pattern of participation is unlikely to be constant across cohorts. Or equivalently, the relative propensity of a cohort to participate is unlikely to be constant across ages. As various economic and social factors evolve, we would expect the age profile of participation to evolve as well. In order to account for such changes in the model, we include variables that represent the economic and social changes that we discussed in the previous section, and that we suspect have been, or are likely to be, of greatest significance for particular age groups. The coefficients on each variable vary freely by age/sex group, except where we have imposed our prior that the coefficient be zero. Because the coefficients differ across age groups, movements in the variables over time change the shape of the age profile, or, equivalently, the shape of the cohort profile, even in those cases where the variable itself does not vary by age group.

---

the same survey), we did not use the unemployment rate gap directly. However, we did examine the robustness of the model to an alternative procedure that used the CBO's unemployment gap, which currently depicts as tight a labor market as any other available indicator, to extrapolate the cyclical variable after 2000, roughly the point at which we deviated from the HP filter. That alternative produced a slightly lower trend in the participation rate for recent years (roughly 0.1 percentage point on the trend level at the end of 2005), consistent with the tighter labor market implied by that gap measure. However, the performance of the model using the CBO gap term also is a little worse in recent years than is our preferred specification.

As mentioned, the age and cohort effects themselves are constant over time. However, the full age or cohort profiles include both the age or cohort effects and the influence of these time-varying variables. Thus, the age effects themselves can be viewed as defining a baseline or average profile from which particular cohorts deviate in accordance with these additional variables, or as residuals that pick up the life-cycle pattern that we have failed to capture through the included variables. The cohort effects can be viewed analogously.

Consistent with the earlier discussion, the variables that we considered including in the model fall into three broad categories: those related to human capital, those related to financing nonparticipation, and those pertaining to family structure. We should note that many of the variables we considered have moved broadly together over our sample period. For example, life expectancies, dependency ratios, and educational attainment have mostly risen over time, while fertility and the frequency of defined-benefit pensions have mostly fallen. Thus, choosing which variables to include and in just what fashion is sometimes a matter of judgment, and the coefficients on the included variables should be interpreted cautiously.

The model is estimated over the period from 1977 to 2005. Table 5 presents the estimated coefficients on these variables as elasticities.

1. Human capital: For men in the age groups ranging from 16 to 24 years old, we included an estimate of the return to a college education developed by Aaronson, Park, and Sullivan (2006). This variable is constructed from a regression of wages on a

standard set of variables that includes different levels of schooling.[32] As expected, a greater return to education is associated with lower rates of labor force attachment.

For the remaining age groups of men and for all age groups of women, we experimented with two variables representing the average educational attainment of a cohort when that cohort was 27 years old.[33] The first is the percent of individuals with a high school degree and the second is the percent with a college degree.[34] However, because of the substantial comovement within each sex between the percent with a high school degree and the percentage with a college degree, we only included college-level attainment in the full version of the model.

College attainment has relatively little relation to the participation rates of men through the middle age groups (25 to 61), but is associated with sharply lower rates of participation for men ages 62-69, where presumably the previous earnings that come with a college education allow men to retire earlier than otherwise. For women, the patterns are more complicated. Greater college attainment is associated with higher rates of participation for women in most age groups, where eventual college attainment likely reflects the cohort's career aspirations (and thus educational goals) and its degree of labor market attachment. This is most notable for the teenage groups, including the 16-17 year

---

[32] We thank Dan Aaronson for providing us with these estimates.

[33] Data on educational attainment for the 25-29 year age group—ages by which the vast majority of individuals have achieved their terminal degrees—are published back to 1940. If all of the fourteen age groups that define our participation equations were similarly 5 years wide, then measuring the educational attainment appropriate to each equation would be a simple matter of leading or lagging these 25-29 year old attainments by the appropriate number of years. However, because several of our age categories are only two years wide, we attributed to each cohort the educational attainment of the 25-29 year olds in the year in which that cohort was 27 years old. We then averaged these across the cohorts relevant to each of the each age-specific participation equations in each year. For cohorts that were not yet 29 years old by the end of our sample period, we extrapolated their eventual educational attainment linearly by the average change in attainment over the previous eight cohorts.

[34] In 1992, the questions on education in the CPS switched from asking about years of schooling to asking about highest degree/level attained. We bridged this change using methodology and data from Jaeger (1997) and Kominski and Siegel (1993).

olds, for whom we would expect no direct effect of their eventual college attainment. College-educated women seem to share their male counterparts' penchant for early retirement (ages 62-65), but for those older than 65 college attainment is associated with much higher participation.

For women aged 18-61 (above typical high-school age but below typical retirement ages), we included in the model the ratio of median weekly earnings for full-time working women to those of full-time men as a measure of the female/male wage gap. To the extent that the historical increase in this ratio has been exogenous, it likely represents an expansion of women's labor market opportunities that would be expected to draw more women into the work force and perhaps reduce the degree of specialization into market and home production within the household; as a result, patterns of women's participation become more similar to those for men. However, we recognize that higher rates of female participation may themselves have contributed to a higher wage ratio through greater labor market experience and other human capital investments.

In the event, a higher female-to-male earnings ratio is, indeed, associated with higher rates of participation among younger women, particularly those aged 25 to 44. In contrast, the increase in the relative wages of women is associated with lower rates of participation for women over age 50, where, perhaps, greater similarity to men means sharing their propensity to retire early when possible.

2. Financing nonparticipation. We included two variables as proxies for factors that potentially influence labor force decisions of individuals in older age groups. First, we included a variable for gender-specific life expectancy as of age 65, based on life

tables published by the Census Bureau, as an estimate of future income needs.[35] Greater life expectancy means more years of retirement to finance, ceteris paribus, and is associated with higher rates of labor force participation for men and women in the three oldest age groups (although not significantly so for the middle group of older women). Of course, life expectancy and health are closely related, and the positive association may also reflect improved health among individuals in these age groups.

Second, for men we included a composite variable that incorporates changes in early retirement rules, the retirement age for social security, and the delayed retirement credit.[36] This variable is measured as the average fraction of the Primary Insurance Amount (PIA) a man would receive if he were to retire at age 62-64 or age 65-69.[37] For the 62-64 age group, the greater is the value of this variable, the smaller is the penalty for retiring early. For the 65-69 age group, a higher value of this variable implied a greater reward for delaying retirement. Both these expectations are borne out in the estimates, although the coefficient for the latter is not quite statistically significant at the ten percent level.[38]

---

[35]These are not true forecasts of the longevity of an individual or cohort, in that they do not take into account how age-specific mortality rates will change as a cohort ages. Rather, in each year they are based on the current mortality rates for individuals of various ages. Thus, the life expectancy of a person aged 65 in any given year reflects the state of medical knowledge and technology, environment, wealth, etc., current in that year. Nevertheless, in broad terms they do reflect the advances in health over history.

[36]The prospects for the generosity of the Social Security system and of private pensions plans depends in large part on the ratio of potential retirees to likely workers, and it is the current and impending increases in this ratio that drive the current concerns about, in particular, the future of Social Security and Medicare. Accordingly, we constructed a "potential dependency ratio" facing a cohort as the ratio of population over age 64 to the population age 25-64 that, according to Census Bureau estimates and projections, a cohort saw or can expect to see at age 65. However, we found that this variable did not add to the power of the model once the variable for life expectancy was included, and so we did not include it in the specification presented here.

[37] Changes in the earnings test during this period moved closely with the changes in the delayed retirement credit, so our estimates may, in fact, reflect some influence of the former despite their exclusion from the model.

[38] We also experimented with these variables in the equations for older women. However, the coefficients were never statistically significant and their signs and magnitudes often made little sense.

We wanted to include a variable to represent the generosity of the Federal disability insurance program, and, in particular, the changes over time in the stringency of the criteria for being awarded disability benefits. We chose the disability award rate, that is, the fraction of applications for benefits that were approved in each year. Although this variable abstracts only imperfectly from other considerations—the composition of the applicant pool surely varies with the state of the labor market, in addition to other factors—it is an improvement in this regard relative to using a measure of disability benefits recipiency. The disability program should be most relevant to middle-aged individuals, as younger persons are much less likely to be disabled and the elderly are covered by social security retirement benefits instead. The estimated coefficients for this variable are generally negative for men, but not large. For women, the estimates were not statistically significant.

In addition, we experimented with several measures of aggregate household wealth as explanatory variables in our model, including total household net wealth, stock market wealth, and housing wealth. However none of these measures had reasonable explanatory power in the model equations, even for the age groups near retirement age.

3. Family structure. We attempt to capture influences associated with family structure with two variables. In the equations for women aged 18-29, we included a variable for the percentage of the cohort that, when in each age group, has children younger than 6 years old.[39] Not surprisingly, cohorts with a higher proportion of women with young children had substantially lower participation rates at those ages.

[39] The cut-off at age 29 seemed reasonable because the presence of young children at older ages seemed to reflect delayed child-bearing as a result of greater labor market attachment, a factor that is more intuitively captured by other variables in the model, rather than the direct influence of children on participation. We also omitted this "fertility" variable from the 16-17 year age group because it produced what seemed to us a

However, as noted above, the influence of this variable on labor force participation seems likely to have changed over time in response to changing social norms and economic opportunity. If so, then one would want to allow the coefficients on the fertility variable to vary over time. For identification, allowing the coefficient to vary freely is not possible, and simply constraining the coefficients to vary "slowly" over time seemed to us too ad hoc. Instead, we used individual-level data from the CPS to estimate separately for each year an age-group-specific coefficient on a variable for the presence of children less than 6 years old from a cross-section regression of participation.[40] We then interacted these coefficients, which vary by year, with the fertility variable in our model. In this way, the coefficient on the fertility variable in our model is constrained to evolve over time in the same way as the cross-sectional coefficients. To our surprise, however, these interactions did not add to the explanatory power of the model, and thus we did not include them in the full version.

A related development has been the decline in the percentage of women in every age group below age 60 who are married. For obvious reasons, married women have long had lower participation rates than unmarried women. Still, the decline in marriage rates may be both a cause and a result of increased labor force participation. In contrast, marriage rates for women above age 65 have been rising steadily, primarily because of declining rates of widowhood. We included a variable for the percentage of women in the age group who are married, for each age group 18-61. We omitted this variable from the 16-17 age group because their marriage rates are too low to be a significant factor in

---

spurious estimate that for that age—that a greater incidence of young children raised labor force participation.

[40] We thank Julie Hotchkiss for providing us with her data and programs, which we used for our preliminary investigations of this approach. A fuller description of this technique is described in Hotchkiss (2005).

determining their aggregate participation, and from age groups eligible for Social Security because of the complications marriage introduces for Social Security benefits.

Age and Cohort Profiles

The cohort fixed effects represent the influences on trend participation that a birth cohort carries with it through life that are not captured by the right-hand-side variables. They need to be combined with those other variables whose values vary across cohorts in order to see how cohorts' average propensity to participate have evolved, and we will do so below. Still, it is worth noting that for men the estimated cohort effects themselves imply a fairly steady decline in labor force attachment over time. However, much of the trend decline in men's participation, including that from cohort to cohort, appears to be captured by the other included variables. For women, the cohort effects rise early on, peak with cohorts born sometime in the late 1940s, and then decline, finishing late in our sample at a lower level than early in our sample. Again, much of the trend increase in women's participation seems to be captured by the other included variables.

Given the weak employment picture of the past four years, the declines in the cohort effects for recent cohorts of both men and women naturally raise questions of end-point or short-sample bias, and whether the constraints we imposed on the estimates for these recent cohorts might be inadequate. (And legitimately so—how much can we know about these recent entrants with so few observations?). However, the estimated trend level of these youngest age groups (as we will show below) is nevertheless well above their actual participation rates throughout the period, and the model interprets much of the recent decline in these young groups as cyclical. Moreover, the effect of recent

declines in participation for the most recent cohorts on the estimated aggregate trend is negligible.

The age fixed effects, like the cohort effects, represent only that part of the age profile that is not captured by the included variables. By and large, while the pattern of these age effects have the expected shapes, they also clearly suggest that much of the life-cycle pattern is captured in the other variables.

To provide a more complete picture of how labor force participation is estimated to vary across cohorts or across age groups, and how these patterns are estimated to have evolved over time, we construct overall cohort and age profiles. In particular, the trend for an age group in a year can be calculated from

$$\log TLFPR_{g,t} = \log \alpha_g + \lambda_g \log Z_t + \frac{1}{n_g} \sum_{b=1919}^{1988} C_{g,b,t} \log \beta_b , \qquad (4)$$

where Z excludes the cyclical variables from the X vector in the equations above. Then for each age group, we trace out a cohort profile by plotting this trend over time, averaging across the birth cohorts that appear in that age group in each year.[41]

The age profiles are computed in a similar fashion, except that the contributions of the cohort effects are removed from the calculation to remove the direct effects of the changing mix of cohorts in an age group over time. Then, in principle, for each birth cohort we could trace out the trend as we move from age group to age group. For purposes of presentation, however, we aggregated into five-year groups of cohorts.

Figure 10 shows the cohort profiles for selected age groups. For each age group, we show the calculation from (4) for the cohorts that appear in our data in each year. For men, the cohort profiles are generally declining, as successive cohorts have lower

[41] Thus, the cohort profiles shown are, in a sense, a centered moving average of the true cohort profiles.

propensities to participation than their predecessors in each age group, with the notable exception of the oldest age group. Individuals in this group (which begins with cohorts born in the late 1920s), exhibit an increasing propensity to participate that no doubt reflects greater expected longevity and better health rather than a latent favorable attitude towards work that bursts forth only at advanced age. Women share this feature at ages 65 and over. In addition, teenage women, like teenage men, are increasing less likely to participate in the labor force. In the middle age groups, however, successive cohorts of women display higher participation rates to a point, then peak, and in the younger cohorts turn down.

The age profiles in figure 11 are shown for selected groups of birth cohorts in order to highlight how those profiles have evolved over time. The profiles for men have been remarkably stable and follow a familiar pattern. The age profiles for women, in contrast, have evolved significantly, with more recent cohorts apparently reaching their peak rates of participation earlier in life.

The Estimated Trend

Putting this all together, the estimated age effects (α), cohort effects (ß), and observable determinants (λX), with the exception of the cyclical variables, can be weighted by the relevant population shares at each point in time and summed to produce an aggregate trend. More specifically, we compute the trend as

$$TLFPR_t = \sum_{gender} \sum_{g=1}^{14} popshare_{gender,g,t} \alpha_{gender,g} X_t^{\lambda_{gender,g}} \left(\prod_{b=1919}^{1988} \beta_{gender,b}^{C_{g,b,t}} \right)^{\frac{1}{n_g}} \qquad (5)$$

where, again, Z contains all the elements of X except the cyclical variables. In other words, we calculate the trend participation rate for each age group and gender for each year from the estimates of the age effect, the cohort effects of the cohorts that appear in

each age group in that year, and the right-hand-side variables that apply to that age group in that year (or equivalently, to that age group in that cohort). Then, weighted by the population shares of the age group and gender in each period, the rates are aggregated. Through the population weights, the model explicitly incorporates the more traditionally modeled demographic shifts in the age and gender distribution.

Figure 12 shows the model's estimated trend for the aggregate labor force participation rate, while figure 13 shows the estimated trends separately for men and women.[42] The aggregate trend follows the familiar pattern over most of history, but peaks and begins to decline in 2002. More than half of the estimated decline in trend between 2002 and 2005 is due to shifting demographic shares—most importantly, the redistribution of baby boomers from high participation rate ages to low participation rate ages. The remainder is due to the flattening of women's trend participation combined with the ongoing decline in men, as shown in the two panels of figure 13.[43]

Figure 14 illustrates the influence of the various elements of the model on this estimate of the trend. The line labeled "Model Trend" is the same trend shown in figure 12, albeit on a somewhat different scale. The line labeled "age and cohort trend" shows the trend that would be implied by the age and cohort effects alone, using the coefficients estimated in the full model. This line thus represents that part of the estimated trend that

[42] Here and below, the trends shown have been smoothed by taking three-quarter centered moving averages.

[43] An unexpected feature is the dip in the aggregate trend in the late 1990s that interrupts an otherwise easily characterized shape. This dip is primarily accounted for by the trends for women in particular age groups, and appears to be mostly attributable to some odd movements in marriage rates. This anomaly warrants further investigation, but for the moment we are inclined to smooth through this reduction in the estimated trend.

is not captured by the right-hand-side variables.[44] The estimated age and cohort effects alone produce a trend with a shape quite similar to the total model trend.

The remaining lines on the graph illustrate the contributions of each set of variables relative to the baseline established by the age and cohort effects. The line labeled "Age, Cohort, and Family Trend" adds the variables concerning family structure to the age and cohort effects, again using the coefficients from the full model. This set of variables, taken together, flattens out the trend line. This result mainly reflects the influence of changes in the marital status variable, although the presence of young children also contributes to this flattening in the second half of our sample period. The longer dashed line replaces the family structure variables with the human capital variables. This set of variables makes for a more curved and peaked trend, reflecting the increase over time in the female/male earnings ratio together with a shift in the age distribution of women from younger ages—for whom this ratio has a positive influence on participation—to older ages—for whom it has a negative influence. Finally, the ball and chain line replaces the human capital variables with the financing variables. This set of variables turns out to have relatively little influence on the trend until the end of the sample, when it provides a modest boost.

Trend vs. Cycle

One striking feature in figure 12 is the noticeable gap between the level of the trend in 1989-1990 and the peak in actual participation at that time. The figure also shows the predicted participation rate from the model, which includes the effects of the employment variable and its lags. As the figure indicates, the model interprets most of

[44] In order to ease visual comparisons of the shapes of these partial trends, we renormalized each of the lines on figure 14 to have the same mean as the total model trend.

the gap between the trend and the actual level of the participation rate at the end of the 1980s expansion as a cyclical deviation from trend rather than as a residual. The same can be said of the late 1970s and the end of the 1990s booms.

Indeed, more generally, the model estimates a surprisingly (to us) high degree of cyclicality in labor force participation. Table 6 summarizes the cyclical sensitivity of the various demographic groups by summing the coefficients on the employment gap and its two lags. For both sexes, the youngest group (16-17 years old) is by far the most sensitive to the business cycle. Among men, this sensitivity declines quickly and becomes small for prime-aged men. But participation rates for men age 60 and above are again quite sensitive. Among women, the pattern is less clear. The estimated cyclical sensitivity for women remains considerably higher than for men through their mid-50s, but the estimates suggest that, with the marked exception of the 65-69 age group, women's participation is *counter*-cyclical at older ages. However, the cyclical coefficients for the older age groups are imprecisely estimated.

Of course, the contribution of each group to the cyclicality of the aggregate participation rate depends upon its share in the population. For example, although men age 35 to 44 exhibit only a small cyclical responses, they account for 9½ percent of the male population, and so the table understates their contribution to aggregate cyclicality. In contrast, men age 65 and over account for only 6½ percent of the male population. As the age distribution of the population shifts toward these older age groups, the model's predictions for the cyclical responsiveness of the aggregate participation rate, in addition to its trend, will change.

Figure 15 focuses on the past ten years and presents some projections. Abstracting from the dip already mentioned, the estimated trend in the aggregate participation rate is fairly flat until 2002, after which it declines steadily. The actual participation rate begins to decline sooner, near the beginning of the recession. The prediction line indicates that the model explains the high rates of participation through the end of the boom as largely a cyclical phenomenon. Similarly, in terms of the model, the drop in participation during the recession was induced by the economy's movement from the tight labor markets of the late 1990s to the looser labor market of 2001. The further declines in 2002 and 2003 were a combination of weak labor demand and the beginning of a downward trend. As hiring began to pick up in late 2003, these declines subsided. However, the trend rate of participation had been falling as well, and the recent improvement in labor market conditions only served to buoy the participation rate up towards its lower trend level.

We can also use the model to project how the trend will evolve in coming years. To do this we employ the following procedure. For birth-year cohorts that are age 16 or above in 2005, we hold the cohort effect constant at its last value and essentially age these cohorts along the last observed age profile.[45] For newly entering cohorts, we assume that the cohort effect is constant at the average value of the last few cohorts and then age them along the last observed age profile.

As can be seen in figure 15, the model projects that the trend in the aggregate labor force participation rate will fall further over the next ten years; indeed, the projected

[45] This procedure effectively means that we hold most of the RHS variables at their last observed values and keep the cohort and age effects fixed. There are two exceptions to this methodology. First, we allow life expectancy at age 65 to evolve in line with Census projections. Second, we assume that educational attainment for cohorts currently younger than age 27 will continue to change at the rate exhibited by the five most recent cohorts for which we measure attainment.

decline in the trend from 2005 to 2015 is more than three percentage points, comparable to the increase over the first ten years of our estimation period, when female participation was rising so rapidly. Of course, this projection is conditional on the assumptions just described. However, we consider these to be fairly conservative; for example, we do not assume that the cohort effects for men continue their historical declines, which would have produced an even steeper drop in the trend. (Below we will discuss an alternative that projects forward some of the recent model errors.)

Model Performance

Figures 16 to 18 show the data, estimated trends, and model predictions of the participation rate for teenagers (16-19), middle ages (20-61), and older ages (62+), built up from the more detailed demographic groups included in the model. These aggregates highlight the relatively good fit of the model for the broad range of middle age groups and illustrate our concerns about the deviation of actual from the model predictions for the youngest and oldest age groups.

For the 16-19 year age group, the model appears to have captured the general trends and turning points in the participation rates, although for teenage men there have been long stretches where the model prediction deviated from the data. Most recently, however, the model expected the participation rate to recover back towards a fairly flat trend. In fact, the actual rates have remained well below trend, which, while a failure of the model, does mitigate some concerns that endpoint bias may be dragging down the estimated trend.

For ages 20-61, the model fits pretty well and is not surprised by the developments of the past few years. Notably, the model does a good job of capturing the dramatic change in slope in the participation rates of prime-aged women.

In the older age groups, however, actual participation rates have exceeded the model predictions for both men and women in recent years. Although the errors are smaller in magnitude than for teenagers, the large size of this group suggests that these errors represent a substantial risk to our projection. The model also missed fairly uniformly across the older age groups in some earlier periods (e.g., 1985-1986), suggesting that we may have omitted some salient influence on retirement decisions from the model. For example, the errors in the most recent few years could be related to sizable movements in asset valuations, but, as we noted above, we did not find variables representing wealth to be significant in the model.

In the projection of the trend shown in figure 15, we assumed that the sizable recent model errors for teenagers and the older age groups were not a manifestation of changes in the trend. However, an alternative approach would be to interpret the errors as suggestive of a recent change in the age profiles at those ages.[46] To examine how this alternative interpretation would change our projection of the trend, we added the average error over the last two years to the age effects for teens and the 62 and over age group. For the 62 and over group, this change has the effect of reducing the extent of the drop in the age profile for older ages and, as indicated by the upper dotted line in the figure, raises the level of the projected trend by ¼ percentage point by 2015. For teenagers, this exercise reduces the trend, and thus steepens the age profile between youths and prime-

[46] Of course, we could also assume that the errors are indicative of changes in the cohort effect or in the coefficients of the observed variables. However, the interpretation we employ seemed a more natural alternative to us.

age individuals. As shown by the lower dotted line, this change lowers the level of the projected trend by a similar amount.[47] Hence, as it happens, carrying forward both sets of errors leaves the projected trend almost unaltered.

Additional Evidence

Although not directly comparable with the cohort-based model presented above, other aspects of recent patterns in labor force participation can provide independent evidence on the extent to which changes in the aggregate labor force participation rate in recent years were cyclical or structural in nature. In this section, we present several such related analyses, including a comparison of participation rate changes in different states, an examination of gross labor force flows, and changes in the duration and incidence of labor force participation.

Cross-State Evidence

Variation in participation rates across states is one alternative source of information about the potential sources of the post-2000 decline in the aggregate participation rate. In particular, if changes in participation during this period were driven largely by changing labor demand conditions, we would expect those states in which the labor market showed a relatively greater deterioration to also have experienced a larger relative drop in labor force participation rates. On the other hand, to the extent that the changes in participation were unrelated to fluctuations in labor demand, we would expect them to be uncorrelated with a state's particular cyclical condition.

To investigate this proposition, we regressed the annual participation rate in each state on a constant state-specific effect, a common linear trend as a measure of structural

[47] Although the recent model errors for teenagers have been larger than those for the 62+ age group, teenagers are a smaller share of the population.

factors, state-specific cyclical conditions, and a dummy variable equal to zero before 1994 and 1 otherwise to capture any effects of the CPS redesign. To capture possible changes in both the underlying trend rate of participation and in the responsiveness of the participation rate to the business cycle, we allow for a break in the coefficients on the trend and cycle terms after 2000.[48] More specifically, our specification is:

$$lfpr_{s,t} = \alpha_s + \underset{(0.63)}{\underset{0.091}{d94}} + \underset{(0.92)}{\underset{0.021}{\gamma}} * t + \underset{(-2.58)}{\underset{-0.123}{\delta^t}} * d00 * t + \underset{(-6.11)}{\underset{-0.243}{\beta}} * cyc_{s,t} + \underset{(-0.97)}{\underset{-0.028}{\delta^c}} * d00 * cyc_{s,t} + \varepsilon_{s,t} \quad (6)$$

where *s* indexes states, *t* indexes time, *lfpr* is the participation rate, *cyc* is the state unemployment rate (our measure of cyclical conditions), *d00* is a dummy variable equal to 1 beginning in 2001 and zero beforehand, and d94 is the CPS redesign dummy. To control for spurious correlation between the unemployment rate and the participation rate due to measurement error, we instrument for the contemporaneous unemployment rate with a state's lagged unemployment rate and the contemporaneous percent change in payroll employment. The model is estimated using weighted (by population) least squares and data from 1990 to 2005. The estimated coefficients (except for the state effects) are reported below each parameter, with t-statistics shown in parentheses.

If the post-2000 downward movements in the participation rate were associated with structural factors uncorrelated with changes in state-level labor demand, then estimates of δ^t should be negative. If, on the other hand, participation rate declines were caused by changes in demand, with or without an increase in the cyclical sensitivity of the participation rate, then estimates of δ^t should be 0 and β should be negative. If

[48] We exclude state specific time trends because the interpretation of coefficients is clearer without them. Results are qualitatively similar when they are included.

changes in cyclical sensitivity played an important role in the post-2000 behavior of the participation rate, then δ^c should be negative.

Overall, estimation results suggest that both cyclical and structural factors played a role in the post-2000 decline. Estimates of δ^t and β are both negative and statistically significant. On net, the point estimates imply that the break in the common trend accounts for about one-half of the 0.8 percentage point decline in the participation rate between 2000 and 2005, with the remainder accounted for by changes in cyclical conditions.[49] Although the estimate of δ^c is also negative, it is not statistically significant at conventional levels, suggesting little or no change in the cyclical sensitivity of the participation rate. Despite the differences in the information used to identify structural changes, these results are quite similar to those from our cohort-based model, which also estimates that about half of the decline in the participation rate since 2000 was due to structural forces.

Gross labor force flows

Patterns of gross labor force flows may also be useful in discerning the reasons for the post-2000 drop in the participation rate, given a set of assumptions about the types of flows that would be expected to be associated with cyclical and structural changes in participation. In particular, one reasonable presumption is that withdrawal from the labor force as an unusually strong response to the weak job market in recent years should be reflected in an unusually large rate of flows out of unemployment into nonparticipation as

[49] When we include year dummies, so that identification derives from the deviation of state-level variables from average (across state) levels, results are qualitatively similar. We also analyzed whether the effect of cyclical conditions is asymmetric. Results suggest an asymmetrical response of the participation rate to cyclical conditions (with the response greater when the unemployment rate is above the state-specific mean), but reveal no evidence of a post-2000 break in this response; in addition, when we allow for an asymmetrical response, the estimated contribution of a common trend to the post-2000 participation rate decline is qualitatively similar to the results discussed.

job seekers became discouraged. In contrast, the flow out of employment into nonparticipation arguably should be procyclical because employed individuals, to the extent that they are worried about job prospects, would be reluctant to leave their jobs in a weak economy. As a result, any increase in this latter flow during and after the 2001 recession would likely be related to more structural factors.

Figure 19 shows the rates of flows out of employment and unemployment to nonparticipation. As expected, the flow rate from unemployment to out of the labor force increases when the job market weakens, while the flow rate from employment to out of the labor force decreases. We can then use the deviations from these standard cyclical patterns as a test of whether the post-2000 decline in participation reflected structural factors or an unusually strong response to the cyclical deterioration in the labor market.

To implement this test, we first estimate the pre-2001 typical cyclical response using the following equations

$$
\begin{aligned}
un_t &= \underset{\substack{0.017\\(18.10)}}{\alpha^u} + \underset{\substack{0.004\\(2.89)}}{\delta} * d94 + \underset{\substack{-0.036\\(-1.75)}}{\beta^u} * cyc_t + \underset{\substack{-0.0003\\(-1.34)}}{\gamma_1^u} * t + \underset{\substack{-0.0000\\(-0.79)}}{\gamma_2^u} * t^2 + \varepsilon^u \\
en_t &= \underset{\substack{0.029\\(51.07)}}{\alpha^e} + \underset{\substack{-0.000\\(-0.20)}}{\delta} * d94 + \underset{\substack{0.055\\(4.29)}}{\beta^e} * cyc_t + \underset{\substack{-0.0006\\(-5.03)}}{\gamma_1^e} * t + \underset{\substack{0.0000\\(3.55)}}{\gamma_2^e} * t^2 + \varepsilon^e
\end{aligned}
\qquad (7)
$$

where *un* is the rate of flow from unemployment to nonparticipation, *en* is the rate of flow from employment to nonparticipation, *cyc* is a measure of the stage of the business cycle (we use the log difference in aggregate nonfarm payroll employment), *d94* is a dummy variable equaling 1 in 1994 and later and 0 prior to 1994 (to control for the CPS redesign), and t and t^2 are linear and quadratic trend terms, respectively. Using the estimated βs, we then construct estimates of the flow rates excluding cyclical effects through 2005 as

$$en_t^{adj} = en_t - \hat{\beta}^e cyc_t$$
$$un_t^{adj} = un_t - \hat{\beta}^u cyc_t \quad (8)$$

Lastly, we regress these cyclically adjusted measures on quadratic time trends through 2000 and a dummy variable set equal to zero prior to 2001 and to 1 thereafter. This specification reflects our assessment that through 2000, the underlying trend in both flow rates can be reasonably well described by a quadratic time trend. After 2000, however, we allow the average flow rates (excluding the typical cyclical response) to be freely estimated. In this way, the average post-2000 fitted value will reflect both the presence of excessive cyclical responses and the level of the underlying structural rate. Under our assumptions, a higher rate of unemployment to nonparticipation flows (after controlling for the typical cyclical response) would support the excess cyclicality hypothesis, while a higher rate of employment to nonparticipation flows would favor the structural change hypothesis.

Estimation results support the latter hypothesis. The mean value of the post-2000 flow rates of unemployment to nonparticipation (excluding the typical cyclical response) is somewhat *lower* than the average flow rate from 1994-2000, but the p-value of the difference is only 0.38. In contrast, the difference between the mean post-2000 employment to nonparticipation flow rate and the average pre-2001 flow rate is substantial and positive, and the p-value (0.00) indicates that this difference is statistically significant.

The magnitudes of the changes in cyclical and structural flows imply that all of the change in the participation rate since 2000 has been due to structural forces, a greater share than our cohort-model would suggest. However, there are two important caveats that limit the usefulness of the gross-flows-based estimates. First, because we did not

have strong priors about how structural and cyclical forces should be reflected in flows *into* the labor force, our analysis excluded these flows. Second, the gross flows data have a difficult time capturing the procyclical movements in the participation rate. Flows out of the labor force impart a countercyclical influence: The decline in flows out of employment in recessions dominates the increase in the flows out of unemployment, while flows into the labor force do not have a strong correspondence with the business cycle.

Incidence vs. Duration

A final line of enquiry we undertake is to decompose the aggregate participation rate into the incidence of participation—the proportion of individuals who participate in the labor force at all during the year—and duration—the proportion of time individuals spend in the labor force over that year. This decomposition is potentially informative because a decline in the incidence of participation may be an indication that the forces behind the decline in participation are more structural in nature, whereas a change in the duration of participation may be a more temporary development.[50]

Using data from the Annual Demographic Supplement to the CPS, we define the incidence of participation as the percent of individuals who worked or looked for work in at least one week during the year, and the duration of participation as the number of weeks that individuals with a positive incidence spent working or looking for work during the year. The relevant data are available on an annual basis from 1975-2004.[51]

As shown in the figure 20, the recent decline in the participation rate appears to be entirely driven by a decline in the incidence of participation. The duration of participants

[50] See, for example, Murphy and Topel (1987) and Juhn, Murphy, and Topel (1991).
[51] These data were not directly affected by the redesign of the basic CPS questionnaire in 1994, although we cannot rule out that the redesign may have influenced individuals' answers to the supplement questions.

flattened out a bit after 2002, but was still higher in 2004 than in the late 1990s. Judging from the early 1980s and early 1990s, incidence has historically exhibited larger cyclical fluctuations than duration, has tended to drop off slightly before the cyclical peak, and has continued to decline after the cyclical trough. In these respects, the current episode fits the historical pattern. However, incidence has been much weaker in the current recovery. The top panel of figure 21 graphs the incidence of participation for four of the most recoveries, with the level of the incidence indexed to the trough.[52] As can be seen, incidence picked up at or soon after the trough in the recessions ended in the first quarter of 1975 and the fourth quarter of 1982. In contrast, incidence in the jobless recovery of the early 1990s only picked up after about a year and a half. The experience in the most recent recovery is even worse: incidence has declined steadily over the three years following the 2001 recession, although the pace of decline slowed over the past year.

As the bottom panel of figure 21 shows, duration held up better in the recent recovery, although not as well as in the early 1990s. However, interpreting the duration data is a bit difficult because they are affected by the selection of individuals who do not participate at all.

Figure 22 shows the patterns of incidence and duration for selected demographic groups. For both teenagers and young adults, the dropoff from 2000 to 2002 was unusually sharp and represented a significant break from the longer-run trend. This pattern suggests a response to the business cycle, although the magnitude of the drop and the absence of any recovery in subsequent years may be indicative of structural forces as well. For both men and women in their prime working years, the patterns of incidence

[52] The recovery that began in July 1980 has been omitted from the figure because its proximity to the 1981 recession makes interpreting that recovery difficult. The data have been interpolated to a quarterly frequency.

and duration are consistent with some effect of the business cycle but, more generally, seem to match those described by our cohort-based model. In particular, the prime-age male group shows an ongoing decline in incidence, while the equivalent age group for women shows an arcing over consistent with the leveling off of the cohort effects. Finally, older workers are an exception to the aggregate patterns described above. Both incidence and duration have risen, on balance, for individuals 65 and over, partially offsetting the downtrends evidence for younger age groups.

Implications for Potential Labor Input

As we noted in the introduction, the underlying trend in the labor force participation rate is a key factor influencing the potential supply of labor hours to the U.S. economy, and thus has an important influence on potential output growth. Based on the estimates from our model, the downward trend in participation between 2000 and 2005 subtracted about 0.2 percentage point per year from the growth in potential labor hours. By comparison, the rise in the aggregate participation rate contributed about ½ percentage per year, on average, to labor input growth between 1960 and 1995.

Of course, from a growth accounting framework, changes in labor force participation represent only a portion of the change in the total supply of hours. Two other aspects of the total supply of labor—the size of the working-age population (ages 16 and over) and the average number of hours worked by individuals—also are an important determinant of potential output.[53]

The first of these additional factors, the rate of growth of the working-age population, has been relatively steady over the past decade or so, rising about 1.2 percent

[53] Changes in the natural rate of unemployment can also influence the potential supply of labor to the economy. Although we do not address that issue in this paper, the Congressional Budget Office assumes that the NAIRU has held steady at 5.2 percent since the mid-1990s.

per year. Looking ahead, however, Census projections point to a substantial slowing in population growth over the next decade, with the growth rate expected to decline gradually to about 0.9 percent per year by 2010 and 0.8 percent per year by 2015. Of course, both current estimates of the population and projections for future population growth are subject to considerable uncertainty. Indeed, when the 2000 decennial census population estimates were released, the count of the resident population was 6.8 million higher than the previous intercensal estimate. Net immigration is particularly difficult to estimate and project, and both the Congressional Budget Office and the Social Security Trustees assume higher immigration flows than are incorporated into the Census projections.[54]

The second factor, average weekly hours worked by employed individuals in the nonfarm business (NFB) sector, is shown as the dashed line in figure 23. Although this measure of the workweek is not the most widely recognized, we consider it to be the most relevant measure for the purposes of estimate potential labor input because it includes hours of supervisory workers and the self-employed, both of which are excluded from the more familiar workweek collected as part of the BLS Current Employment Statistics (CES) survey.[55] As can be seen in the figure, the NFB workweek has trended downward over the past thirty years or so, perhaps with a slight lessening in that trend over the past decade.

One source of this downward trend has been changes in the industrial composition of employment—most notably, the shift from manufacturing jobs that were frequently

[54] See the 2005 OASDI Trustees Report from the Social Security Administration. For more discussion of the relative merits of the Census Bureau population projects, see CBO (2000).

[55] Effectively, the BLS combines information from the CES survey on workweeks of production or nonsupervisory workers with information from the CPS on the ratio of workweeks for production and nonproduction workers. See Eldridge, Manser, and Otto (2004) for details.

full-time jobs and often included a substantial overtime component to jobs in the service-producing sector. The influence of this change in industry composition on the workweek can be seen in figure 24, which plots the workweek from the CES along with a constructed workweek that holds industry shares constant at their January 1994 levels.[56] The gap between the two lines widened considerably during the 2001 recession, when manufacturing employment fell especially sharply, and has remained wide ever since. Indeed, according to this measure of the workweek, about three-quarters of the net decline in average hours between 2000 and 2005 was the result of changes in the industrial composition of employment.

Previous research also suggests that over the 1970-1990 period changes in laws regulating the operating hours of establishments (Blue Laws), as well as societal shifts toward eating out and all-hours shopping, contributed to an increase in jobs with both shorter and non-standard hours (Kirkland, 2000). Changing demographics likely also influenced the average workweek over this period, though the effects were mixed. The increase in the population share of prime-age workers tended to increase the workweek (Rones, Ilg, and Gardner, 1997), as did the growing desire for professional careers among prime-age women, whose workweeks rose over this period. On the other hand, a greater share of women among the employed would have put downward pressure on the workweek, given that women work fewer hours, on average, than men.

Similarly, the demographic changes that have had so much influence on the aggregate participation rate over the past decade have had little effect, on net, on the

[56] We use the CES workweek for this exercise because of the availability of detailed data on industry-specific workweeks.

aggregate workweek.[57] In large part, this reflects the age profile of average workweeks, which are relatively constant from ages 25 to 65, but considerably lower for youths and for workers older than 65. For the post-2000 period, the increase in the numbers of working older individuals has put downward pressure on the average workweek, but this effect has been largely offset by the declining number of working youths.

To empirically extract the trend in the workweek, we use a Kalman filter model that includes controls for the business cycle. That is, we assume that actual movements in the workweek follow the specification:

$$h_t = \alpha_t + \beta_1 Cyc_t + \varepsilon_t \qquad (9)$$

where α and γ are the unobserved trend components:

$$\alpha_t = \alpha_{t-1} + \gamma_t$$

$$\gamma_t = \gamma_{t-1} + \nu_t$$

and the errors are:

$$\varepsilon_t = \rho\varepsilon_{t-1} + \eta_t, \quad \eta \sim iid$$

$$\nu_t \sim N(0, \sigma_\nu^2)$$

We estimate this trend-cycle decomposition on the workweek in the nonfarm business sector with quarterly data from 1970 to 2005, using the unemployment rate to control for the business cycle and the first difference in the percent change in real GDP to account for our expectation that the workweek responds more quickly than other inputs to abrupt changes in demand.

Interestingly, the picture looks quite similar to that for the labor force participation rate. The estimate of α_t, which is shown as the dashed line in figure 25,

[57] Demographic detail on average weekly hours is only available from the CPS.

indicates that the trend workweek has fallen, on net, over the past five years, from about 33.0 hours in 2000 to 32.5 hours in 2005. In addition, the model views some of the decline in the workweek over the past five years as cyclical, with the level above its trend in the late 1990s, falling below its trend in 2001 and 2002, and subsequently moving back toward the trend level by 2005. The model's estimate of the trend decline between 2000 and 2005 subtracts about 0.3 percentage point per year from the growth in potential hours over that period.

An important caveat to this analysis is our reliance on the nonfarm business workweek, which incorporates payroll data for production or nonsupervisory workers from the CES survey. An alternative measure can be constructed using data solely from the CPS, which includes self-reported workweeks for all types of workers. As is indicated by the solid line in figure 23, average weekly hours in the CPS are significantly higher than what is published by the BLS for the nonfarm business sector. In part, this difference reflects the CPS definition, which includes hours worked at all jobs. But even adjusting for this and other differences in their construct, the CPS workweek exceeds the measured NFB workweek.[58]

In addition, the two measures of the workweek seem to exhibit different longer-run trends. In particular, rather than the gradual downward trend evident in the nonfarm business workweek over the past thirty years, the CPS workweek held steady, or even increased a bit on net, over that period. That said, both the CPS and NFB workweeks fell sharply during the 2001 recession and have remained at this lower level ever since. And, on net, both workweeks currently stand about ½ hour lower than their level at the most recent business cycle peak.

[58] See Aaronson and Figura (2005).

Conclusion

In this paper, we have reviewed an array of evidence pertaining to the sources of the persistent decline in the aggregate labor force participation rate since 2000. In braod terms, this evidence suggests that the business cycle initially played an important role in this decline, contributing to the sharp run-up in labor force participation in the late 1990s and to both the subsequent drop-off during the 2001 recession and the ensuing period of weak labor market performance over the next couple of years. However, the evidence also highlights a number of more structural factors that have contributed to a potentially longer-lasting downtrend in labor force participation.

To assess the relative importance of these influences, we develop and estimate a model that attempts to coherently combine what we observe about cohort labor force attachment with what we know about demographic shifts into a unified structure. Although the estimates from the model are clearly a reduced form, this basic specification appears to provide a valuable structure for estimating and interpreting aggregate developments in labor force participation. Using the model, we estimate that most of the decline in participation between 2000 and 2003 reflected cyclical influences. In 2004 and 2005, however, the participation rate has moved toward the (declining) longer-run trend, leaving the level of the participation rate in late 2005 close to its trend level.

These results have important implications for the assessment of current macroeconomic conditions. First, the model's result that the current rate of labor force participation is close to its trend rate suggests that the low level of the participation rate is not artificially masking the extent of unemployment (or at least no more than usual), so that the unemployment rate is providing a reasonably accurate picture of the state of the

labor market. Of course, that is not to say that the participation rate might not move above its trend level with a further strengthening in labor demand, as apparently happened in the late 1990s. But the model would view such an increase as cyclical rather than as a sustainable increase in the participation rate.

Second, our estimate of a downward trend in the participation rate has potential implications for the longer-run growth potential of the U.S. economy. In particular, the model results point to a continuation of this declining trend, which, coupled with the slowdown in population growth projected by the Census Bureau and a possible further downtrend in average weekly hours, would depress the increments to aggregate labor supply over the coming decade. Absent a pickup in the underlying pace of productivity growth, such a slowing in labor input would, in turn, reduce the sustainable rate of economic growth relative to the robust pace experienced over the past decade or so.[59]

Although our analysis is incomplete in a number of ways, we would emphasize, in particular, two important caveats to this interpretation of recent developments in labor force participation. First, our cohort-based model of participation generally experienced difficulty in capturing the extent of the decline in the labor force attachment of teenagers. If the unexplained shortfall in participation for this group reflects a decline in the age profile for teenagers, then the participation rate trend may be lower than our model suggests. Alternatively, to the extent that the decline in the labor force participation rates of youths reflects more time spent in school by these cohorts, this additional investment in human capital may imply other changes the shape of the age profile of participation for these cohorts. In particular, we have highlighted both that educational attainment tends

[59] In fact, Aaronson and Sullivan (2001) argue that demographic changes may also contribute to slower potential output growth by reducing slightly the contribution to growth from changes in the average quality of the workforce.

to increase labor market attachment for individuals in their prime working years, reflecting the higher wages and greater opportunities associated with more education, and that it has tended to reduce the participation rates of older individuals owing to the associated income effects.

Second, the rising participation rates of the elderly—another group for which the recent performance of the model has been problematic—would seem to be a particularly important wild card in the years ahead. This age group is large and growing, and a further uptrend in these rates could contribute significantly to movements in the aggregate participation rate in the future. Moreover, longevity and health are particularly difficult variables to forecast, and coupled with the likely shortfall in the labor supply of younger workers, positive innovations in those determinants of participation could be especially potent.

References

Aaronson, Daniel, Kyung-Hong Park, and Daniel Sullivan. 2006. "The Decline in Teen Labor Force Participation." *Economic Perspectives*. Federal Reserve Bank of Chicago. 30(1): 2-18.

Aaronson, Daniel, and Daniel Sullivan. 2001. "Growth in Worker Quality." *Economic Perspectives*. Federal Reserve Bank of Chicago. 25(3): 53-74.

Aaronson, Stephanie, and Andrew Figura. 2005. "How Biases are Measures of Cyclical Movements in Productivity and Hours?" FEDS Working Paper 2005-38. Washington: Federal Reserve Board (September).

Autor, David H. and Mark G. Duggan. 2003. "The Rise in the Disability Rolls and the Decline in Unemployment." *The Quarterly Journal of Economics* 118(1): 157-205.

Becker, Gary S. 1993. *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education*. Chicago: University of Chicago Press.

Benhabib, Jess, Richard Rogerson and Randall Wright. 1991. "Homework in Macroeconomics: Household Production and Aggregate Fluctuations." *Journal of Political Economy* 99(6): 1166-87.

Berger, Mark C. 1983. "Changes in Labor Force Composition and Male Earnings: A Production Approach." *Journal of Human Resources* 17(2): 177-96.

Blau, Francine D. and Lawrence M. Kahn. 2005. "Changes in the Labor Supply Behavior of Married Women: 1980-2000." Working Paper 11230. Cambridge, Mass. (March).

Bosworth, Barry and Gary Burtless. 1992. "Effects of Tax Reform on Labor Supply, Investment, and Saving." *Journal of Economic Perspectives* 6(1): 3-25.

Bound, John. 1989. "The Health and Earnings of Rejected Disability Insurance Applications," *American Economic Review* 79(3): 482-503.

Bound, John and Timothy Waidmann. 1992. "Disability Transfers, Self-reported Health, and the Labor Force Attachment of Older Men: Evidence from the Historical Record." *The Quarterly Journal of Economics* 107(4): 1393-419.

Bradbury, Katherine .2005. "Additional Slack in the Economy: The Poor Recovery in Labor Force Participation During This Business Cycle." Public Policy Brief 05-2. Federal Reserve Bank of Boston (July).

Burtless, Gary. 1999. "An Economic View of Retirement," in *Behavioral Dimensions of Retirement Economics*, edited by Henry Aaron. Brookings Institution Press.

Burtless, Gary and Joseph F. Quinn .2001. "Retirement Trends and Policies to Encourage Work Among Older Americans." In *Ensuring Health and Income Security for an Aging Workforce*, edited by Peter P. Budetti, Richard V. Burkhauser, Janice M. Gregory, and Allan Hunt. The W.E. Upjohn Institute for Employment Research.

Coile, Courtney C. and Phillip B. Levine. 2006. "Bulls, Bears, and Retirement Behavior." *Industrial and Labor Relations Review* (forthcoming).

Congressional Budget Office. 2000. *CBO's Projections of the Labor Force*. Washington: Congressional Budget Office (September).

Coronado, Julia and Maria Perozek. 2003. "Wealth Effects and the Consumption of Leisure: Retirement Decisions During the Stock Market Boom of the 1990s." FEDS Working Paper 2003-20. Washington: Federal Reserve Board (June).

Dellas, Harris and Plutarchos Sakellaris. 2003. "On the Cyclicality of Schooling: Theory and Evidence" *Oxford Economic Papers* 55(1): 148-72.

Devereux, Paul J. 2004. "Changes in Relative Wages and Family Labor Supply." *Journal of Human Resources* 39(3): 696-722.

Eissa, Nada and Hilary Hoynes. 2004. "Taxes and the Labor Market Participation of Married Couples: The Earned Income Tax Credit." *Journal of Public Economics* 88(9-10): 1931-58.

Eissa, Nada and Hilary Hoynes. 2005. "Behavioral Responses to Taxes: Lessons from the EITC and Labor Supply." Working Paper 11729. Cambridge, Mass.: National Bureau of Economics Research,

Eldridge, Lucy P., Marilyn E. Manser, and Phyllis Flohr Otto. 2004. "Alternative Measures of Supervisory Employee Hours and Productivity Growth." *Monthly Labor Review* 127(April): 9-28.

Goldin, Claudia. 2006. "The Quiet Revolution that Transformed Women's Employment, Education, and Family." *American Economic Review, Papers and Proceedings* (forthcoming).

Grant, James H. and Daniel S. Hamermesh. 1981. "Labor Market Competition Among Youths, White Women, and Others." *Review of Economics and Statistics* 63(3): 354-60.

Greene, William H. and Terry G. Seaks. 1991. "The Restricted Least Squares Estimator: A Pedagogical Note." *The Review of Economics and Statistics* 73(3):563-67.

Gustman, Alan L. and Thomas L. Steinmeier. 2002. “Retirement and the Stock Market Bubble.” Working Paper 9404. Cambridge, Mass.: National Bureau of Economic Research (December).

Hausman, Jerry A. 1986. "Taxes and Labor Supply." In *Handbook of Public Economics Vol. 1*, edited by Alan Auerbach and Martin Feldstein. North-Holland.

Haveman, Robert, Philip de John, and Barbara Wolfe. 1991. “Disability Transfers and the Work Decision of Older Men.” *The Quarterly Journal of Economics* 106(3): 939-49.

Himmelberg, Charles and Margaret M. McConnell. 2005. “How Much Labor Market Slack: The Importance of Adjusting for Trend Participation Rates.” Unpublished paper. Federal Reserve Bank of New York (January).

Hotchkiss, Julie L. 2005. “What’s Up with the Decline in Female Labor Force Participation? Working Paper 2005-18. Federal Reserve Bank of Atlanta (August).

Jaeger, David A. 1997. “Reconciling the Old and New Census Bureau Education Questions: Recommendations for Researchers.” *Journal of Business & Economic Statistics* 15(3): 300-09.

Juhn, Chinhui. 1992. "Decline of Male Labor Market Participation: The Role of Declining Market Opportunities." *Quarterly Journal of Economics* 115(1): 79-121.

Juhn, Chinhui and Kevin M. Murphy. 1997. "Wage Inequality and Family Labor Supply." J*ournal of Labor Economics* 15(1, pt.1): 72-97.

Juhn, Chinhui, Kevin M. Murphy, and Robert H. Topel. 1991. "Why has the Natural Rate of Unemployment Increased Over Time?" *BPEA*, 2:1991, 75-126.

Juhn, Chinhui, Kevin M. Murphy, and Robert H. Topel. 2002. "Current Unemployment, Historically Contemplated." *BPEA*, 1:2002, 79-116.

Killingsworth, Mark, and James Heckman. 1986. “Female Labor Supply: A Survey.” In *Handbook of Labor Economics, Vol. 1*. Edited by Orley Ashenfelter and Richard Layard. North-Holland.

Kirkland, Katie. 2000. “On the Decline in Average Weekly Hours Worked.” *Monthly Labor Review* 123(July): 26-31.

Kominski, Robert and Paul M. Siegel. 1993. “Measuring Education in the Current Population Survey.” *Monthly Labor Review* 116(September): 34-38.

Loughran, David and Steven Haider. 2005. "Do the Elderly Respond to Taxes on Earnings: Evidence from the Social Security Retirement Earnings Test." RAND Labor and Population Working Paper WR-223. San Diego: RAND (January).

Mulligan, Casey B. and Yona Rubinstein. 2006. "Specialization, Inequality, and the Labor Market for Women," Unpublished Manuscript. University of Chicago (January).

Murphy, Kevin M. and Robert H. Topel. 1987. "The Evolution of Unemployment in the United States: 1968-1985. In *NBER Macroeconomics Annual 1987*. Edited by Stanley Fischer. The MIT Press.

Parsons, Donald O. 1980. "The Decline of Male Labor Force Participation." *Journal of Political Economy* 88(1): 117-34.

Pencavel, John. 1986. "Labor Supply of Men: A Survey." In *Handbook of Labor Econmics, Vol. 1*, edited by Orley Ashenfelter and Richard Layard. North-Holland.

Pension Benefit Guaranty Corporation. 2005. *An Analysis of Frozen Defined Benefit Plans*. Washington: Pension Benefit Guaranty Corporation (December).

Perry, George. 1970. "Changing Labor Markets and Inflation." *BPEA*, 3:1970, 411-48.

Perry, George. 1971. "Labor Force Structure, Potential Output, and Productivity." *BPEA*. 2:1971, 533-78.

Polivka, Anne E. 1996. "Data Watch: The Redesigned Current Population Survey." *Journal of Economic Perspectives* 10(3): 169-80.

Polivka, Anne E. and Stephen M. Miller. 1998. "The CPS After the Redesign: Refocusing the Economic Lens." in *Labor Statistics and Meausrement Issues*, edited by John Haltiwanger, Marilyn Manser, and Robert Topel. University of Chicago Press.

Polivka, Anne E. and Jennifer M. Rothgreb. 1993. "Overhauling the Current Population Survey: Redesigning the Questionnaire." *Monthly Labor Review* 116(September): 10-28.

Rones, Philip L., Randy E. Ilg, and Jennifer M. Gardner. 1997. "Trends in Hours of Work since the Mid-1970s." *Monthly Labor Review* 120(April): 3-14.

Sevak, Purvi. 2005. "Wealth Shocks and Retirement Timing: Evidence from the Nineties." Unpublished Paper. Hunter College.

Shimer, Robert .1998. "Why is the U.S. Unemployment Rate So Much Lower?" In *NBER Macroeconomics Annual 1998*, edited by Ben S. Bernanke and Julio Rotemberg. The MIT Press.

Social Security Administration. 2004. *Annual Statistical Report on the Social Security Disability Insurance Program, 2003.* SSA Publication No. 13-11826 (August).

Toossi, Mitra. 2005. “Labor Force Projections to 2014: Retiring Boomers.” *Monthly Labor Review* 128(November): 25-44.

Venti, Steven F. and David A. Wise. 2001. "Aging and Housing Equity, Another Look." Working Paper 8608. Cambridge, Mass.: National Bureau of Economic Research (November).

Wachter, Michael L. 1978. “Intermediate Swings in Labor Force Participation.” *BPEA*. 2:1977, 545-76.

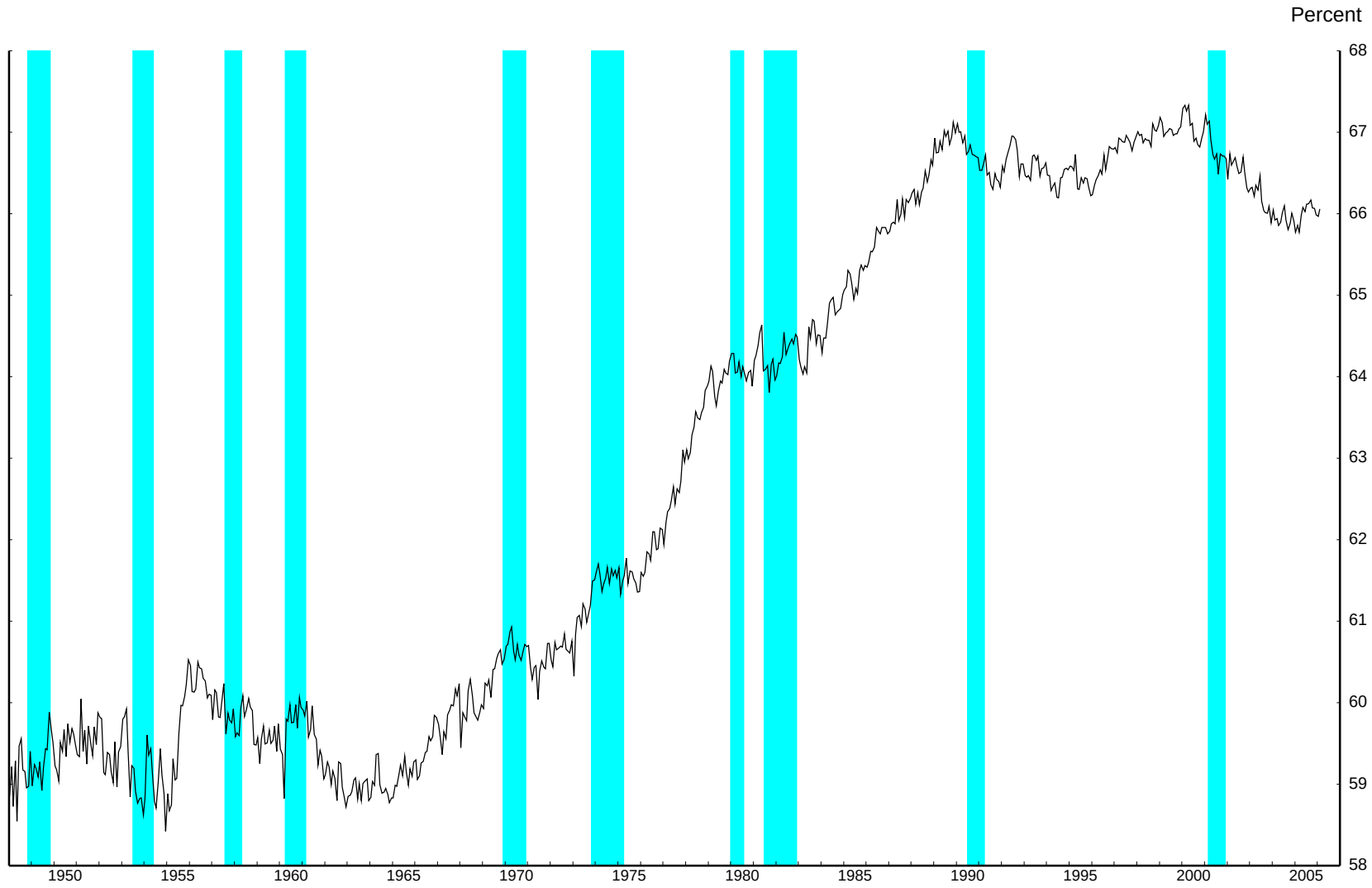
Watson Wyatt Worldwide. 2005. "More Companies Froze, Terminated Pension Plans in 2004, Watson Wyatt Analysis Finds." Press Release. June 22.

Welch, Finis. 1979. “Effects of Cohort Size on Earnings: The Baby Boom’s Financial Bust.” *Journal of Political Economy* 87(5): S65-S97.

Welch, Finis. 1997. "Wages and Participation." *Journal of Labor Economics* 15(1, pt. 2): S77-S103.

Figure 1

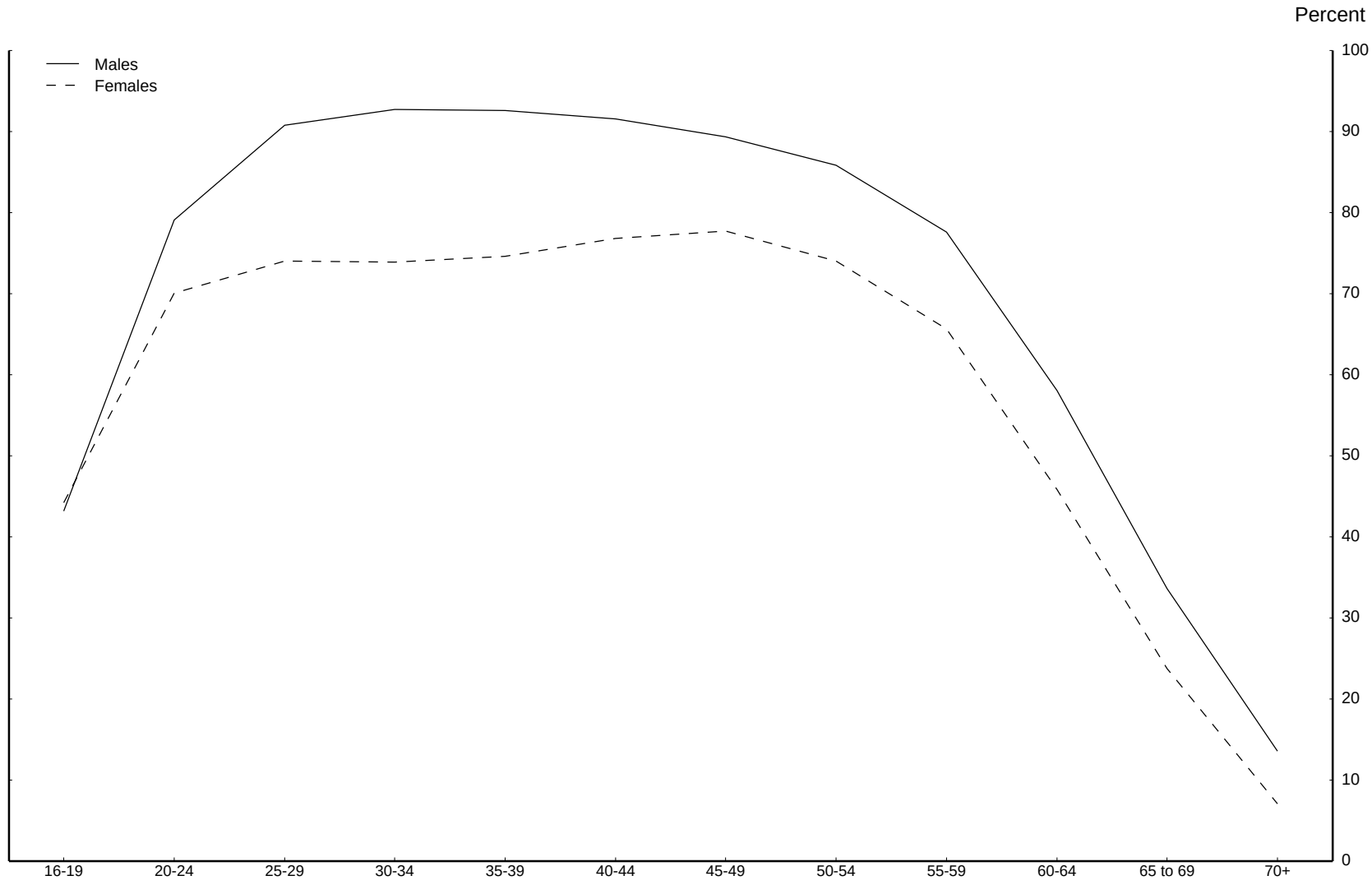
Aggregate Labor Force Participation Rate



Source. Bureau of Labor Statistics. Data adjusted by the authors as described in footnote 7.
Note. Shaded areas are NBER dated recessions.

Figure 2

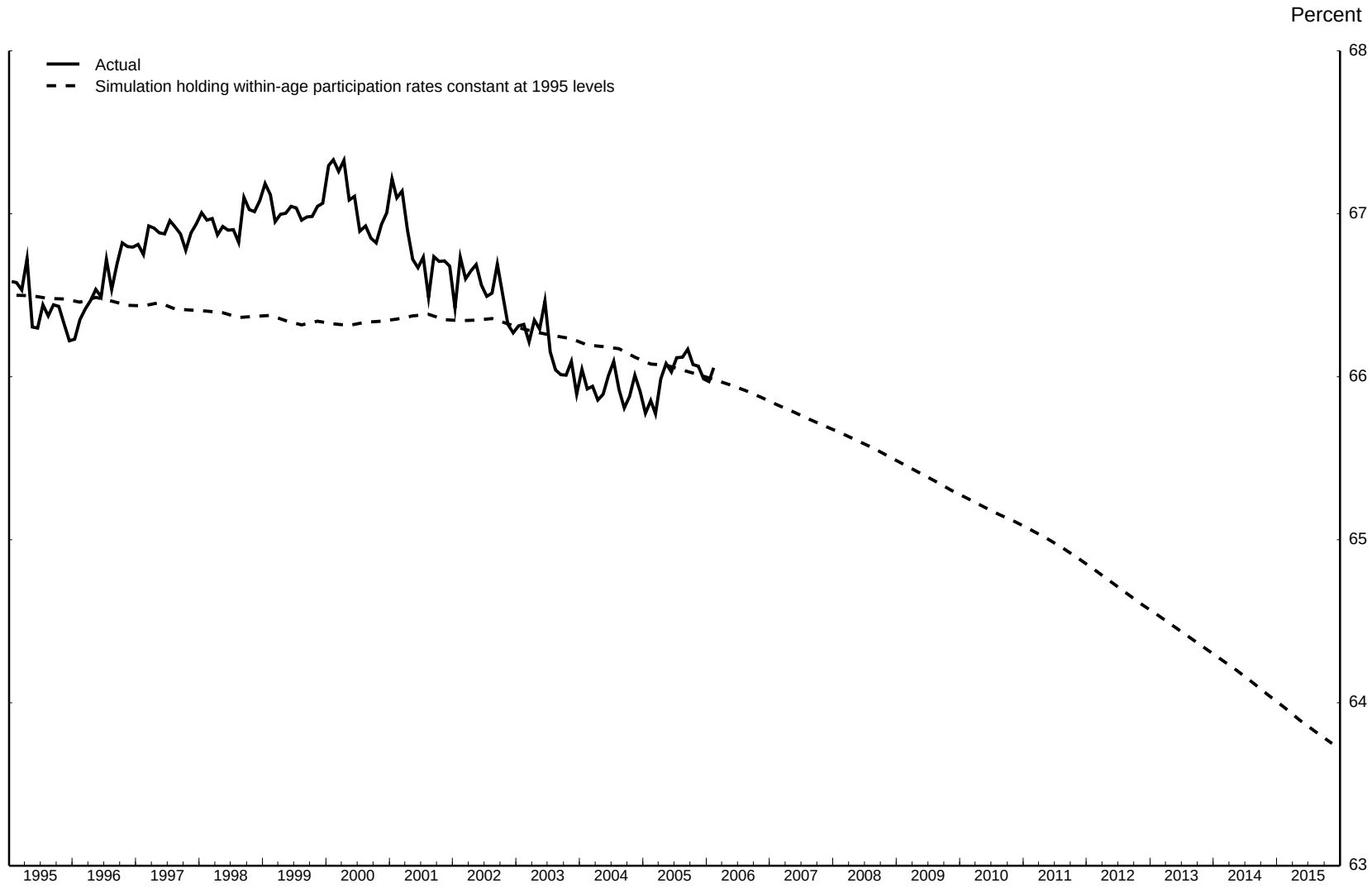
Labor Force Participation Rates by Age (2005)



Source. Bureau of Labor Statistics.

Figure 3

The Influence of Population Shares

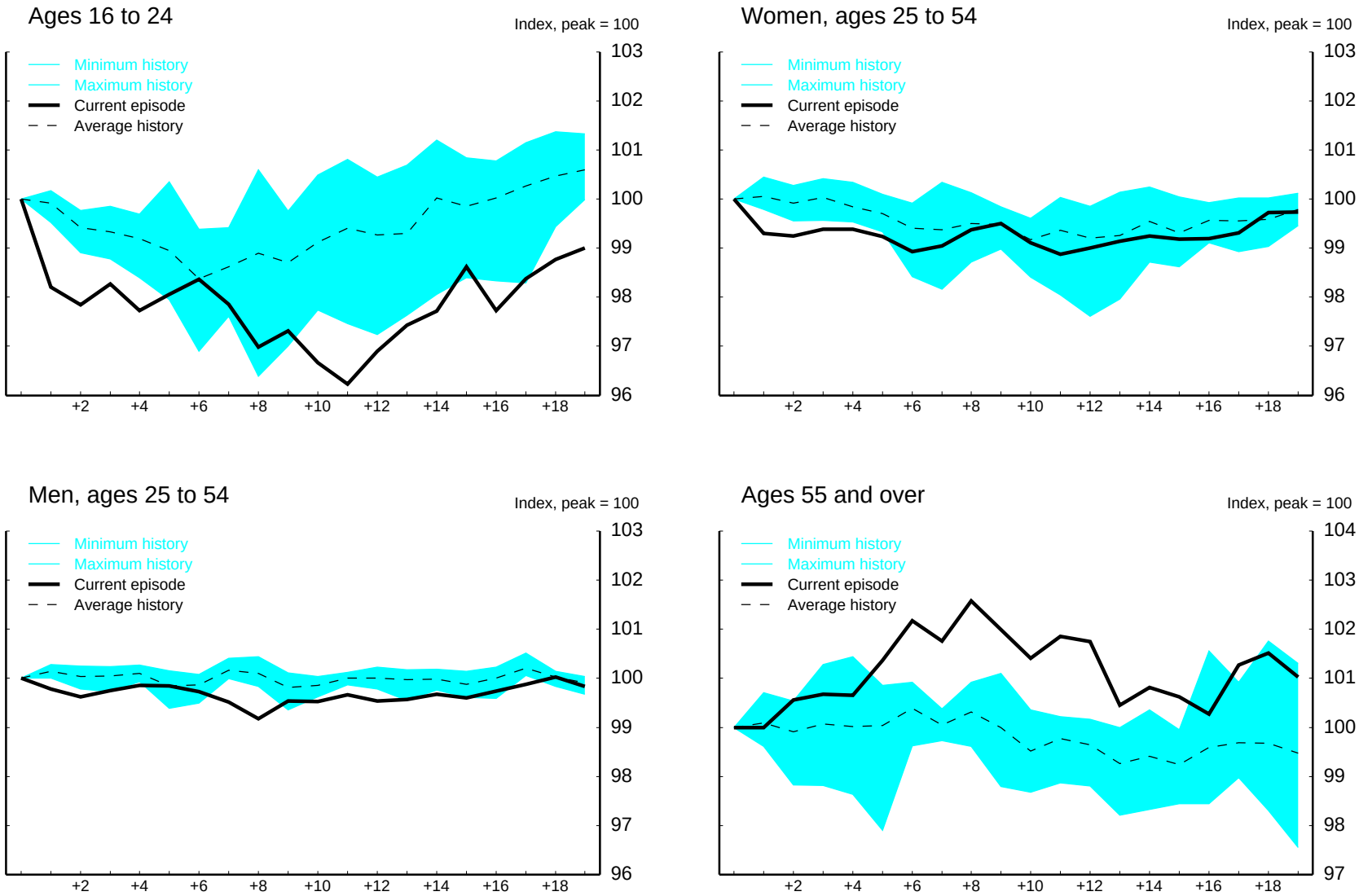


Source. Bureau of Labor Statistics. Data adjusted by the authors as described in footnote 7.

Figure 4
Labor Force Participation Rates by Enrollment
(Ages 16 to 24)

Source. Bureau of Labor Statistics and authors' calculations.
Note. Series shown are a 5-month centered moving average of the seasonally adjusted series.
Note. Shaded areas are NBER dated recessions.

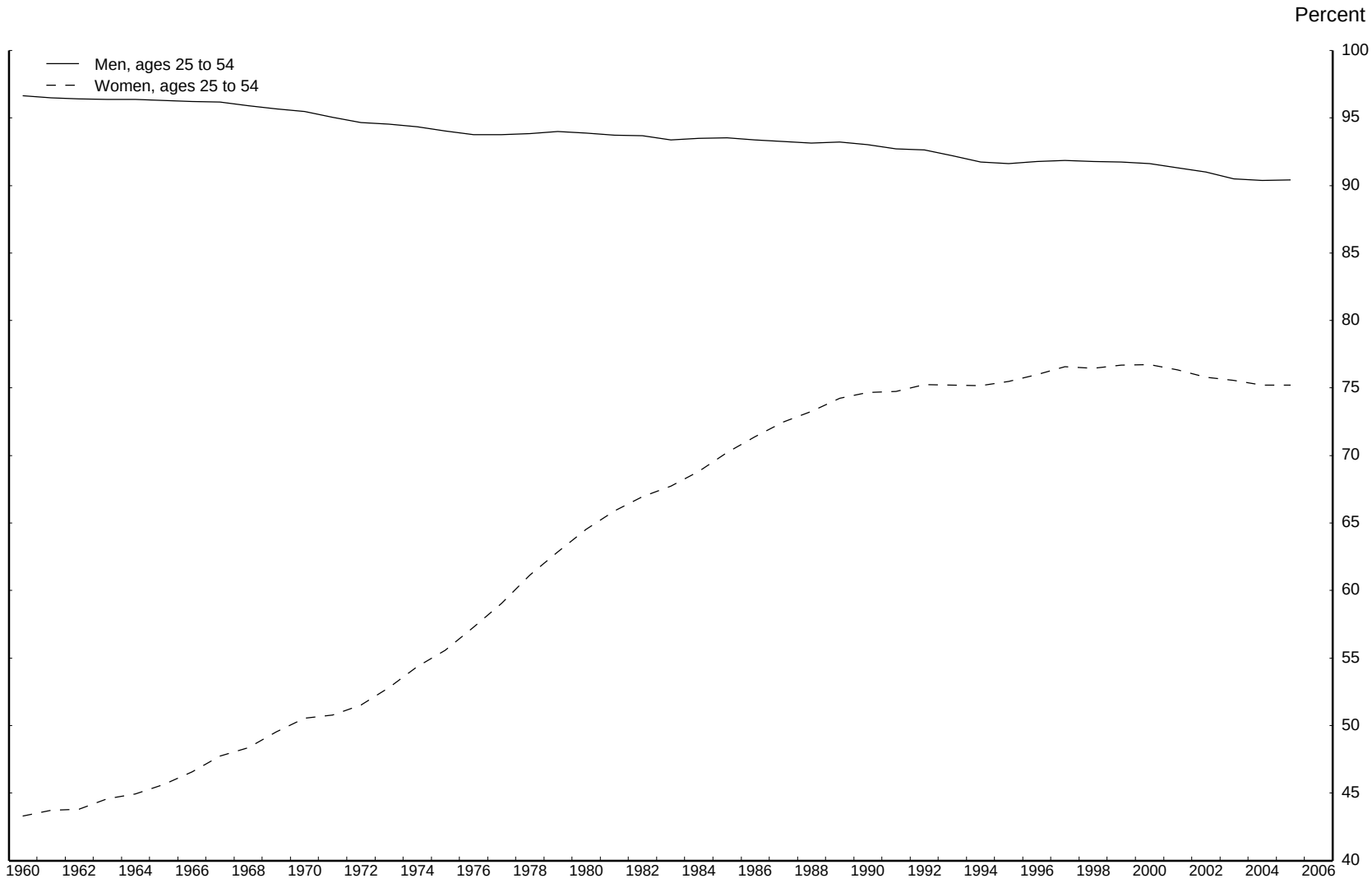
Figure 5
Quarterly Cyclical Comparisons
Labor Force Participation Rates



Note. Current episode peak is 2001q1; historical peaks included are 1969q4, 1973q4, 1981q3, and 1990q3.
Source. Bureau of Labor Statistics and authors' calculations. Data adjusted by the authors as described in footnote 7.

Figure 6

Labor Force Participation Rates of Prime-Aged Persons

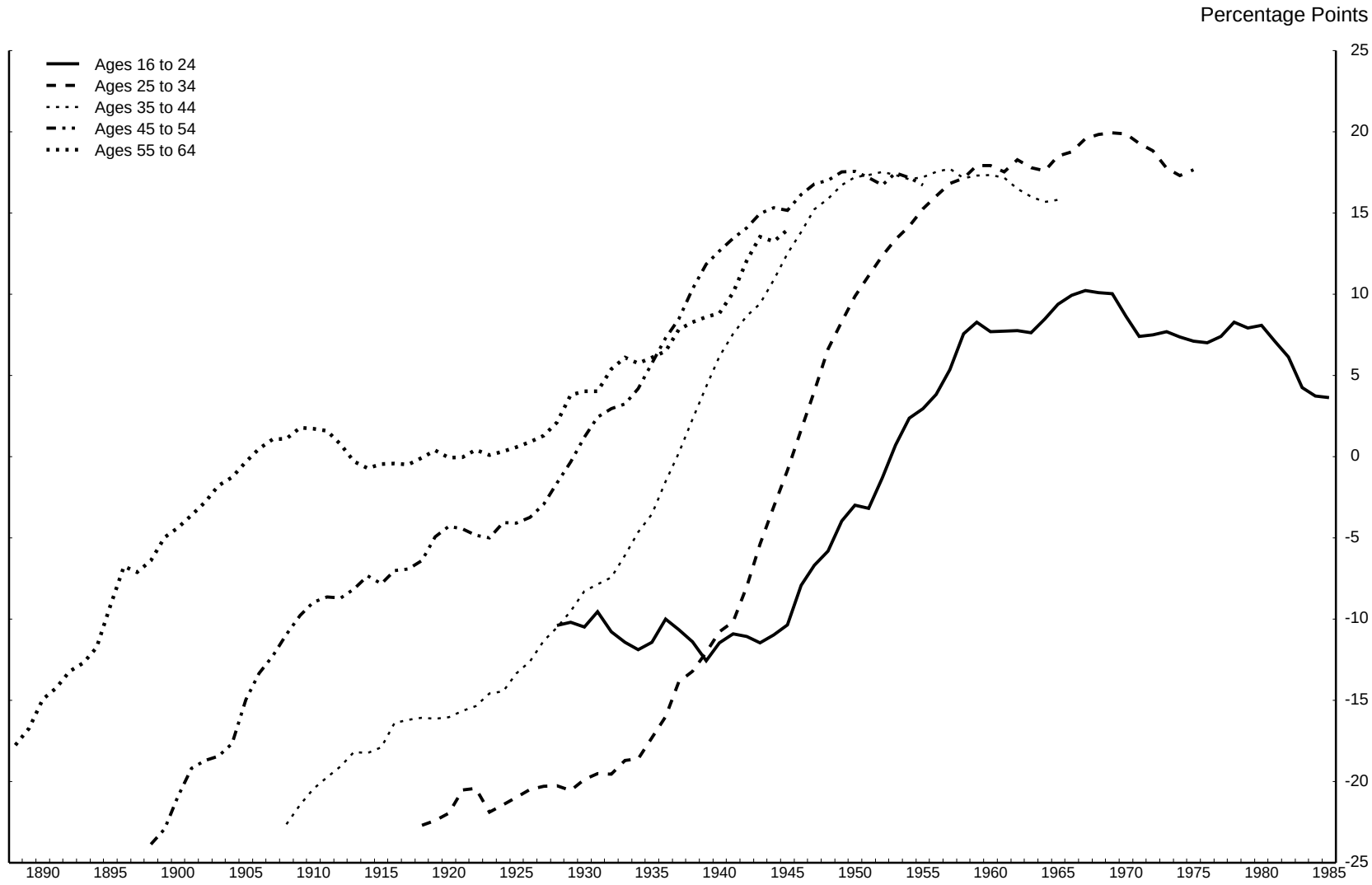


Source. Bureau of Labor Statistics. Data adjusted by the authors as described in footnote 7.

Figure 7

Female Labor Force Participation by Age and Birth Year

(deviations from age specific means)



Source. Bureau of Labor Statistics and authors' calculations. Data adjusted by the authors as described in footnote 7.

Figure 8

Participation Rates of Single Mother Welfare Recipients and Nonrecipients

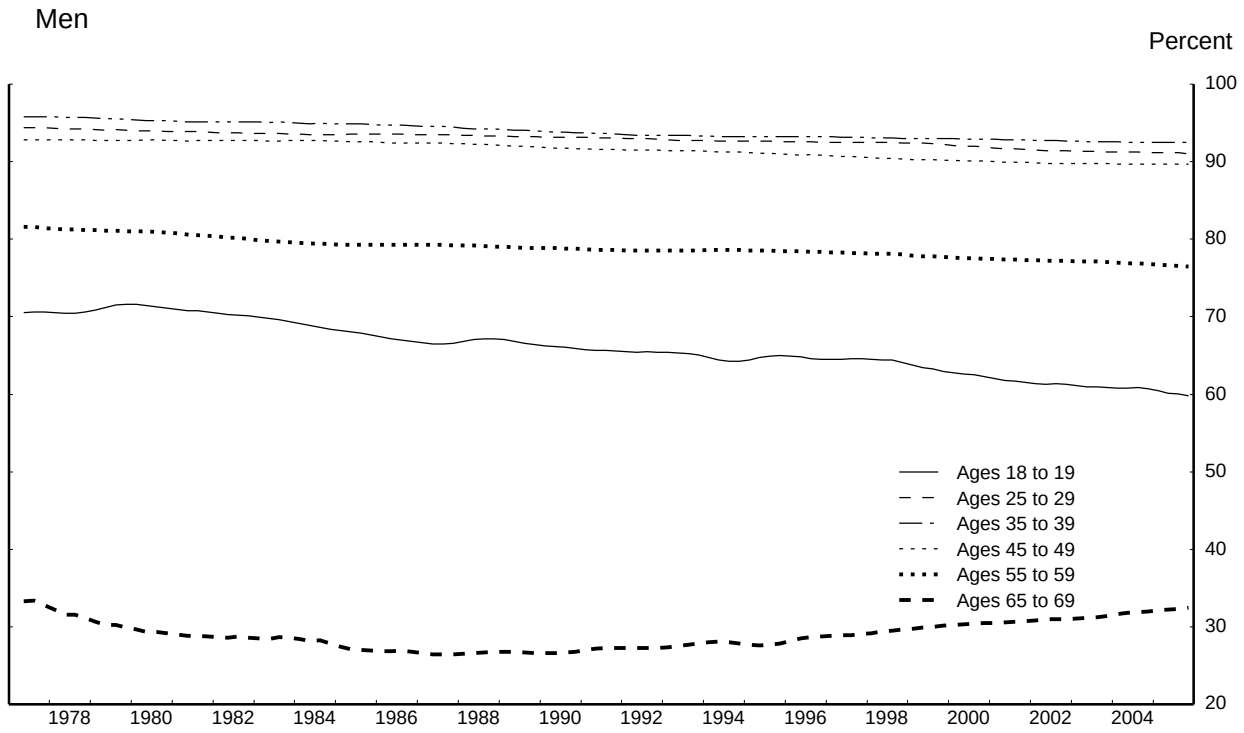
Source. Authors' calculations using Current Population Survey data.

Figure 9

Individuals Reporting Illness or Disability as a Reason for Limited Work

Source. Authors' calculations using Current Population Survey data.

Figure 10
Estimated Cohort Profiles



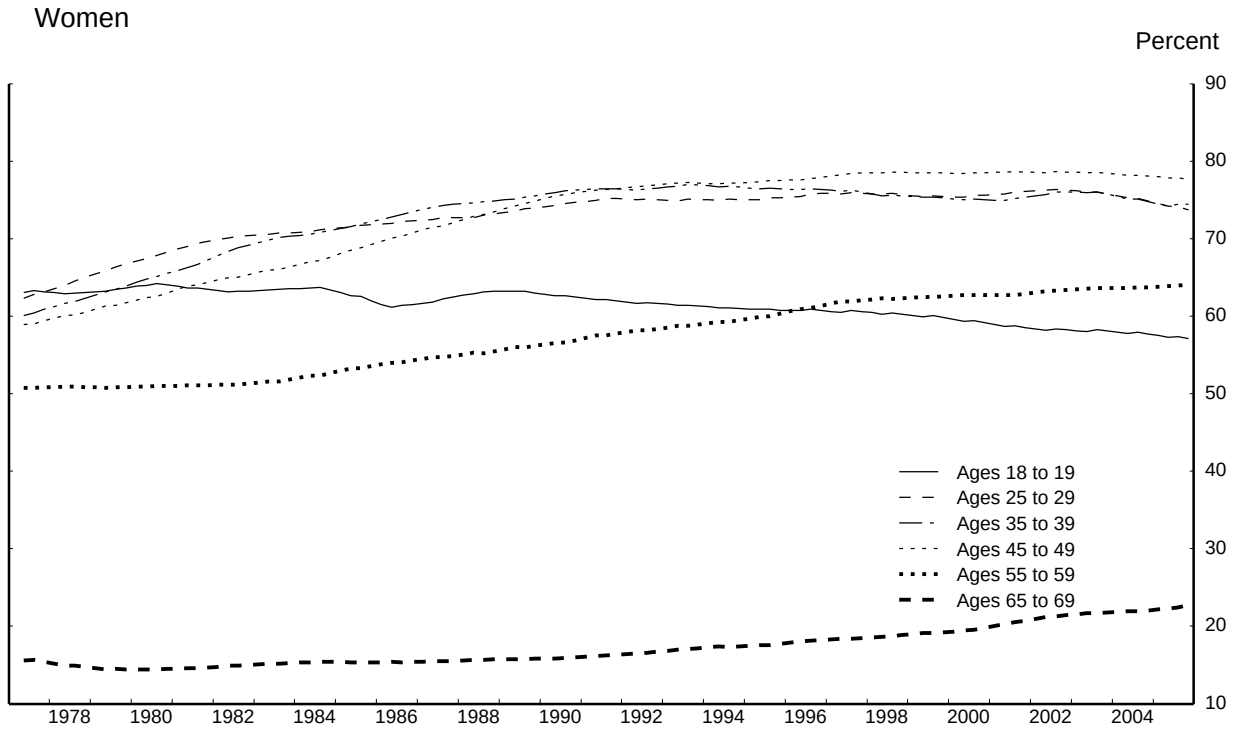
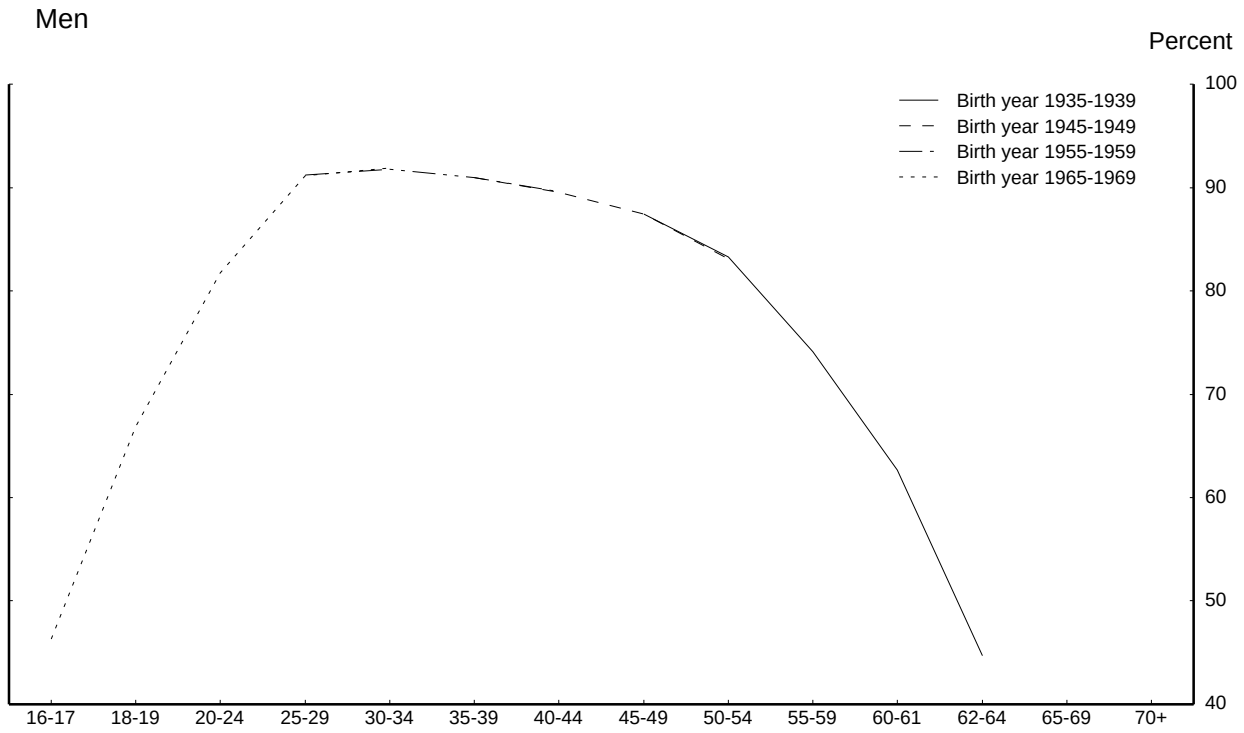


Figure 11
Estimated Age Profiles



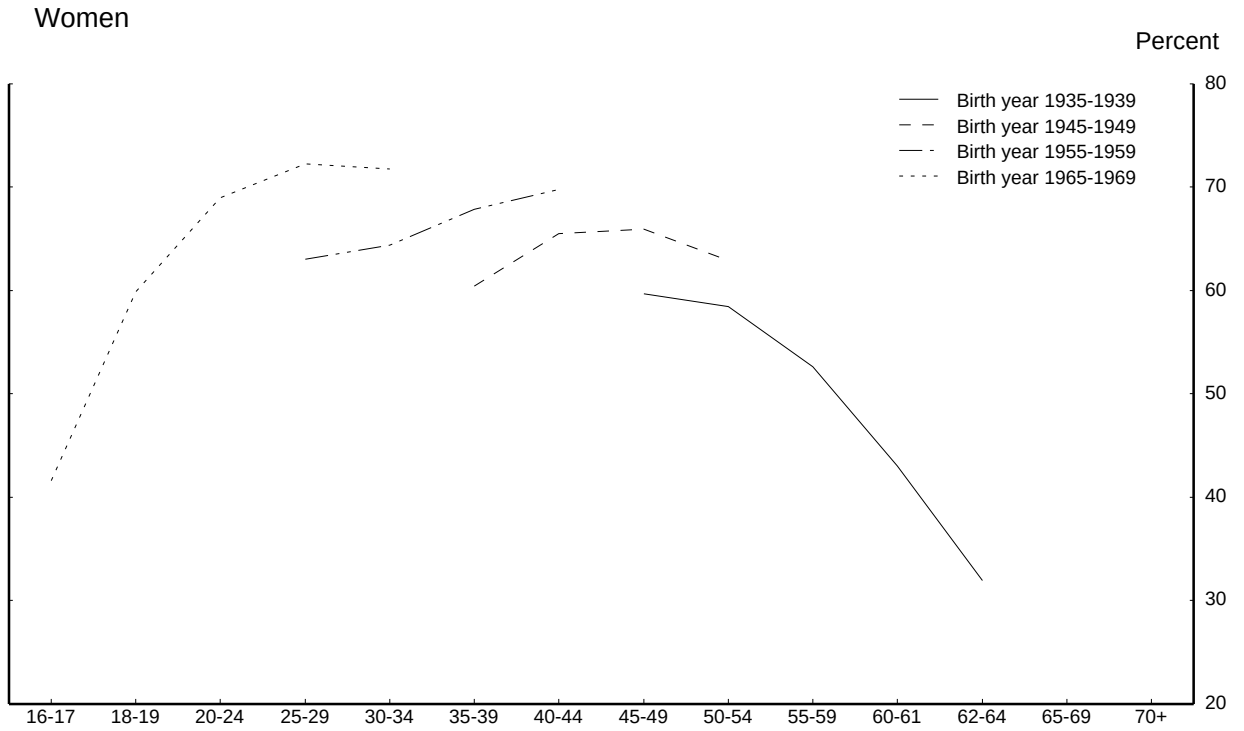
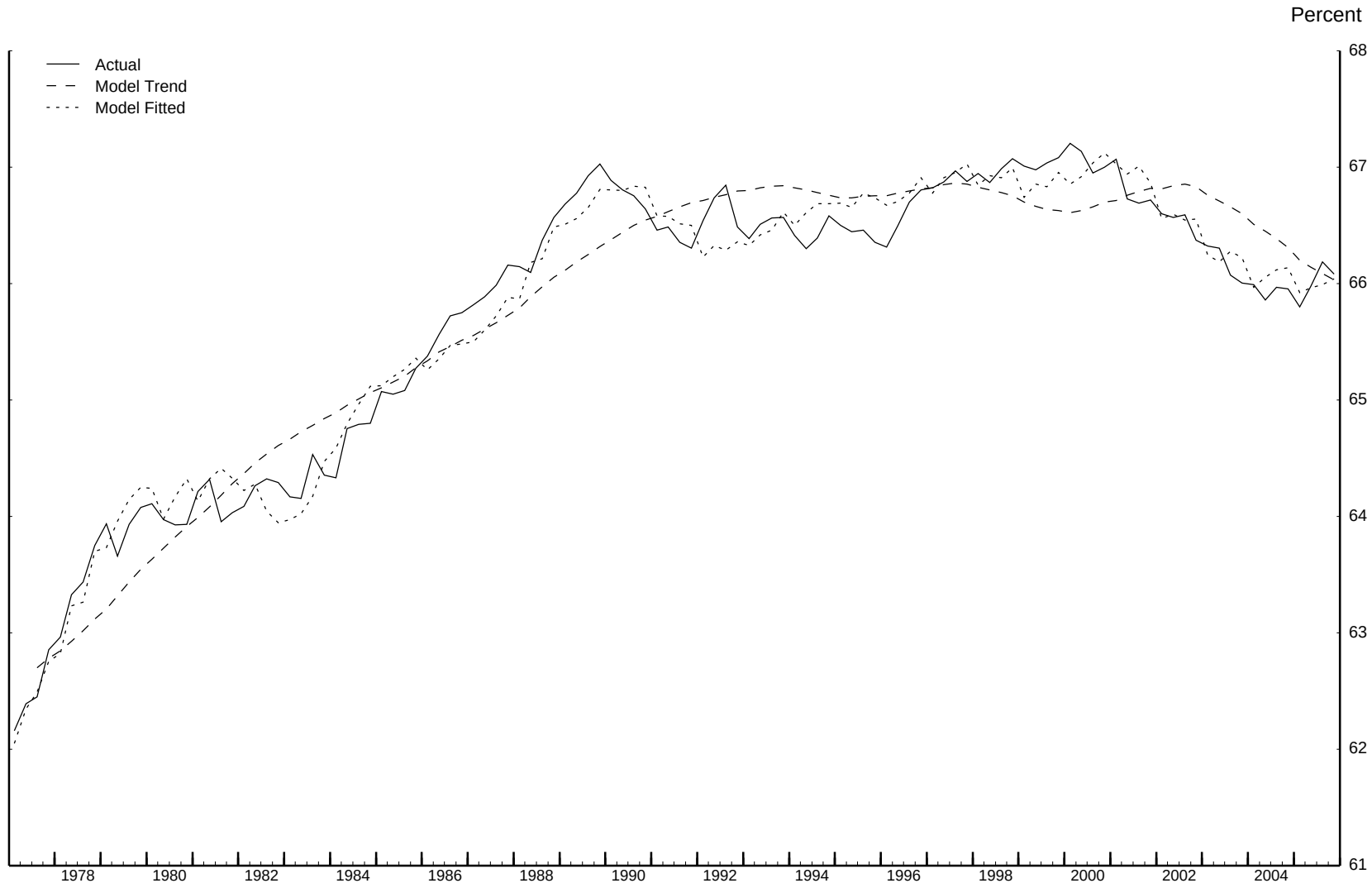


Figure 12

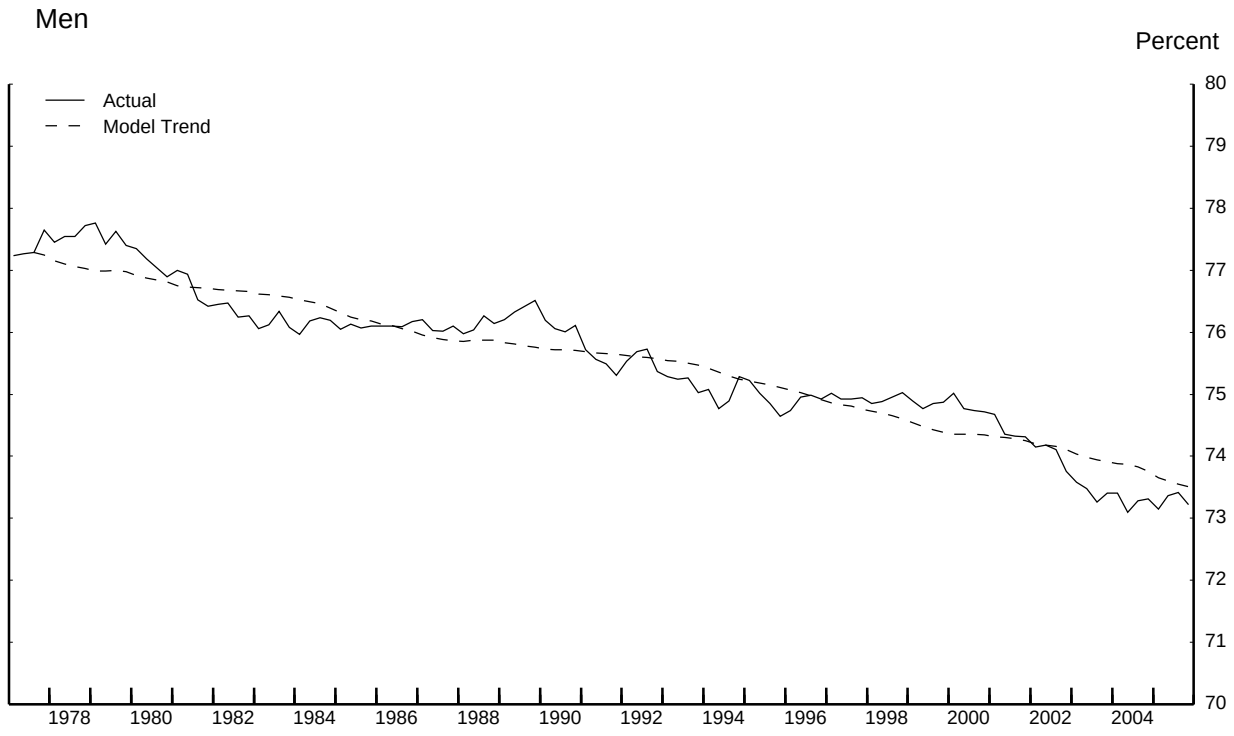
Labor Force Participation Rate Model Results: 1977-2005



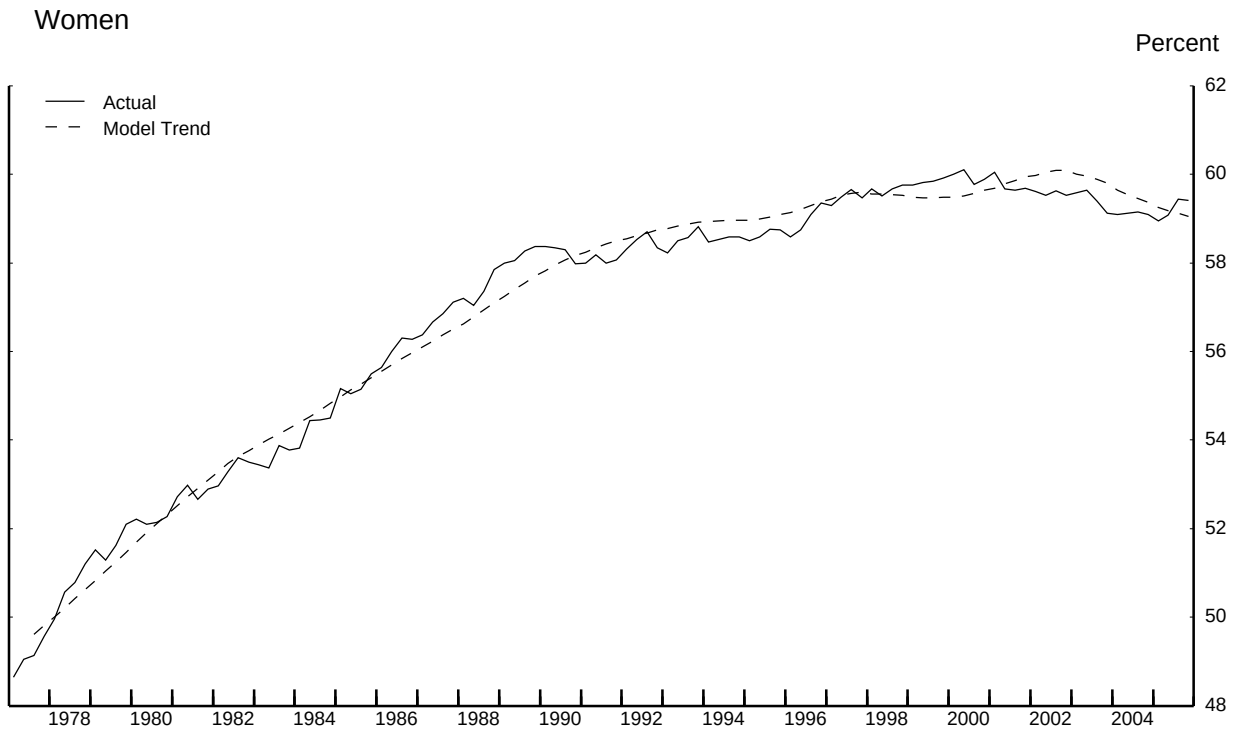
Source. Bureau of Labor Statistics and authors' calculations. Data adjusted by the authors as described in footnote 7.

Figure 13

Labor Force Participation Rate Model Results by Sex



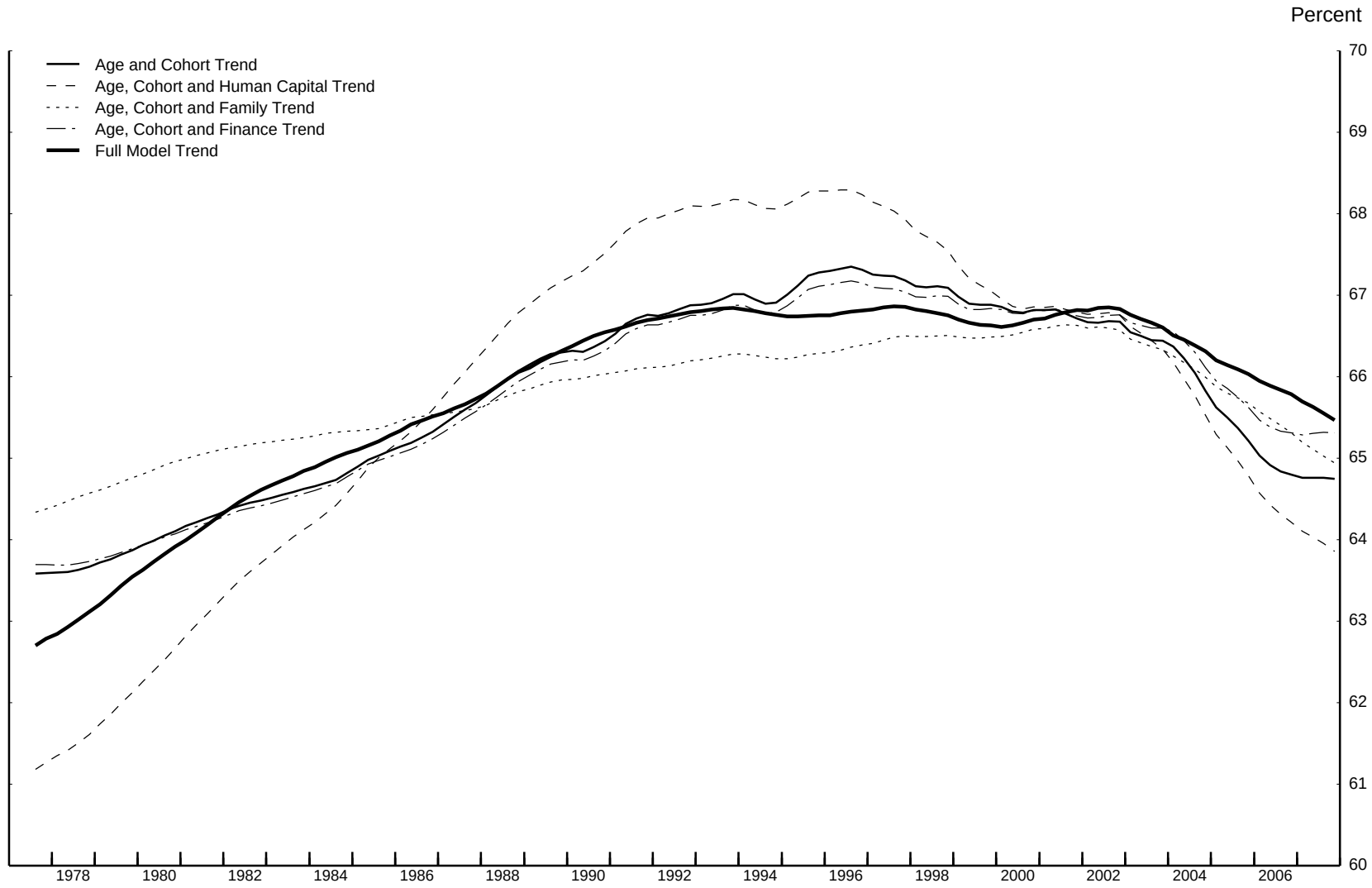
Source. Bureau of Labor Statistics and authors' calculations. Data adjusted by the authors as described in footnote 7.



Source. Bureau of Labor Statistics and authors' calculations. Data adjusted by the authors as described in footnote 7.

Figure 14

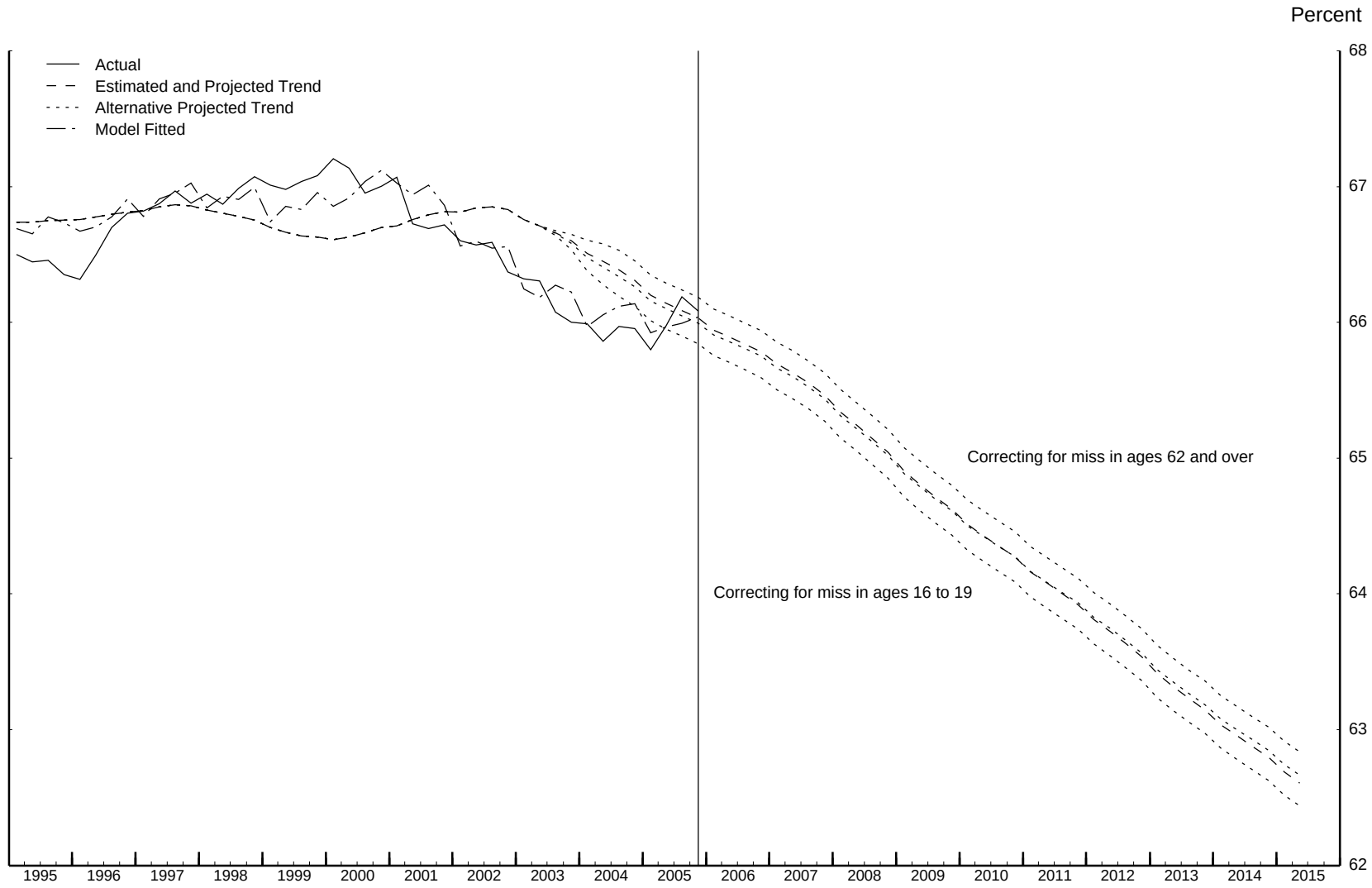
Labor Force Participation Rate Model Results



Source. Bureau of Labor Statistics and authors' calculations.

Figure 15

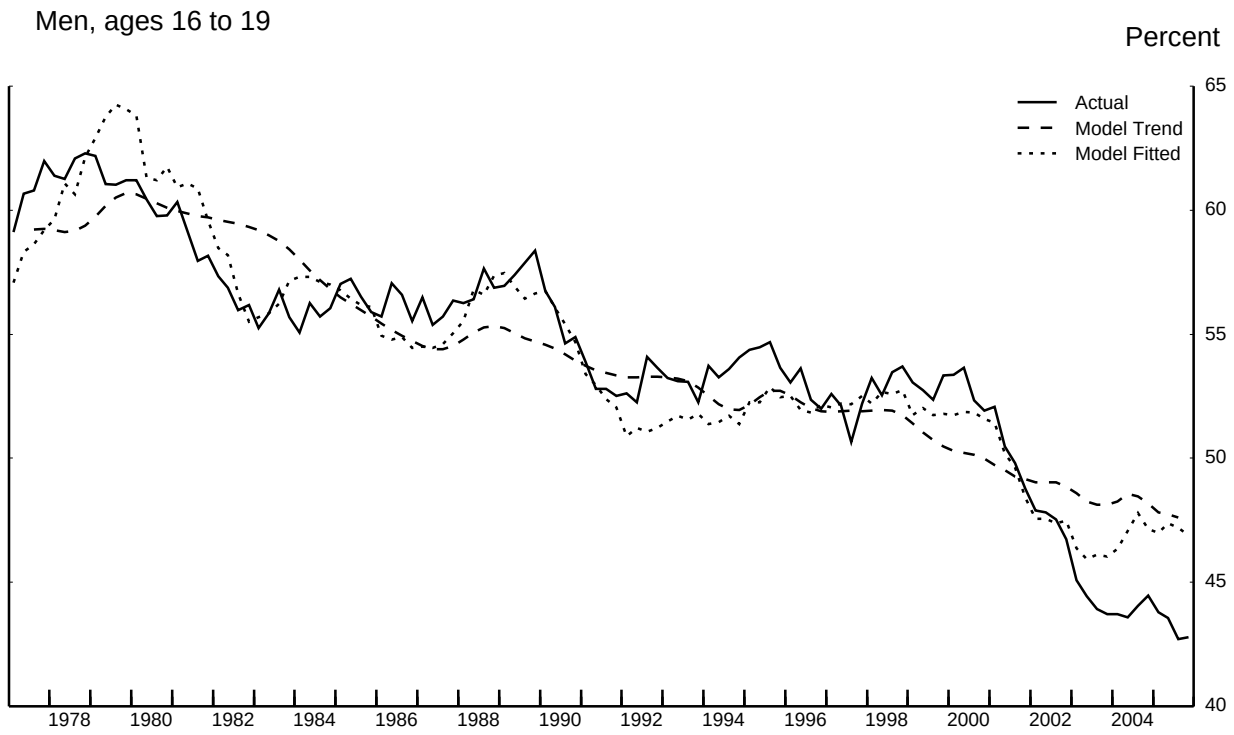
Labor Force Participation Rate Model Results: 1995-2015



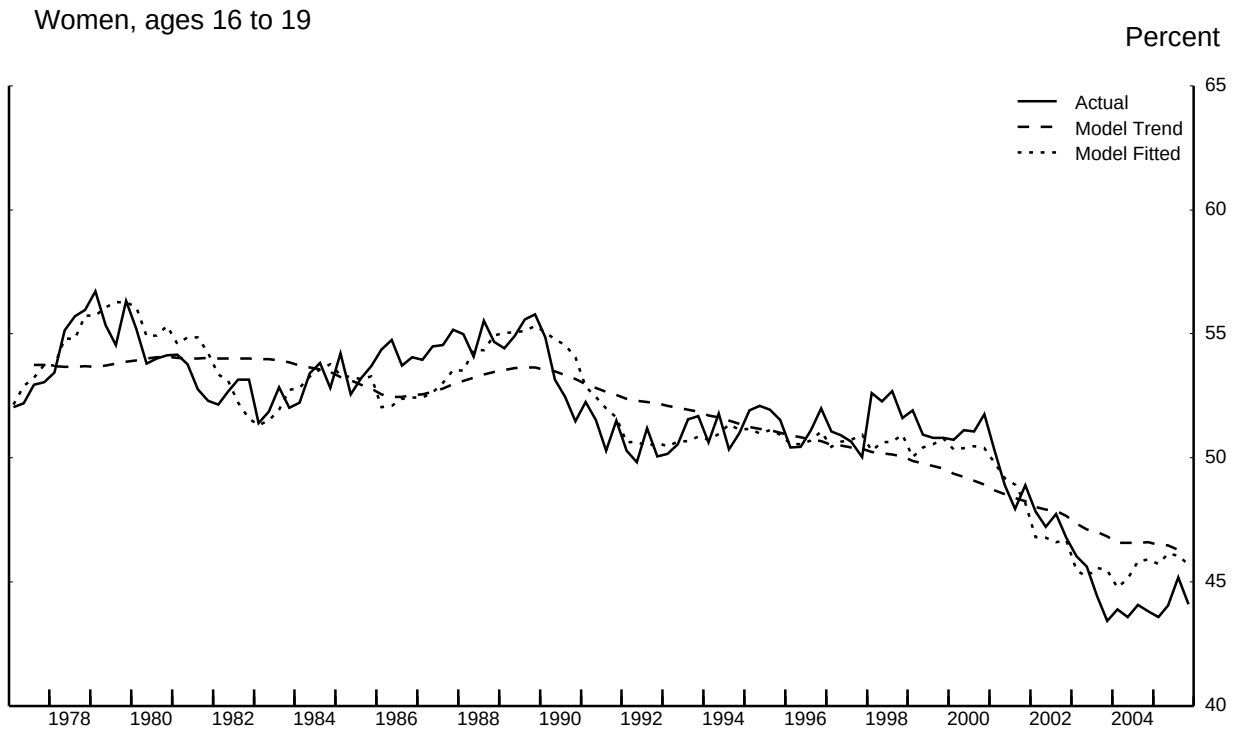
Source: Bureau of Labor Statistics and authors' calculations. Data adjusted by the authors as described in footnote 7.

Figure 16

Performance of the Labor Force Participation Rate Model: Teenagers



Source. Bureau of Labor Statistics and authors' calculations. Data adjusted by the authors as described in footnote 7.

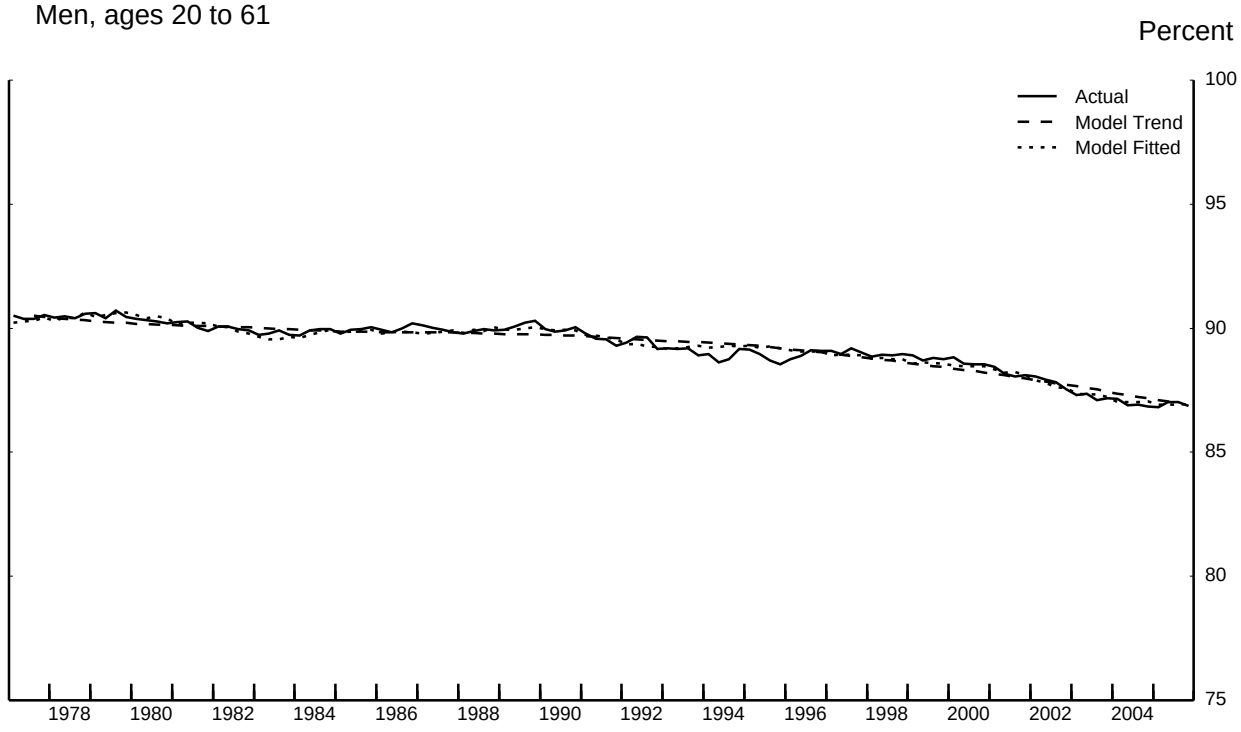


Source. Bureau of Labor Statistics and authors' calculations. Data adjusted by the authors as described in footnote 7.

Figure 17

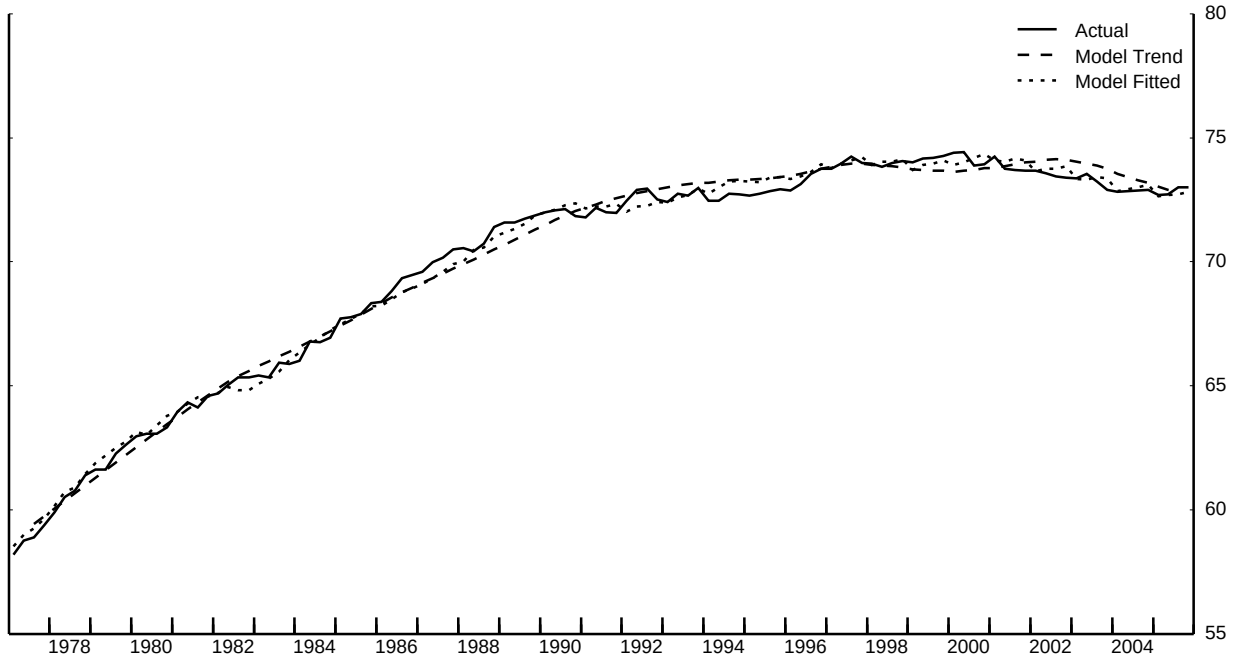
Performance of the Labor Force Participation Rate Model: Ages 20 to 61

Men, ages 20 to 61



Source. Bureau of Labor Statistics and authors' calculations. Data adjusted by the authors as described in footnote 7.

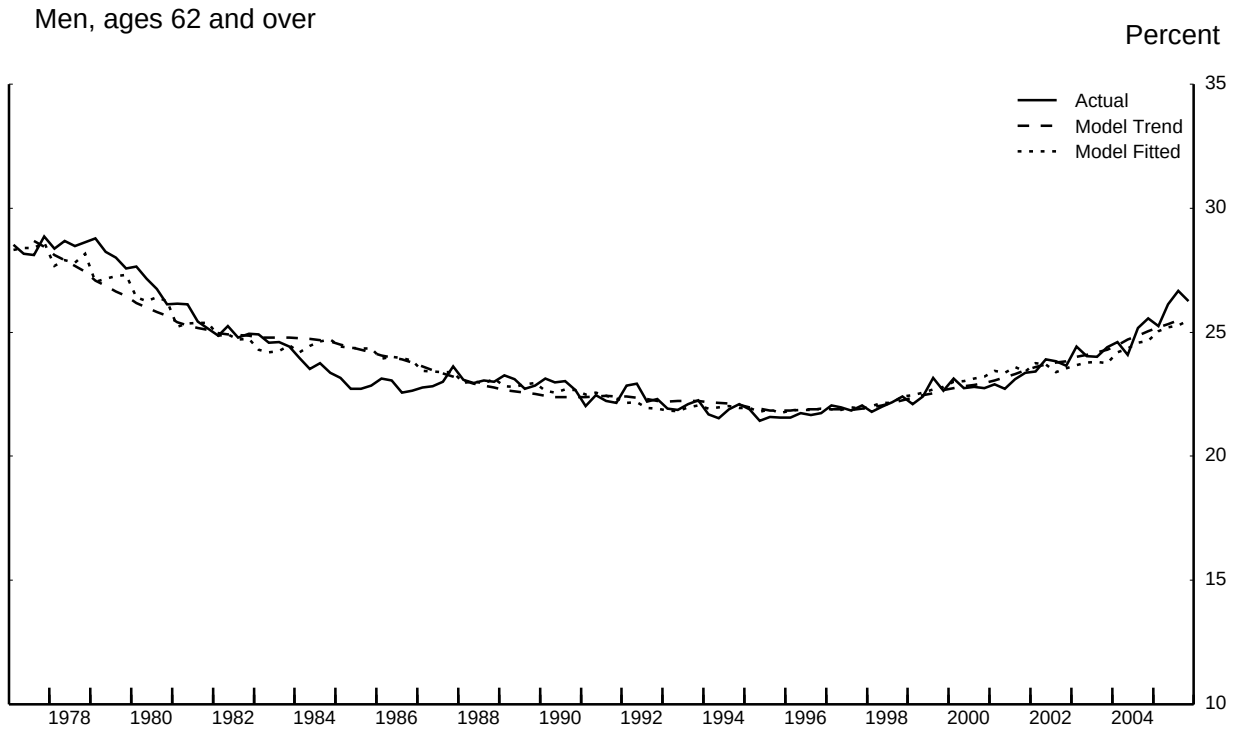
Women, ages 20 to 61



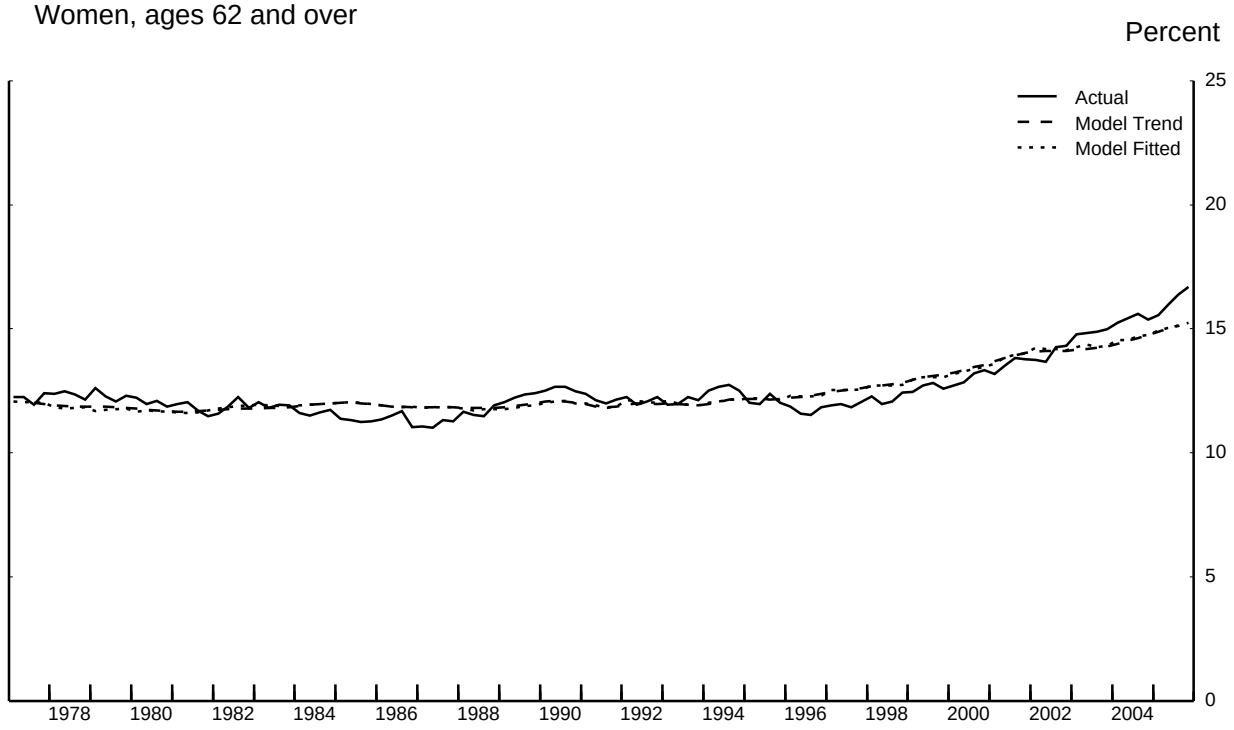
Source. Bureau of Labor Statistics and authors' calculations. Data adjusted by the authors as described in footnote 7.

Figure 18

Performance of the Labor Force Participation Rate Model: Ages 62 and over



Source. Bureau of Labor Statistics and authors' calculations. Data adjusted by the authors as described in footnote 7.



Source. Bureau of Labor Statistics and authors' calculations. Data adjusted by the authors as described in footnote 7.

Figure 19

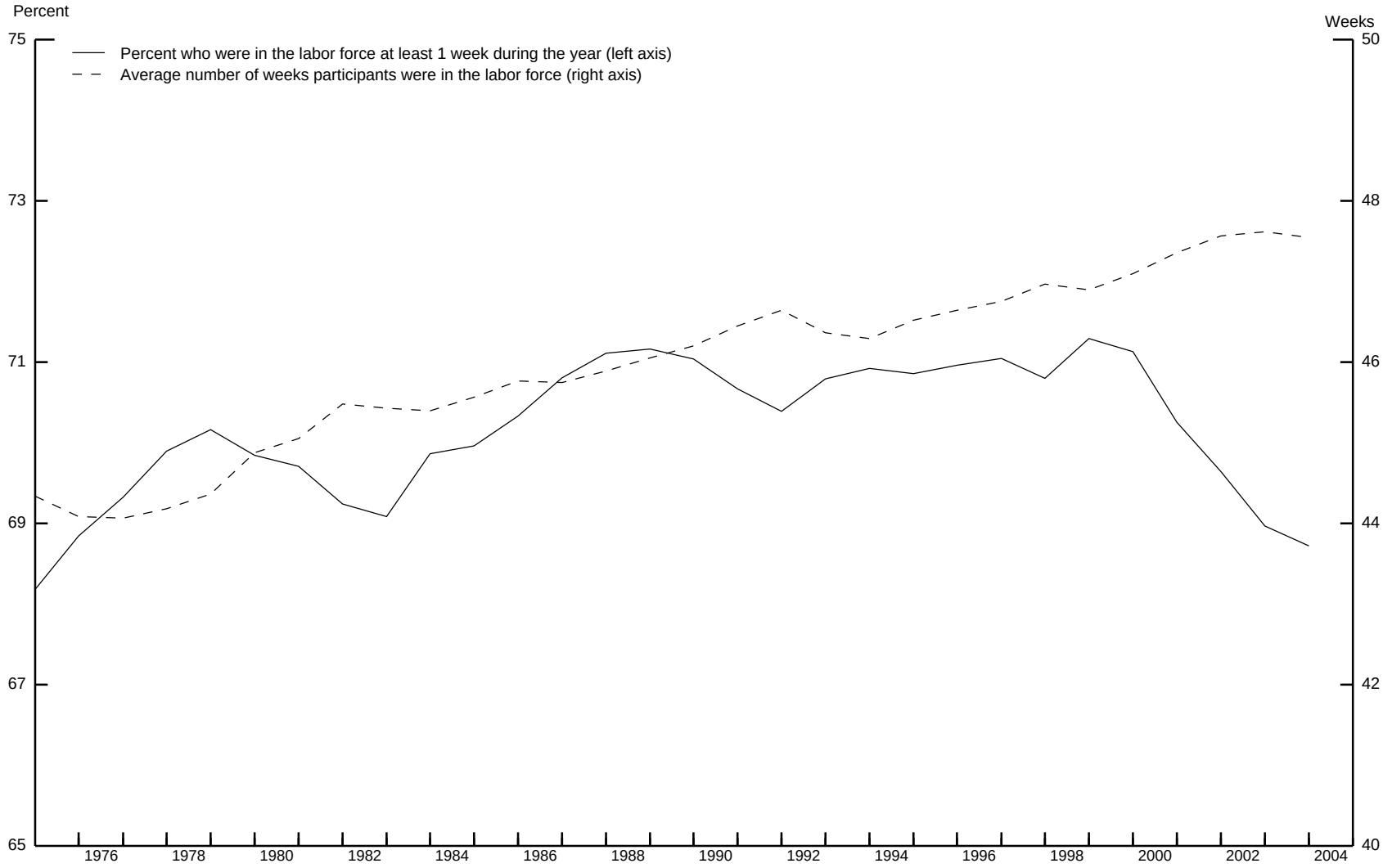
Flows out of the Labor Force

(as a percent of the labor force)

Source. Authors' calculations using Current Population Survey data.

Figure 20

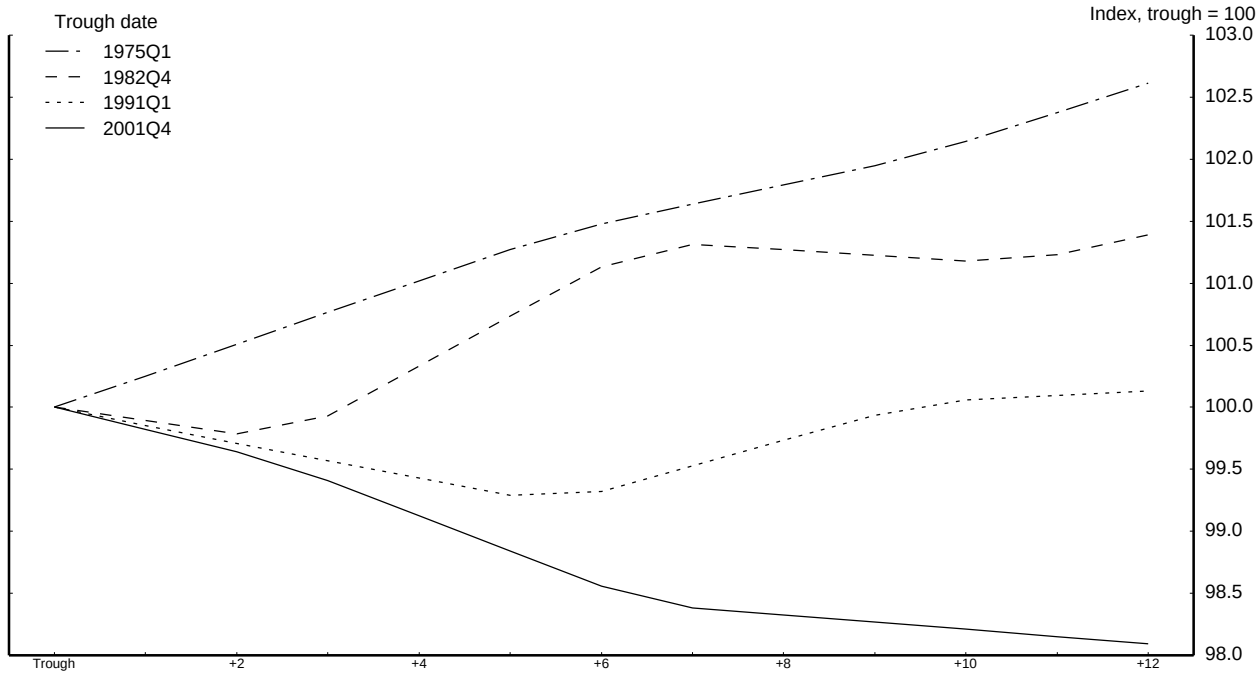
Incidence and Duration of Participation



Source. Authors' calculations using Current Population Survey data.

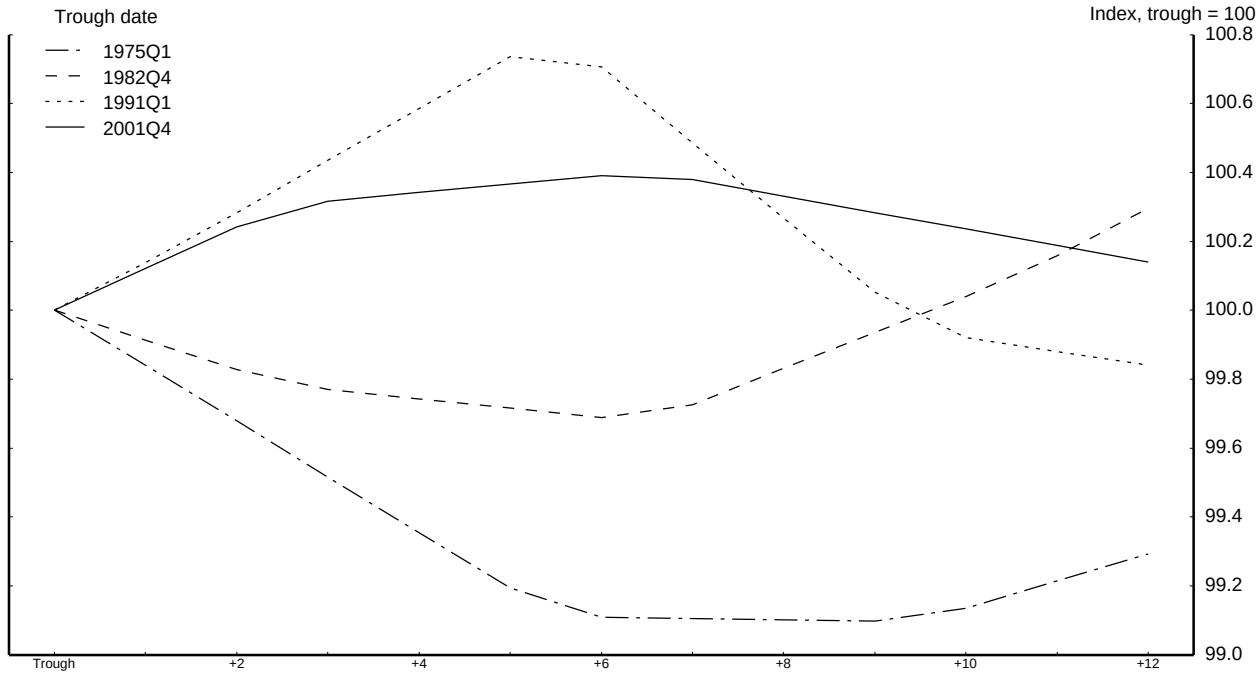
Figure 21
Cyclicality of Incidence and Duration

Incidence of Participation



Source. Authors' calculations using Current Population Survey data.

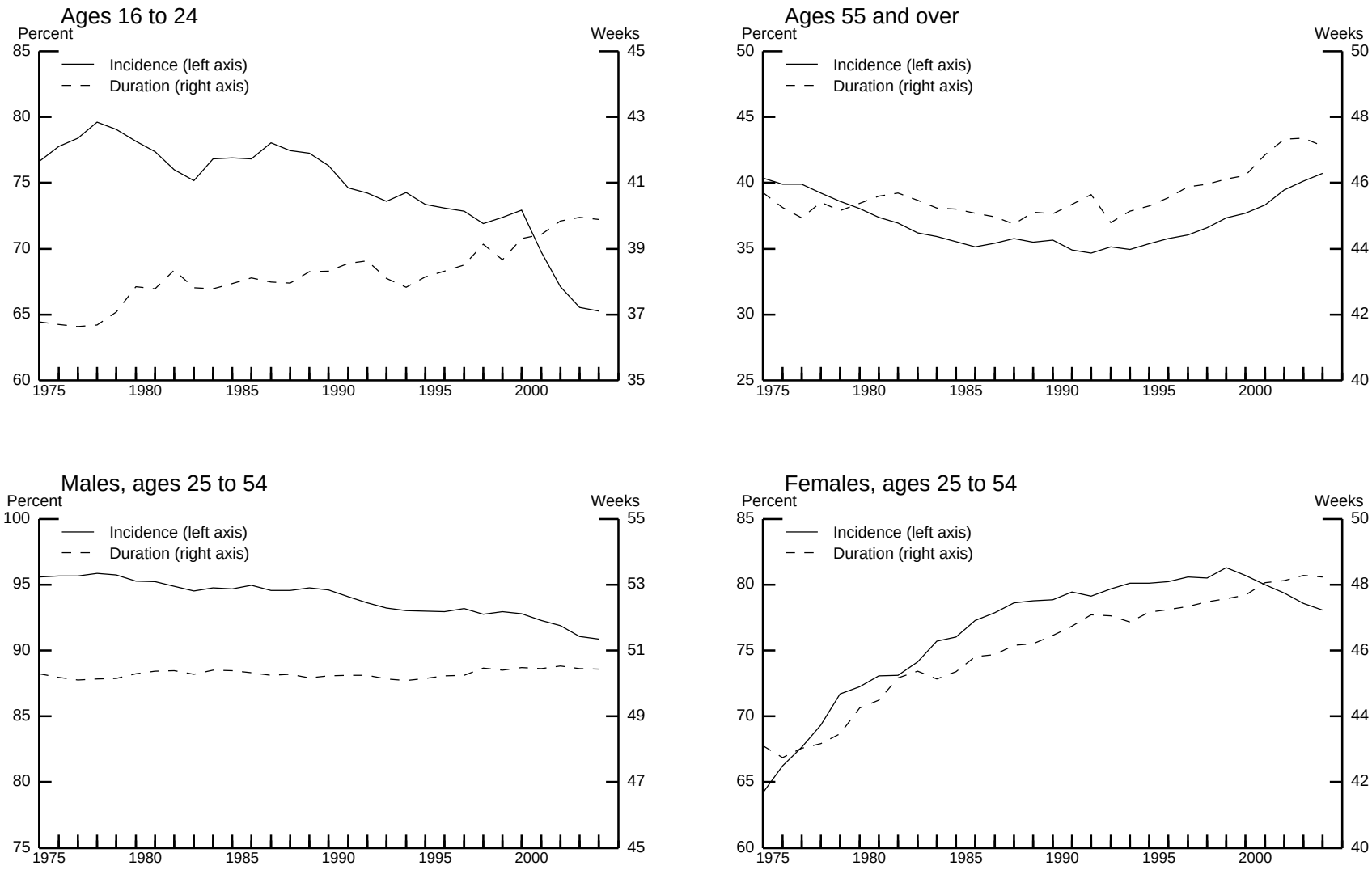
Duration of Participation



Source. Authors' calculations using Current Population Survey data.

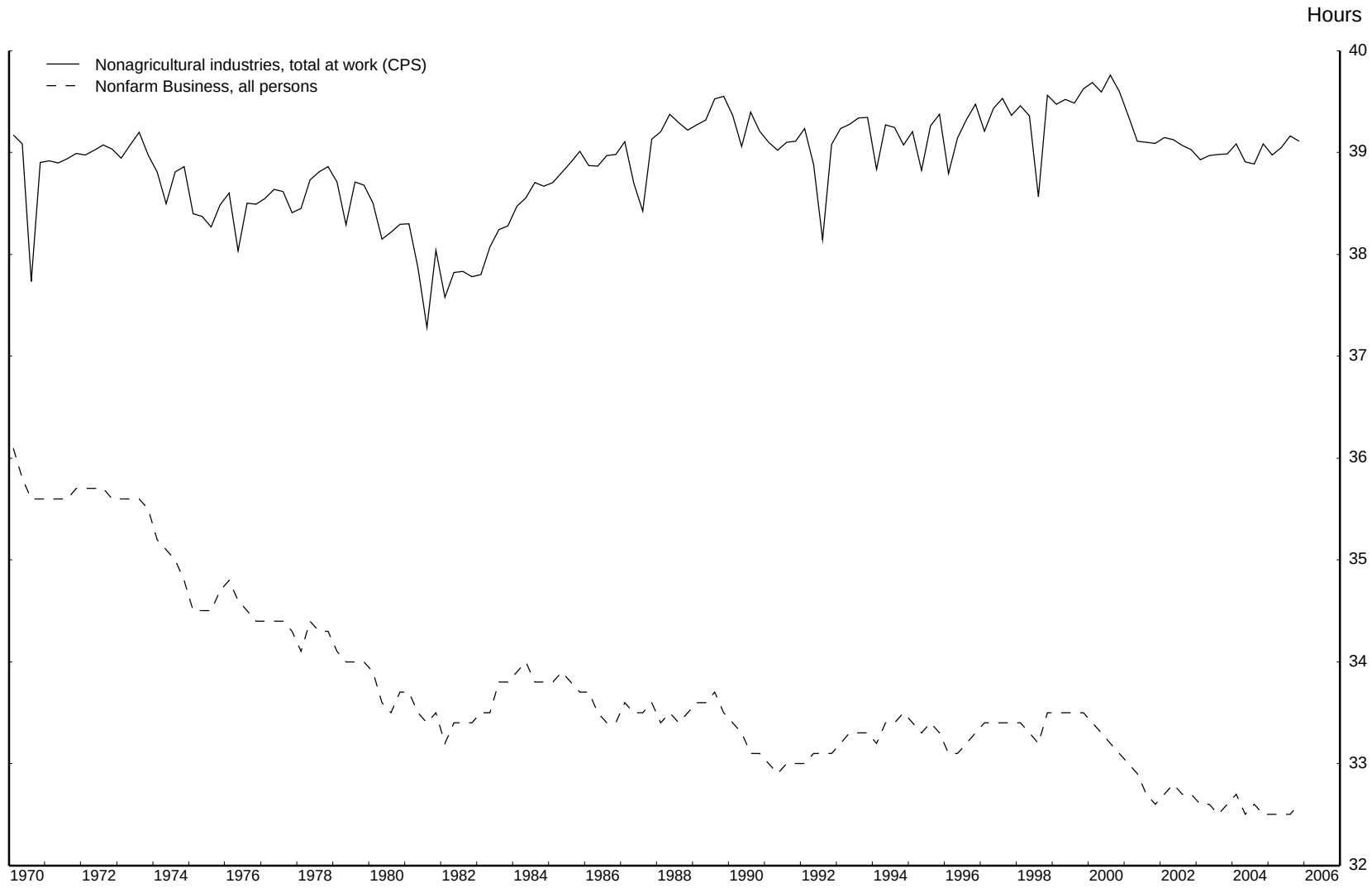
Figure 22

Incidence and Duration of Participation by Age



Source. Authors' calculations using Current Population Survey data.

Figure 23
Average Weekly Hours

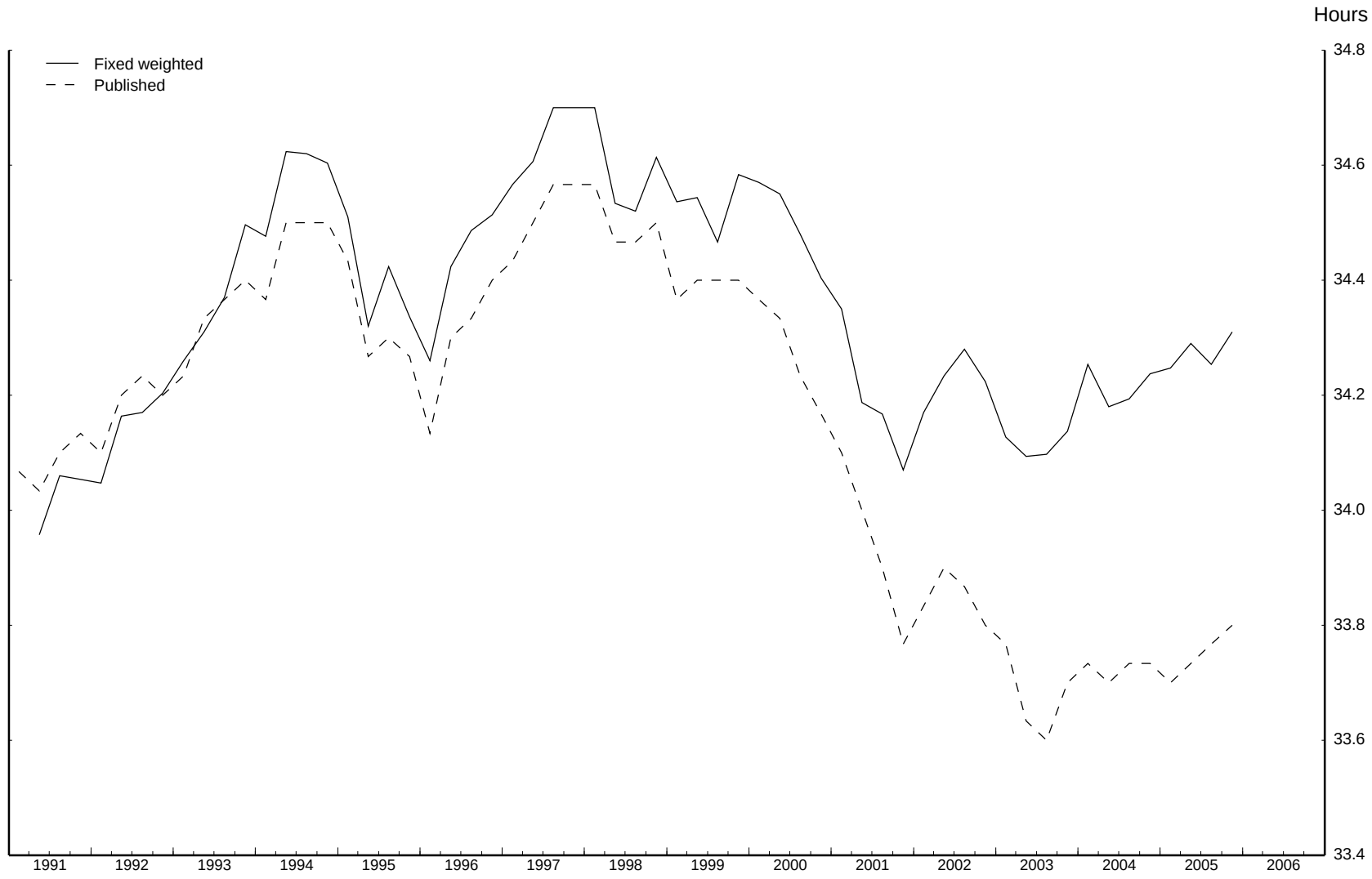


Source. Bureau of Labor Statistics and Author's calculations.

Figure 24

Average Weekly Hours

(CES, production workers)



Source. Bureau of Labor Statistics.

Figure 25

The Trend Workweek in the Nonfarm Business Sector

Source. Bureau of Labor Statistics and authors' calculations.

Table 1
Population Shares
(percent of population ages 16 and over)

Age Groups	1965	1975	1985	1995	2005	2010
16 to 19	10.2	10.7	8.3	7.3	7.2	7.1
20 to 24	9.8	12.1	11.6	8.9	9.0	8.9
25 to 34	16.9	20.1	22.8	20.7	17.3	17.1
35 to 44	18.8	14.7	17.6	21.0	19.0	16.9
45 to 54	17.2	15.4	12.6	15.6	18.6	18.5
55 to 64	13.2	13.0	12.2	10.5	13.3	14.9
65 plus	13.8	14.1	15.0	16.0	15.5	16.6

Source. Census Bureau. Data adjusted by the authors as described in footnote 7.
Note. Columns may not sum to 100 due to rounding.

Table 2

The Contribution of Changing Population Shares to the Aggregate Labor Force Participation Rate

Age Groups	1980 to 1995	1995 to 2005	2005 to 2010
Change in Aggregate Participation Rate	2.86	-0.59	ND
Contribution of:			
16 to 19	0.33	-0.04	0.04
20 to 24	-0.33	0.01	-0.01
25 to 34	-0.15	-0.57	-0.00
35 to 44	1.06	-0.35	-0.36
45 to 54	0.41	0.41	-0.02
55 to 64	0.19	-0.10	-0.24
65 plus	-0.89	0.21	-0.27
Total	0.62	-0.42	-0.87

Note. Contributions are the sum of the relevant disaggregated categories from a decomposition based on 28 distinct age/sex groups.

Source. Bureau of Labor Statistics and authors' calculations. Data adjusted by the authors as described in footnote 7.

Table 3
Labor Force Participation Rate
(percent)

Age and Gender		1977	1985	1995	2000	2005
Males,	16 to 19	60.6	56.7	54.3	52.8	43.2
	20 to 24	84.1	83.6	82.9	82.6	79.1
	25 to 29	94.2	93.6	92.5	92.5	90.7
	30 to 34	96.0	95.2	93.7	94.2	92.7
	35 to 39	95.6	94.8	92.4	93.2	92.5
	40 to 44	94.7	94.2	92.0	92.1	91.5
	45 to 49	92.7	92.8	90.7	90.2	89.3
	50 to 54	88.8	88.2	86.4	86.8	85.8
	55 to 59	82.6	79.1	77.3	77.0	77.6
	60 to 61	74.0	68.5	65.4	66.0	65.5
	62 to 64	54.3	45.9	44.9	47.0	52.5
	65 to 69	31.2	25.9	26.7	30.3	33.5
	70 plus	14.6	11.2	11.5	12.1	13.5
Females,	16 to 19	52.6	53.4	51.9	51.2	44.2
	20 to 24	66.7	71.9	70.0	73.1	70.0
	25 to 29	62.5	72.0	74.7	76.7	73.9
	30 to 34	57.6	70.9	74.8	75.5	73.8
	35 to 39	60.0	72.3	76.2	75.7	74.6
	40 to 44	60.2	72.5	78.0	78.7	76.7
	45 to 49	58.5	68.3	77.2	79.1	77.7
	50 to 54	54.2	61.3	70.7	74.1	74.0
	55 to 59	49.9	52.3	59.4	61.4	65.6
	60 to 61	40.8	41.8	46.0	49.0	53.7
	62 to 64	29.6	29.8	32.5	34.1	39.9
	65 to 69	14.8	13.7	17.2	19.5	23.7
	70 plus	4.7	4.4	5.2	5.8	7.1

Source. Bureau of Labor Statistics. Data adjusted by the authors as described in footnote 7.

Table 4

Contribution of Changes in Enrollment Shares to the Labor Force Participation Rate

(2000 to 2004)

Age	Total change	Enrollees	Non-enrollee	*Contribution of share change*
16 to 19	-8.17	-5.09	-1.42	-1.68
20 to 24	-2.8	-0.81	-1.22	-0.78

Source. Bureau of Labor Statistics and Author's calculations.

Table 5

Estimates from the Labor Force Participation Rate Model

Variable	Age	Men	*p-value*	Women	*p-value*	Variable	age	women	*p-value*
Return to education	16 to 17	-0.41	*0.00*			Female/male	18 to 19	0.13	*0.22*
	18 to 19	-0.17	*0.00*			earnings ratio	20 to 24	0.07	*0.15*
	20 to 24	-0.01	*0.00*				25 to 29	0.34	*0.01*
							30 to 34	0.27	*0.00*
Eventual college	16 to 17			0.22	*0.00*		35 to 39	0.17	*0.00*
attainment	18 to 19			0.29	*0.00*		40 to 44	0.28	*0.04*
	20 to 24			-0.01	*0.67*		45 to 49	0.08	*0.27*
	25 to 29	-0.01	*0.00*	-0.02	*0.57*		50 to 54	-0.18	*0.18*
	30 to 34	0.02	*0.22*	0.12	*0.00*		55 to 59	-0.22	*0.03*
	35 to 39	0.01	*0.01*	0.17	*0.00*		60 to 61	-0.17	*0.46*
	40 to 44	0.01	*0.12*	-0.02	*0.55*				
	45 to 49	0.00	*0.38*	0.01	*0.50*	Marriage rate	18 to 19	-0.01	*0.73*
	50 to 54	0.00	*0.62*	0.08	*0.00*		20 to 24	-0.26	*0.00*
	55 to 59	-0.02	*0.87*	0.07	*0.00*		25 to 29	-0.56	*0.00*
	60 to 61	-0.01	*0.01*	-0.03	*0.51*		30 to 34	-1.15	*0.00*
	62 to 64	-0.15	*0.12*	-0.20	*0.00*		35 to 39	-0.79	*0.00*
	65 to 69	-0.07	*0.00*	0.26	*0.00*		40 to 44	-1.10	*0.00*
	70 over	0.02	*0.01*	0.41	*0.00*		45 to 49	-1.04	*0.00*
							50 to 54	-0.69	*0.00*
Life expectancy	62 to 64	1.07	*0.00*	2.48	*0.00*		55 to 59	-0.01	*0.94*
	65 to 69	1.76	*0.00*	0.68	*0.17*		60 to 61	-1.65	*0.00*
	70 over	2.59	*0.00*	1.93	*0.00*				
						Children under 6	18 to 19	-0.15	*0.00*
Disability	40 to 44	0.00	*0.33*				20 to 24	-0.33	*0.00*
	45 to 49	-0.01	*0.21*				25 to 29	-0.39	*0.00*
	50 to 54	-0.01	*0.05*						
	55 to 59	-0.01	*0.27*						
	60 to 61	-0.04	*0.01*						
Early retirement rules	62 to 64	-2.31	*0.00*						
Delayed retirement credit	65 to 69	0.02	*0.10*						

Table 6

Cyclical Sensitivities from the Labor Force Participation Rate Model

Age	Men	*p-value*	Women	*p-value*
16 to 17	2.88	*0.00*	2.33	*0.00*
18 to 19	0.78	*0.00*	0.63	*0.00*
20 to 24	0.29	*0.00*	0.29	*0.00*
25 to 29	0.14	*0.00*	0.46	*0.00*
30 to 34	0.18	*0.00*	0.53	*0.00*
35 to 39	0.03	*0.55*	0.43	*0.00*
40 to 44	0.06	*0.18*	0.39	*0.00*
45 to 49	0.07	*0.02*	0.12	*0.51*
50 to 54	0.08	*0.40*	0.25	*0.02*
55 to 59	-0.01	*1.00*	-0.17	*0.06*
60 to 61	0.38	*0.03*	-0.53	*0.09*
62 to 64	0.53	*0.19*	-0.96	*0.00*
65 to 69	0.62	*1.00*	0.70	*1.00*
70 over	0.73	*0.05*	-0.37	*1.00*