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The power of inclusive labor force participation for mitigating population aging: closing gaps at the intersection between race/ethnicity and gender in the United States*

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Abstract

We develop a dynamic microsimulation model to project the labor force and economic dependency ratios in the United States from 2022 to 2060, taking population projections and the large inequalities between population groups of different race/ethnicity and gender into account. We contrast policy scenarios and show the potential impact that closing the gaps in education, health, and participation rates between population sub-groups can have on increasing the U.S. labor force. Our baseline projections indicate an increase of the labor force of about 27 million people by 2060 which is mainly caused by population growth. The downstream effects of removing disparities in population health and educational attainment on labor force participation can add about 10% (+2.6 million people) to our baseline projections. The potential effects of closing gaps between genders and between minority groups and the non-Hispanic White population, however, are much larger if we assume the equalization of participation rates for individuals with similar characteristics. Closing gender gaps within ethno-racial groups, for instance, can add 9.9 to 14.3 million people to the labor force, depending on the assumptions. Overall, reducing disparities in labor force participation rates has the potential to more than compensate the effects of demographic aging on the economic dependency ratio.

JEL: C5, J11, J21

Keywords: Labor force projections, age dependency, dynamic microsimulation, race/ethnicity

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1. Introduction

Demographic aging exerts considerable pressure on the economic and social systems of industrialized countries, particularly because it reduces the size of the labor force while increasing the economically dependent share of the population. Population aging will lead to changes in labor and capital markets, and the financing of social security such as pension and healthcare systems. Although all OECD countries are affected by aging, the demographic dynamics differ considerably (OECD, 2023). In this respect, the United States is in a more favorable position than other large economies because its old-age dependency ratio, which measures the percentage of individuals aged 65 and over in relation to those at ages 20 to 64, is expected to increase less than in other OECD countries. It was 30.4% in 2022 and is expected to increase to 40.4% by 2050. Over the same period, this ratio is projected to increase from 40.5% to 58.1% in Germany and from 54% to 80.7% in Japan. China, where old-age dependency stood at merely 19.4% in 2022, will surpass the United States and reach 47.5% by 2050.

Bloom et al. (2015) summarize the main economic concerns about demographic aging which are a lower labor force participation, reduced consumption by older people, fiscal integrity of pension systems, disease and disability in older persons, and the financing of old age care. The economic implications of demographic aging depend also on non-demographic factors such as length of schooling and retirement age, and, more in general, on age-specific activity rates of the population. While demographic aging poses economic challenges, policy options such as increasing the labor force participation of women or older people might mitigate its effects (Juhn and Potter, 2006; Perez-Arce and Prados, 2021).

A dynamic microsimulation allows to examine the effect that changes in parameters can have on labor supply outcomes in the long-term. We develop a dynamic microsimulation model to project the future labor force in the United States, taking the large inequalities between population groups into account. Our focus is on changes in labor force participation rates (LFPR) and disparities at the intersection between race/ethnicity and gender to contrast different policy scenarios and show the potential impact that closing the gaps between population sub-groups can have on increasing the U.S. labor force.

Here, the U.S. shows considerable room for improvement, for two reasons. First, in the recent past activity rates have developed less favorably than in most other industrially advanced countries: OECD data show that, for the population aged 15 years of more, the U.S. LFPR declined markedly between 2000 and 2015 and recovered only partially thereafter, while the LFPR of most other economically advanced countries increased steadily (OECD, 2023). In 2022, in the age group 25 to 64, the U.S. labor force participation rate was well below the average of industrialized countries and of EU countries (78.1% vs. 81.9% and 81.2%, respectively).

Second, the U.S. is characterized by large inequalities in labor market outcomes by population groups. A number of studies have shown that there are large and persistent differences in employment and incomes between racial/ethnic groups, between genders as well as between people with and without disability (Daly et al., 2020; Baumberg Geiger et al., 2019; Collins & Michael, 2017). More recently, attention has increasingly turned to examining how race/ethnicity and gender intersect or interact to influence labor market outcomes (Autor et al., 2019; Chavez et al., 2022; Moen et al., 2022). There are large disparities by education, race/ethnicity, or gender in health and longevity (Berger et al., 2022; Berkman & Truesdale, 2022). The relevance of these differences for labor force developments is underscored by projections that show how the size of various population groups is expected to change in the next decades (Johnson, 2020).

We contrast the effects of changes in important individual characteristics of labor force participation, i.e., education and health status, with the effect of changes in the participation propensities associated with these characteristics for different population groups by gender and race/ethnicity. In our baseline scenario, we project the future size and composition of the U.S. labor force under the demographic assumptions defined in the Census-Bureau's population projections, holding the impact of all influencing factors on labor force participation and health status constant. We examine the implications of reducing gaps by gender, by race/ethnicity, and by a combination of gender and race/ethnicity. While some scenarios are perhaps unrealistic as, for example, a full convergence of women's LFPR to that of men is beyond the scope of policy changes, the simulations provide benchmarks for how policy changes might mitigate the effects of demographic aging on labor force participation.

The main results from these projections indicate that closing gaps at the intersection of gender and race/ethnicity has considerable potential to cushion the negative economic consequences of demographic change. In addition, reducing gaps in participation rates between individuals with similar characteristics belonging to different population sub-groups has a much stronger effect than improvements in education or health (while keeping propensities to participate in the labor market constant) on labor force participation. Overall, reducing disparities in LFPRs has the potential to more than compensate for the projected demographic change and may actually lead to economic dependency ratios which will be more favorable in the future than they are today.

2. Background

Labor force projections are often based on cohort models included in large macroeconomic models to investigate long-term economic developments. The U.S. Congressional Budget Office (CBO), for instance, uses a cohort model that estimates labor force participation rates by age-sex-education and race/ethnicity subgroups. The model treats age groups within each sex-education-race subgroup as a separate system of equations and estimates cohort effects that are constrained across the age group equations within each system (Montes, 2018). The U.S. Bureau of Labor Statistics (BLS) projects the future supply of labor by age, gender, race and ethnic groups using data from the Current Population Survey (CPS). To obtain the total labor force, participation rates estimated for each age, gender, race, and ethnicity group are multiplied by the population projection for that group and then summed up.

These approaches place high demands on the consistency of assumptions and, in its Report to the Social Security Advisory Board, the Technical Panel on Assumptions and Methods recommends to expand the use of microsimulation techniques to ensure the internal consistency of the key assumptions (TPAM, 2019). Microsimulation starts from granular data that are projected forward and has proven to be particularly useful to answer 'What if..?' questions (Zaidi & Rake, 2001). We use a highly stylized dynamic microsimulation which allows to focus on the major determinants of labor force participation, allowing to quantify the effect of single parameter changes on aggregate outcomes, and, ultimately, to contrast different what-if scenarios.

Labor force participation depends on individual characteristics (for example, skills and health status), contextual factors (such as gender roles and work norms), and policies (such as retirement regulations and labor market institutions). With our estimations we aim to highlight particularly the role played by education and health as determinants of labor force participation and, on the other hand, investigate the impact of gaps that exist between individuals of different gender and race/ethnicity but with otherwise similar characteristics.

There is a strong and well-documented positive relationship between labor market outcomes and both education and health. According to OECD data for 2021, the labor force participation rate of individuals who completed tertiary education in the United States was 26.1 percentage points greater than the rate for individuals who have not completed high school (OECD.Stat, 2023). This gap is slightly wider than the OECD average of 24.6 percentage points. The participation gap between those with high or lower formal education is much more pronounced for women (36 percentage points) than it is for men (19.3 percentage points).

Measuring health inequalities in labor market outcomes poses greater challenges, as there are a variety of different health indicators. However, there is ample evidence that poor health strongly limits the ability of working-age people to earn a living, and there are also indications for negative effects of health trends on labor supply and employment in the United States (García-Gómez et al., 2013; Baumberg Geiger et al., 2019; Perez-Arce & Prados, 2021).

CPS data for 2017 show that the gap in participation rates between persons aged 50 to 69 years of age who are in poor health (persons in the bottom third of the distribution) and those in good health varied between 23 and 30 percentage points, depending on gender and age group (Böheim et al., 2023). These health gaps were large when compared to those in a set of European countries comprising Sweden, Switzerland, the Netherlands and Germany, and the labor force participation rates of people in poor health were also low. This might be partly explained by differences in absolute health status among those in poor health, as studies show that adults in the U.S. have worse health than adults in Europe and other high-income countries and there are indications that the difference is particularly pronounced among socio-economically disadvantaged groups (Avendano et al., 2009; Wahrendorf et al., 2013; Woolf & Aron, 2013; Atella et al., 2021).

However, the influence of health on labor market participation is also contingent on the presence of labor market institutions and policies. In response to rising disability benefit enrolment and population aging, many countries have carried out reforms and strengthened existing policies to prevent health-related work incapacity and to improve the labor market integration of individuals with health problems. Comparative studies indicate that the United States have lacked substantial reform in this area and that policies to support the labor market integration of people with health limitations are underdeveloped (OECD, 2003, 2010; Morris, 2016; Böheim & Leoni, 2018). Berkman and Truesdale (2023) argue that the standard U.S. policy approach to population aging, working longer, is in jeopardy because a large fraction of Americans struggles to work into their late 50s, let alone into their 60s and 70s. Working longer is thus not a straightforward response to population aging, but needs to be facilitated by adequate policies.

Measures to increase labor force participation must take into account that people with otherwise similar characteristics, but different gender and ethno-racial identity, face different social conditions, experience disadvantages and privileges, and are exposed to different social norms, which strongly influence labor market outcomes. Disparities by gender and race are a well-known feature of the U.S. labor market. They have been investigated for several decades, but particularly the use of population descriptors such as race and ethnicity continues to pose many theoretical and empirical challenges (Browne & Misra, 2003; Daly et al., 2020; Paul et al., 2022; Mauro et al., 2022).

The distinctions between race and ethnicity are imprecise, and are neither biologically based nor static categories, but "reflect the sociohistorical constructs of race and ethnicity as they currently exist in U.S. society" (Hummer, 2023, p. 639). Much of the categorization of race and ethnicity currently used in the U.S. is the result of data collection efforts by the Office of Management and Budget and the U.S. Census Bureau, efforts that have a long and partially contentious history (Mays et al., 2003; Ross et al., 2020). Although we acknowledge the limitations of the concepts of race and ethnicity, and the heterogeneity within each of these categories as to origin, length of residence, language use, et cet., we use the categories specified by the CPS in their data.

The importance of including race and ethnicity in investigations of labor supply is underscored by the existence of large and persistent health differentials between population groups (Walker et al., 2016; Zimmerman & Anderson, 2019). Hummer (2023) highlights several ethno-racial disparities in U.S. population health and summarizes recent literature. For example, Black Americans have higher mortality rates than White Americans at most ages; American Indians or Alaska Natives have a lower estimated life expectancy at birth than any other ethno-racial group; and Asian Americans have lower average age-specific mortality rates, substantially higher life expectancy, and more positive health profiles compared with all other ethno-racial groups. Other ethno-racial disparities exist, stressing the need to account for these differences in studies such as ours. Differences in health indicators vary mainly by race/ethnicity, but also by gender. With respect to life expectancy, the most recent United States Life Tables (Arias et al., 2022) show that in 2020 the life expectancy at birth of Hispanic women (81.3 years) was longer than that of non-Hispanic White women, whereas Hispanic men had a slightly shorter life expectancy (74.6 years) than non-Hispanic White men (74.8). Relative gaps between ethno-racial groups can differ considerably by gender, for example, among non-Hispanic Blacks women's life expectancy at birth (75.4 years) is five years shorter than that of non-Hispanic White women, while men's life expectancy (67.8 years) is seven years shorter than that of non-Hispanic White men.

Studies on intersectionality emphasize that gender and race should not be treated as independent population descriptors, but that, quite conversely, considering how these different dimensions of stratification are intertwined is conducive to a more nuanced and accurate analysis of labor market dynamics (Moen et al., 2022; Paul et al., 2022). Intersectional approaches maintain that combinations of race and gender together shape social and economic identities and that these combinations create distinctive obstacles and opportunities for all groups (Browne & Misra, 2003). Several studies provide evidence on intersectional differences in wages and incomes, particularly comparing Black and White women and men. Daly et al. (2020), for instance, show that Black men earn less than White men and black women less than white women, but the differential for women is only about half that for males. Paul et al. (2022) as well as George et al. (2022) highlight that Black women face an unexplained wage gap (relative to White men) that goes beyond the simple addition of the separate penalties for gender and race. Evidence on disparities of labor force participation at the intersection of gender and race/ethnicity, on the other hand, is scarcer.

Figure A 3 and Figure A 4 in the Appendix, using CPS data for 2017, show heterogeneous patterns in participation rates by gender and race/ethnicity. For example, Hispanic men have LFPRs that are greater than those of most other minority groups and close to those of the majority non-Hispanic White population in most age groups. Hispanic women, however, have comparatively greater LFPRs only at early ages but lower rates than most other groups above the age of 25. Among the Black and African American population, by contrast, women have comparatively high participation rates, while men have low participation rates. Although these data are not adjusted for labor supply determinants such as education and fertility, they provide a first indication for the relevance of differences by gender and race/ethnicity for assessing the development of labor supply.

The empirical findings on differences in labor market outcomes raise numerous questions about the underlying causes of the observed patterns and the extent to which these patterns vary or are persistent over time. (For an overview of different approaches to studying these questions, see Browne and Misra, 2003.) For our projections, we take an agnostic stance with respect to the mechanisms underlying the observed inequalities and assume that these inequalities will persist over time unless addressed by appropriate policies.

3. Method

3.1. Modeling approach

We build on previous work using the dynamic microsimulation model microWELT-US to project labor supply developments in the United States (Böheim et al., 2023). Those projections included different scenarios to assess the impact that changes in education, health and the labor market integration of people with health limitations could have on future labor force participation. We refine our modeling approach to account for differences between population groups by race/ethnicity and gender.

MicroWELT-US builds on the microWELT modeling platform, which was designed as a versatile, extendable, and portable tool for comparative studies of welfare transfers and is extensively documented in Spielauer et al. (2020a, 2020b), Amann et al. (2021), and the project website microWELT.eu. The core of microWELT-US consists of demographic models, supplemented with socio-economic processes (education and employment) and the modeling of health statuses. By simulating individuals in their family context, intergenerational processes such as the intergenerational transmission of education are considered. Education influences the labor force directly and indirectly via differences in family characteristics (e.g., lower fertility of higher educated women), the education-specific prevalence of health limitations, and differential mortality. microWELT-US explicitly models mortality, fertility, the formation and dissolution of partnerships, partner matching, education, migration, leaving parental home, health, and labor force participation.

Dynamic microsimulation is an established tool for labor force projections. An example of another dynamic multi-country model that, among other applications, was applied for labor force projections in the U.S. is the collection of LSD-Models (Van Hook et al., 2020; Vézina & Bélanger, 2020). MicroWELT-US and LSD share the same programming technology as both are implemented in Modgen, a generic microsimulation language developed and maintained at Statistics Canada. Like LSD, microWELT-US combines a continuous-time, competing-risk approach for its demographic core modules with cross-sectional imputation models used for the periodic (monthly) update of labor force participation. However, there also exist some critical differences in the respective approaches. Unlike LSD, microWELT is a time-based interacting population model allowing the communication between simulated persons and introducing a central observer keeping track, communicating, and reacting to aggregate simulation outcomes at any moment during the simulation. The time-based design – each simulated unit passing through time simultaneously, rather than being simulated one by one – is a prerequisite for some of the central model features of the microWELT platform, including the modeling of partnerships and family links, the intergenerational transmission of education, and model alignment to aggregate targets.

One of the key features of microWELT-US is the ability to reproduce existing population projections in aggregate outcomes such as age-specific fertility, mortality by age and sex, and net migration by age and sex. Data on population projections and their underlying assumptions concerning fertility, mortality, and net-migration are taken from the U.S. Census Bureau allowing us to simulate the future size and composition of the U.S. population consistent with official population projections (U.S. Census Bureau, 2018). Our only demographic assumptions refer to differences by education in fertility (age of first childbirth, childlessness) and mortality, which we assume to remain constant over time. Our simulation model builds on data from the ASEC public use file data (2017) that was used for the creation of the starting population file containing all relevant information on the composition of the population (such as age, gender, race/ethnicity, education, family composition) in the first year of the simulation as well as the estimation for behavioral processes (such as labor force participation or the formation of partnerships).

Labor force participation is modeled with logistic regressions based on age, gender, education, health status, and - in the case of women – the presence of dependent children and the age of the youngest child. The estimations are based on 2017 CPS data. In the CPS, the race and ethnic origin of individuals are identified by two questions that ask respondents to self-identify their race and ethnicity by selecting them from "flashcards" listing racial groups and ethnic origins.[1] People of Hispanic origin are those who indicate that their origin is Mexican, Puerto Rican, Cuban, Central or South American, or some other Hispanic origin. It should be noted that people of Hispanic origin may be of any race. Respondents who select their race as White and indicate that their origin is not one of the Hispanic origin subgroups are called non-Hispanic White origin. We perform our estimations separately by sex and the following population groups: 1. non-Hispanic White, 2. non-Hispanic Black and African American, 3. non-Hispanic American Indian or Alaska Native, 4. non-Hispanic Asian or Pacific Islander, 5. other non-Hispanics and 6. Hispanics. This population group definition corresponds with the one used in the population projection from the Census Bureau.[2] For a man of population group g, our estimations take the form

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_{e1}x_{e1} + \beta_{e2}x_{e2} + \beta_{e3}x_{e3} + \beta_{edu}x_{edu} + \beta_h x_h + \sum_{i=1}^{m}\beta_{ai}x_{ai} + e \quad (1)$$

[1] The description of the CPS approach to identify race and ethnicity is taken from the survey website (https://www.census.gov/programs-surveys/cps/technical-documentation/subject-definitions.html), for further details see also the technical paper on CPS design and methodology (U.S. Census Bureau, 2019).

[2] Details can be found at https://www.census.gov/programs-surveys/popproj.html.

where p is the probability of labor force participation. The parameters to be estimated are ($ß_0$,..) and are estimated by maximum likelihood. x_{e1} to x_{e3} are binary variables which indicate the highest level of education according to our classification of education (with base category 0 corresponding to the lowest level of education, e_1 denotes high-school graduation, e_2 indicates some college, and e_3 indicates a university degree), x_{edu} is an indicator for current education participation. x_h is a binary health indicator where the value 1 indicates impaired health and 0 no health problems, and x_a is a set of m age-group binary single year age indicators. For women, additional controls x_y for the age of the youngest child are added in the form of 4 age-group binary indicators which indicate the age of the youngest child in the family in one of four age categories (0-2, 3-4, 5-9, 10-14, 15 and older).

For women of population group g our estimation then takes the form

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_{e1}x_{e1} + \beta_{e2}x_{e2} + \beta_{e3}x_{e3} + \beta_{edu}x_{edu} + \beta_h x_h + \sum_{i=1}^{m}\beta_{ai}x_{ai} + \sum_{j}^{4}\beta_{yj}x_{yj} + e \quad (2)$$

Table A 1 and Table A 2 report the odds-ratios from the corresponding logistic regression estimates. Based on the coefficients obtained from these logistic regressions, we calculate individual probabilities of labor force participation.[3] Each individual is then assigned their labor force participation status randomly by drawing a random number between 0 and 1. If this number exceeds the estimated probability, labor force status is set to zero, and to one otherwise. We update the labor force status monthly for each individual based on the estimation results from these regressions. As individuals age over time and possibly change their education or health status, their labor force participation probability is updated throughout the simulation.

For the oldest age group, changes in retirement age legislation are incorporated when shifting the age parameter from our logistic regression models backwards as retirement age increases: If, for example, retirement age increases by one year from 65 to 66, the likelihood of labor force participation of a 60-year-old person is determined by using the estimated coefficient for age 59 instead of age 60. If retirement age increases to age 67, the estimated coefficient for age 58 is used to determine the probability of a 60-year-old person, and so on. Thus, with retirement age 67 our model implies that a 60-year-old person has the same labor force participation rate as a 58-year-old person with identical characteristics (gender, education, and health status) when retirement age is 65. By explicitly taking health status into account, the effect of raising the retirement age on labor force participation is thus dampened. In this way, we account for non-linear effects of increases in retirement age on labor force participation as sickness-related withdrawals from the labor force partly counteract such an increase.

In our simulations we assume – in line with current legislation – that the retirement age at full-benefits gradually increases to 67 for people born in 1960 or later. Early retirement benefits will still be available at age 62 (although the benefits will be reduced over time).

Following Böheim et al. (2023) formal educational attainment is classified into four levels, (1) “below high-school” (up to grade 9), (2) “high-school” (grade 10-12), (3) “(some) college”, and level (4) “university. We model three educational processes: (1) school enrolment, (2) education attainment, and (3) the intergenerational transmission of education (i.e. the influence of the parents' education on the education of their children). To model this third process, we use information on respondents’ and their parents’ educational attainment included in the OECD PIAAC data.

[3] Predicted probabilities, $\hat{p}_i$, are calculated by $\hat{p} = \exp(\hat{X}'(\beta))/(1 + \exp(\hat{X}'(\beta))$. The age parameters of our estimations are smoothed by a fifth-degree polynomial for each population and gender group to achieve a smooth path of the age-dependent change in labor force participation. The parameters for these polynomials are reported in the appendix.

Health is modeled as a binary indicator taking the value 1 if respondents in the ASEC report health limitations implying work-limitations and zero otherwise. In the simulation model, this indicator is implemented with logistic regressions, where the dependent variable "has health limitations" is explained by an interaction term of age and education level ($x_{edu} * age$) and a binary population group indicator (x_g), estimated separately for men and women. This estimation takes the form:

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_{edu}x_{edu} * age + \beta_g x_g + e \; (3)$$

Corresponding population group specific health limitation profiles are reported in the Appendix (Figure A 1 and Figure A 2). Similar to labor force participation, each individual is randomly assigned a health status depending on their personal characteristics.

3.2. Outcomes of interest

We are interested in the future development of labor supply and how changes in labor force participation can cushion the economic impact of demographic aging. For this reason, in addition to labor force participation rates and absolute changes in the size of the labor force, we project also the development of various economic dependency indicators.

Changes in purely demographic ratios, such as the old-age dependency ratios quoted at the beginning of this paper, can be a poor approximation to changes in the relationship between the number of persons who are economically active and those who are not (Sanderson & Scherbov, 2015; European Commission, 2021). In contrast to demographic dependency ratios, economic dependency ratios consider, to an extent, age-specific economic characteristics of the population, such as length of schooling, retirement age, and participation behavior (Loichinger et al., 2017).

We use two economic indicators that can be contrasted to demographic indicators computed solely as ratios of different age groups. Following a common approach, we express economic dependency as the size of the labor force relative to the population (Dep_{pop}), i.e. we divide the number of active persons by the total population. This indicator is sensitive to changes in education, changes in retirement age as well as changes in health and more in general in participation behavior. In addition, we compute the ratio between the economically active persons aged 50+ and the total population aged 50+ (Dep_{50+}). While these two economic dependency indicators are similar, they place a different emphasis on the impact of aging and provide complementary information for assessing changes over time. An increase in fertility leading to a larger young cohort, for instance, or an educational expansion keeping youngsters from entering the labor market at an early age, will lead to a deterioration of Dep_{pop} but not of Dep_{50+}. On the other hand, an increase in life expectancy will affect both indicators negatively but have a stronger effect on Dep_{50+} than on Dep_{pop}.

4. Results

4.1. Baseline

The baseline scenario shows how the future size and composition of the U.S. labor force will evolve over time under the demographic assumptions defined in the Census Bureau's population projections, holding the impact of all influencing factors on labor force participation and health status (equations 1 to 3 above) constant throughout the simulation period (2022 to 2060). According to the official demographic projections, the total population in the U.S. is set to grow from 336.4 million to 404.6 million between 2022 and 2060, corresponding to an increase of 20.3%. The number of people aged 65 and over, however, will increase by 65.3% (from 57.2 to 94.5 million), while those aged between 20 and 64 will increase only by 12.7% (from 195.9 to 220.9 million). Against this backdrop, we project labor supply in our baseline scenario to expand by 16.1% over this period (from 169.3 to 196.5 million people). With an average yearly growth rate of 0.5% our projections are slightly greater compared to current CBO's projections (2023).[4]

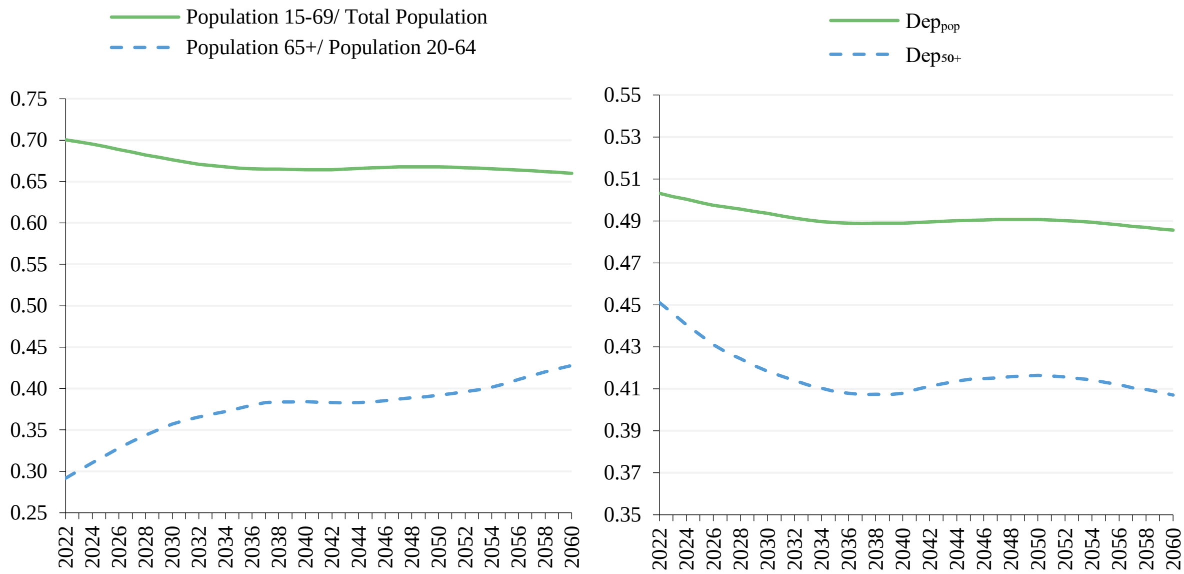
The main driver behind this expansion is population growth. (See also the population changes by age group displayed in Figure 5.) Labor force participation rates will increase only marginally, from 77.5 to 78.6% for the age group 20 to 64 and from 67.4 to 68.2% in the total population. This change in participation rates is mainly driven by changes in education, with higher education leading to more labor force participation, particularly at older ages, but also to a lock-in effect and lower participation at younger ages. LFPRs of men are projected to remain fairly stable in almost all age groups, with larger increases in the age groups over 60 and small reductions in the youngest age groups (Table A 5 in the Appendix). The overall expansion of participation rates results almost entirely from women's increased labor supply, especially in the age groups over 40.

[4] CBO's projections imply an increase of 0.3% over the time period 2023 to 2053 resulting in an increase in the number of people in the labor force of approximately 17 million persons. Our projections imply a greater increase, of about 23 million persons, over the same time period.

Table A 4 in the Appendix provides a disaggregated overview of changes in labor supply by gender and race/ethnicity, showing that 87% of the total (net) increase (23.7 out of 27 million) is attributable to Hispanic men and women. In contrast, the labor supply of non-Hispanic White men and women is projected to fall by 14.8 million people.

In the baseline scenario, the U.S. will experience a significant deterioration of demographic dependency indicators (Figure 1): the ratio of 15- to 69-year-olds to the total population will decrease from 71% to 66%, and the ratio of those aged 65 and older to 20- to 64-years of age will increase from 27% to 43%. The economic dependency indicator (Dep_{pop}), measured as the share of the labor force on the total population, is projected to fall from 50.3% to 48.6%, meaning that, between 2022 and 2060, for every 12 active persons, the number of inactive people will increase by one. The decrease in the share of labor force participants relative to the total population is thus weaker than implied by demographic indicators alone. As we can see in Figure 1, most of the deterioration can be expected to take place in the next decade, with an approximately constant development thereafter. As the second economic dependency indicator highlights, the relationship between active and inactive people among those aged over 50 will experience a particularly strong change, with Dep_{50+} falling from 45% to 41% between 2022 and 2032 (and remaining fairly stable in the following decades).

Figure 1: **Change in demographic and economic dependency ratios, 2022-2060**



Notes: Simulations performed with the microWELT model based on ASEC (2017) data and population projections by the U.S. Census Bureau.

4.2. Scenarios

To assess how policy reforms that address the disparities of labor force participation along the intersection of gender and race/ethnicity might affect labor force participation in the coming decades, we select a series of what-if scenarios. The scenarios aim to quantify the potential of removing disparities between subgroups of the population, defined by gender and race/ethnicity. We first examine the implications of reductions of gaps by gender, secondly by race/ethnicity (Scenarios 1 and 2). Scenario 3 models the downstream effects of removing educational and health disparities without directly changing labor force participation rates for given characteristics. Scenario 4 combines Scenario 2 and Scenario 3.

With respect to closing gender gaps in labor force participation, an increase in female labor force participation will likely require a redistribution of care responsibilities between partners/spouses in families with young children. A full convergence of women’s LFPRs towards those of men may thus be unrealistic, which is why we assume that increases in labor force activity of mothers with young children are partly matched by reductions in labor force activity of their spouses. With respect to race/ethnicity, we use convergence towards the majority population as reference point, i.e. we assume that the implementation of policies achieve a convergence of minority population groups towards non-Hispanic Whites. This approach provides benchmarks for ambitious policy changes, while refraining from using best-performing but possibly highly selected population subgroups, such as Asian minorities, as reference point.

4.2.1. Scenario description

To assess to what degree closing the gaps in labor force participation between race/ethnicity and gender can mitigate population aging, we estimate alternative scenarios, which are summarized in Table 1.

Scenarios S1 and S1b: Convergence by gender within race/ethnicity subgroups, for given personal characteristics

Here, we assume the labor force participation rates of women converge to the labor force participation rates of men in their own population group (by race/ethnicity), holding personal characteristics constant. While we do not model any changes in education or health status of women compared to the baseline scenario, the effect of the set of characteristics controlled for in the labor force participation equations (1) and (2) change gradually over time so that in the year 2060 men and women with identical characteristics have the same probability of being in the labor force. Technically this is achieved by substituting the parameters that determine women's labor force participation (as specified in equations 1 and 2) by men's parameters for an increasing share of women from the same population group. Thus, over the period of 38 years the share of women for whom the men's parameters are used increases linearly by about 2.6 percentage points each year until, in 2060, the parameters estimated for men are used for all women.

The presence of children in the household is a major explanatory factor when analyzing differences in participation rates between genders. This is shown not least by the fact that during the pandemic, it was mainly women who left the labor market because there were fewer childcare and schooling options (Albanesi & Kim, 2021). The availability of childcare facilities and other "family-friendly" policies can make an important contribution to reduce gender gaps in labor market activity (Blau & Kahn, 2013). However, assuming that women with (small) children increase their labor force participation while men in the same households maintain their present level of labor force participation might understate the extent to which parents form their participation decisions collectively and substitute or share caring activity within the household.[5]

For this reason, when modeling the closure of gender participation gaps, we differentiate between households with and without children and assume that in the former, the increase in mothers' labor force participation is partially offset by a reduction in fathers' participation. This is a conservative assumption in that it does not contemplate that the intra-household adjustment in labor force participation might occur at the intensive rather than at the extensive margin, i.e., with fathers reducing the number of hours worked rather than exiting the labor force.

We assume a gradual convergence to shared care activities between parents and that the (negative) impact of young children on labor market participation fades gradually over time for mothers while it increases for fathers. Concerning the parameters associated with child care (the age of the youngest child), the (negative) impact for women is reduced gradually over time, while for men, the negative impact is increased such that the increasing labor force participation of mothers is accompanied by a corresponding decrease of fathers' labor force participation. As a result, the labor force participation rates of mothers and fathers converge in the course of the simulation, leading to greater labor force participation rates for women but lower ones for men compared to the baseline scenario (

[5] For a theoretical model of household labor supply that accounts for parents' preferences for children's welfare and parental time invested in children, see for example Cherchye et al. (2012).

Figure A 5). In scenario S1, we simulate this convergence for all households with children under the age of 15, in scenario S1b we restrict the convergence between spouses to households with children under the age of 5. While these age limits are discretionary, the ages of 5 and 15 are often used as cut-offs in studies that investigate demographic or labor market outcomes (for example, Fogli & Veldkamp, 2011; Smock & Schwartz, 2020).

Scenario S2: Convergence by race/ethnicity, for given for given personal characteristics

Similar to S1 and S1b, we assume that for given personal characteristics the gap in labor force participation between population subgroups by race/ethnicity closes over the period 2022 to 2060. While in S1 and S1b women's rates converge to men's over time, here we assume that women and men in different race/ethnicity subgroups converge to the labor force participation rates of women and men in the reference population group (non-Hispanic Whites), without closing gender gaps. It is worthwhile to note that population groups with higher LFPRs than non-Hispanic Whites, such as Asian men and Asian women, maintain their own, higher LFPRs and do not converge to lower LFPRs.

S3: Convergence of education and health status

In scenario S3, we analyze the effect of reducing population-group specific differences in education and health status between 2022 and 2060 on labor force participation. Here, the health-age profile of each population group converges over time to the reference group's profile (non-Hispanic Whites). Educational disparities are removed by assuming that educational attainments are identical to the reference group's education for all birth cohorts after 2008. In other words, this scenario assumes that men and women in minority population subgroups attain the same educational level and health status as their counterparts in the majority population, while subgroups with more favorable characteristics than non-Hispanic White women and men maintain their own characteristics. The propensities to participate in the labor market, conditional on personal characteristics, are held constant for all population subgroups.

S4: combining S2 and S3

In this scenario, elements of S2 and S3 are combined to simulate the potential for closing gaps between race/ethnicity subgroups with respect to the majority population, in terms of education and health status, and the labor force participation propensities associated with these characteristics. Please note that here there is no convergence between genders, but only between the groups towards the reference group within genders. Women from all minority populations reach LFPRs of non-Hispanic White women (or maintain their higher LFPRs) and men from all minority populations reach LFPRs of non-Hispanic White women (or maintain their higher LFPRs).

Table 1: **Scenario specification**

	Applying parameters for…	
	…labor force participation…	…education and health status…
	…from…	
Baseline Scenario	own	own
Convergence Scenarios		
S1 / S1b: Convergence in participation propensities between women and men within each group by race/ethnicity	own group men	own
S2: Convergence in participation propensities of women and men in minority groups towards women and men in majority population	non-Hispanic White	own
S3: Convergence of education and health status of women and men in minority groups towards women and men in majority population	own	non-Hispanic White

S4: S2 + S3	non-Hispanic White	non-Hispanic White

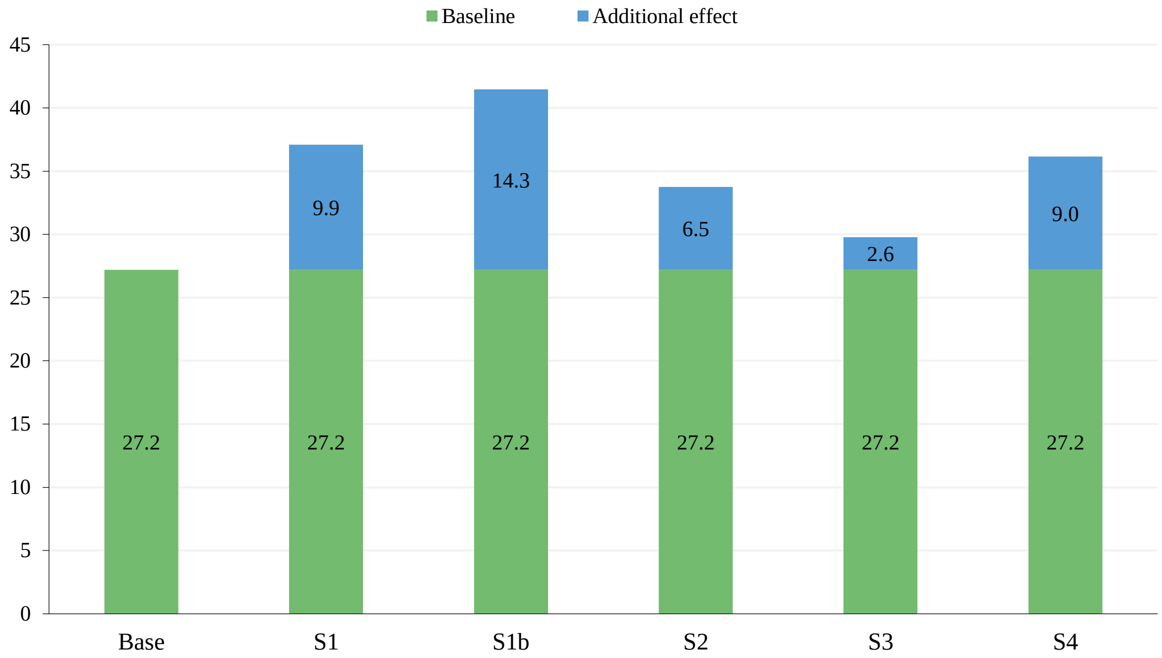
Notes: “Own” denotes that the scenario applies the Baseline Scenario parameters from the logistic regression models for each population and gender group when 1) labor force status and / or 2) education and health status are determined within the simulation. “non-Hispanic White” denotes that instead of own group parameters, those from the reference group (non-Hispanic Whites) are used when labor force and / or education and health status are determined. “Own group men” applies for all women the parameters from men within the same population group.

4.2.2. Scenario results

Figure 2 shows how the total number of people in the labor force changes between 2022 and 2060. While in the base scenario the labor force will increase by 27.2 million, the increase is greater in all alternative scenarios. Closing gender gaps would add an additional 9.9 million people to the U.S. labor force according to scenario S1 and 14.3 million people according to scenario S1b. This highlights the large potential that greater activation of women has for the expansion of labor supply. Reducing disparities by race/ethnicity in terms of labor force participation rates, while holding gender gaps within population subgroups constants, can add about 6.5 million people to the labor force. Changes in education and health, by contrast, are projected to have a much smaller impact and add only about 2.6 million workers to the labor supply (under the assumption that participation propensities are held constant, conditional on personal characteristics). Scenario S4, which combines S2 and S3, increases the labor supply by 9 million workers compared to the baseline projection. In relative terms, the scenarios add between 1.2% (S3) and 7.2% (S1b) to the total labor supply in the U.S. in 2060.

Table A 4 in the Appendix shows how the projected labor supply expansions are distributed between populations sub-groups. When compared to the baseline, scenarios S1 and S1b lead to large numbers of additional White and Hispanic women supplying their labor force. In relative terms, however, the effects relative to the baseline are strongest for Asian women (+1.7/+2.1 million, respectively, compared to the baseline of +3.4 million). The additional labor supply of non-Hispanic White women (+5.3/+5.8 million) would mitigate, but not fully offset, the decline in labor force projected in the baseline (-7.2 million), Closing the gaps by race/ethnicity (S2) has the largest impact on the labor supply of Asian and Hispanic women, as well as on Black and African American men. The latter also show the strongest reaction in labor force participation under the assumption of improvements in educational attainment and health status (S3).

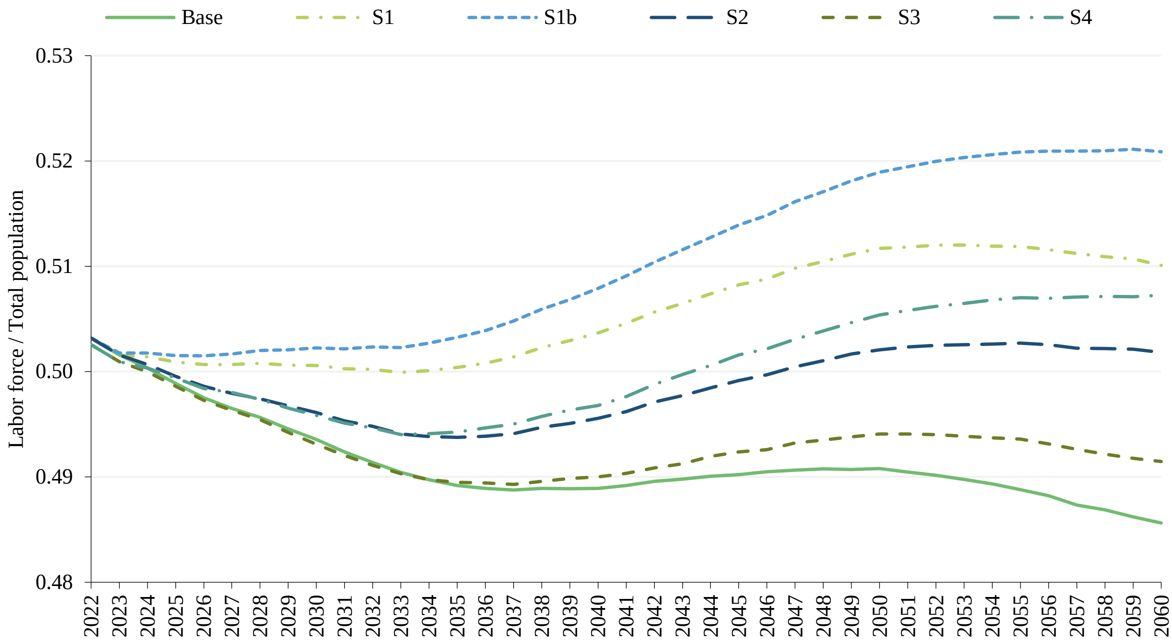
Figure 2: **Change in labor force supply between 2022 and 2060, baseline and scenarios**



Notes: Own calculations, simulated values based on microWELT. The Baseline Scenario projects an increase of the labor force of 27.2 million persons by 2060.

Figure 3 shows how the total number of people in the labor force as a share of total population changes over time. Removing disparities across the gender or the race/ethnicity dimension contributes considerably to mitigate population aging: According to scenarios S1 and S1b, the rate remains stable over the next decade and increases to 51.0% and 52.1% in 2060. In S2, where race/ethnicity disparities are removed over time, the share of labor force participants is slightly lower (50.2%) in 2060 than in 2022. Removing health- and education-specific differences between population groups (S3) increases the rate by about half a percentage point compared to the baseline scenario (49.1%), whereas in the combined scenario S4 the rate is almost two percentage points greater than in the baseline projection (50.7%). Overall, the simulations show that reducing disparities has the potential to more than compensate for the projected demographic change and may actually lead to economic dependency ratios which will be more favorable in the future than they are today.

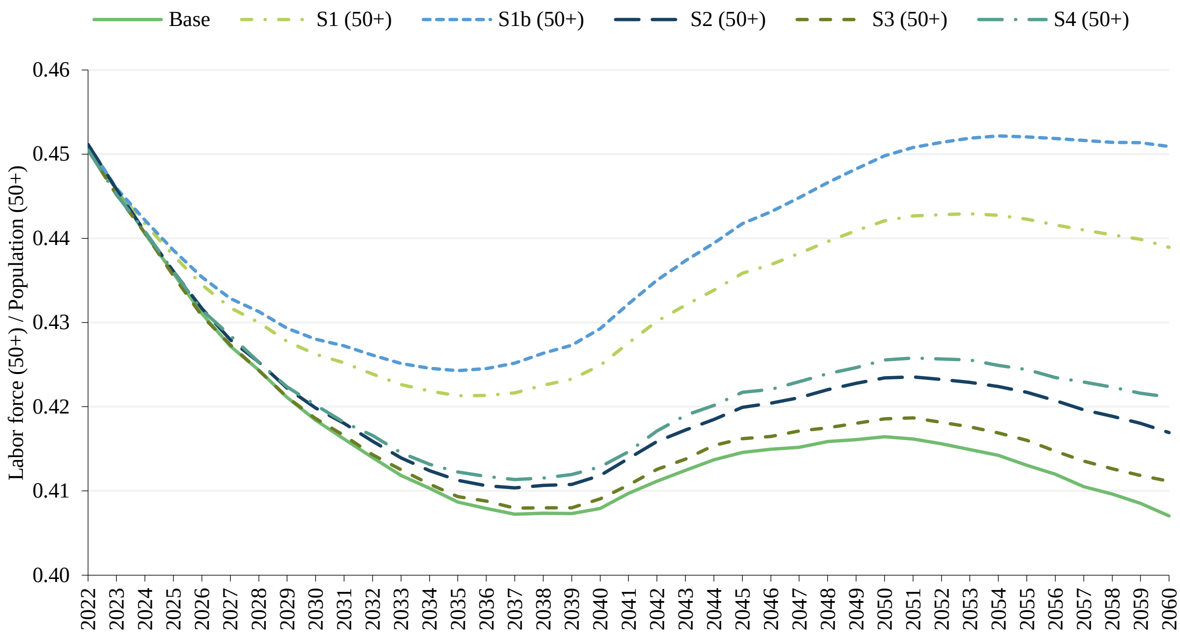
Figure 3: **Ratio between labor force and total population between 2022 and 2060, baseline and scenarios**



Notes: Own calculations, simulated values based on microWELT.

Figure 4 shows how the second economic dependency indicator (*Dep_{50+}*) is projected to evolve over time in the different scenarios. In this perspective, scenarios S2, S3 and S4 achieve only relatively small deviations from the baseline, whereas scenarios S1 and S1b stand out more clearly as possible avenues to compensate for the projected demographic change. This highlights the potential that closing gender gaps in LFPRs at older ages can have for reducing dependency rates. As Figure A **3** and Figure A **4** in the Appendix show, the gender gaps in participation rates increase considerably with age, but there is also large variation across ethno-racial groups, with gender gaps that are much larger in the Hispanic and the Asian population, than in the non-Hispanic White population.

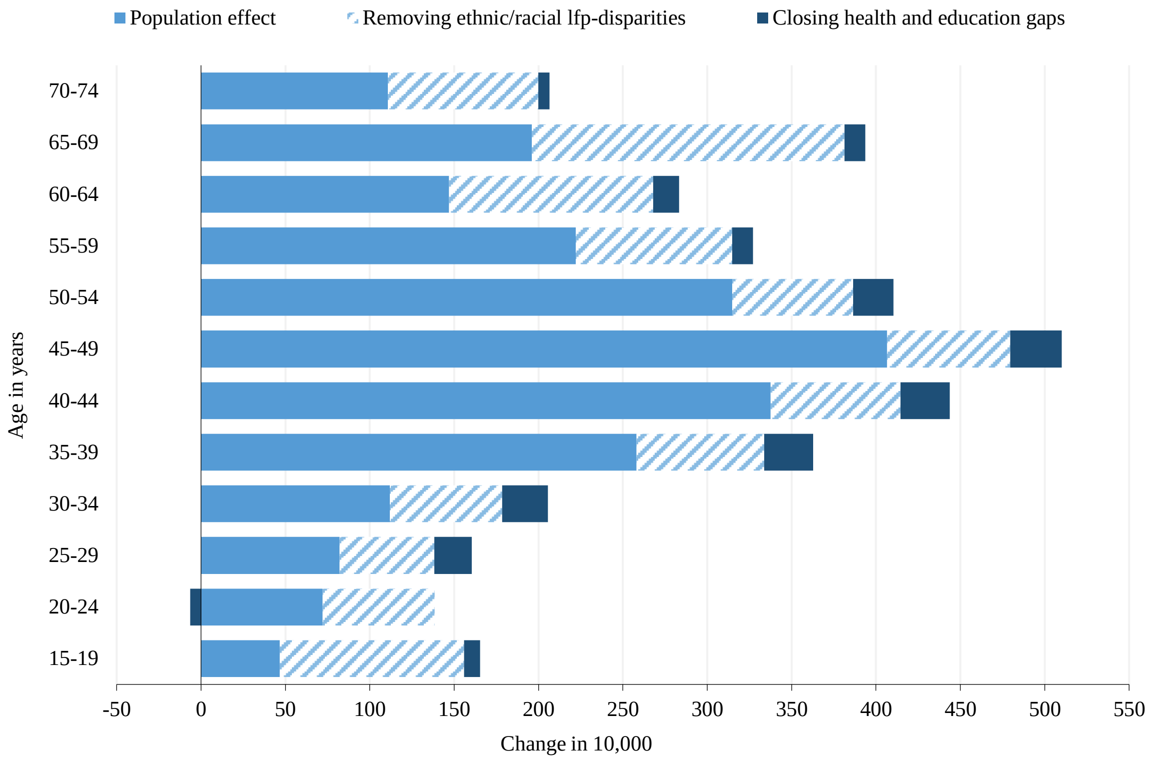
Figure 4: **Ratio between labor force and population aged 50 years and older**



Notes: Own calculations, simulated values based on microWELT.

Figure 5 decomposes the total change in the labor force of scenario 4 into the change from differences in composition of the population (which is already included in the baseline), the change stemming from removing ethnic/racial disparities in labor force participation (scenario 2) and the change stemming from removing disparities in education and health status (scenario 3). Population growth is the dominant effect in the majority of age groups, with the largest impacts expected in prime working-age groups. However, closing gaps in participation rates between ethno-racial groups for persons with similar characteristics would have large effects for the labor supply of younger and older persons. In the age group 65 to 69, for instance, reducing disparities would add about 1.85 million people to the labor force, thus almost doubling the effect resulting from population growth. Closing gaps in educational attainment and health status would make a smaller, evenly distributed contribution to increasing labor supply across almost all age groups. Since more education leads to a lock-in effect, improvements in health and educational attainment can have opposing effects on labor force participation at younger ages. This explains the small negative effect in the age group 20 to 24, while the positive effects resulting from improved health are slightly larger than the educational lock-in effects for the age group 15 to 19.

Figure 5: **Decomposition of total change in the number of labor force participants in scenario S4**



Notes: Own calculations, simulated values based on microWELT.

5. Summary and discussion

In comparison to other advanced economies, the United States has distinctive characteristics in terms of population aging and labor force participation. Three key aspects stand out: firstly, the age distribution of the U.S. population is and remains more favorable, as indicated by a lower demographic dependency ratio, than in most other OECD countries. This ratio stood at 30.4% in 2022 and is projected to rise to 40.4% by 2050, which is notably lower than the projected dependency ratios of other large economies. Secondly, labor force participation in the U.S. is relatively low and lacks the pronounced upward trajectory seen in most other OECD countries. The third distinctive feature lies in the significant disparities in labor force participation among gender and racial/ethnic groups.

These disparities arise from substantial variations in education and health outcomes, translating into notable and enduring disparities in employment and earnings across different racial/ethnic groups and genders (Daly et al., 2020; Chetty et al., 2020; Moen et al., 2022). However, disparities in labor force participation extend beyond education and health backgrounds and individuals of identical age, gender, familial obligations, education, and health, but belonging to different racial/ethnic groups, may differ in their labor supply. Other disparities pertain to gender-based variations in labor force participation, exhibiting significant variation across different racial/ethnic groups.

The significance of these disparities in the context of labor force trends is highlighted by forecasts that suggest impending shifts in the size of various population groups in the forthcoming decades (Johnson, 2020). We use a dynamic microsimulation model, microWELT-US, to quantitatively assess potential increments in the future labor force through the elimination of various categories of participation gaps. While incorporating education, health, partnership status, and the presence and age of dependent children within families as determinants of labor force participation, in terms of overall demographic shifts our model accurately reproduces the official population projections based on age, gender, and race/ethnicity.

In our baseline scenario, we project the future labor force under assumptions of status quo at the individual level, where labor force changes solely emanate from alterations in population size and composition. This scenario also accommodates changes in retirement age and in educational attainment. Under these assumptions, the labor force size is expected to grow by 27.2 million, while the ratio of labor force to total population will decline from 0.503 to 0.486. Our scenarios indicate that around one-third of this change could be offset by resolving educational and health disparities among population groups, leading to the addition of 2.6 million workers. (See Figure **3**.) In contrast, complete elimination of disparities in labor force participation among racial/ethnic groups for otherwise identical characteristics, could yield an addition of 6.5 million workers. The impact of closing the gender gap in labor force participation has a comparable or even larger impact, contingent on assumptions about how increased women's labor force participation affects men's participation in the presence of young children within families. In light of these findings, it becomes evident that promoting convergence in labor market behaviors between men and women emerges as a notably promising strategy for enhancing labor force participation rates. The more ambitious scenarios even surpass the effect of population aging on economic dependency ratios.

While the scenarios underscore the potential consequences of addressing disparities between population groups, it is essential to acknowledge that some disparities may be more amenable to policy interventions than others, and their effects might vary in terms of timelines. For instance, improvements in education take decades to manifest in increased labor force participation, while changes in retirement age yield immediate effects. To maintain realism in our scenarios, we do not adopt an idealized approach, aiming to converge labor force participation (or education) with the best-performing racial/ethnic group. Instead, we converge towards the non-Hispanic White population, while maintaining the levels of better-performing groups. In the same way, when addressing gender gaps, we make assumptions about how the presence of young children influences men's labor force participation, considering that caregiving responsibilities will be more equitably shared as maternal labor force participation increases. Empirical evidence suggests that increases in maternal labor force participation minimally affect men's labor force attachment (Patnaik, 2019). Additionally, Farré and González (2018) demonstrate that the introduction of two weeks of paternity leave in Spain boosted maternal employment rates without significantly altering fathers' labor market engagement (Tamm, 2019).

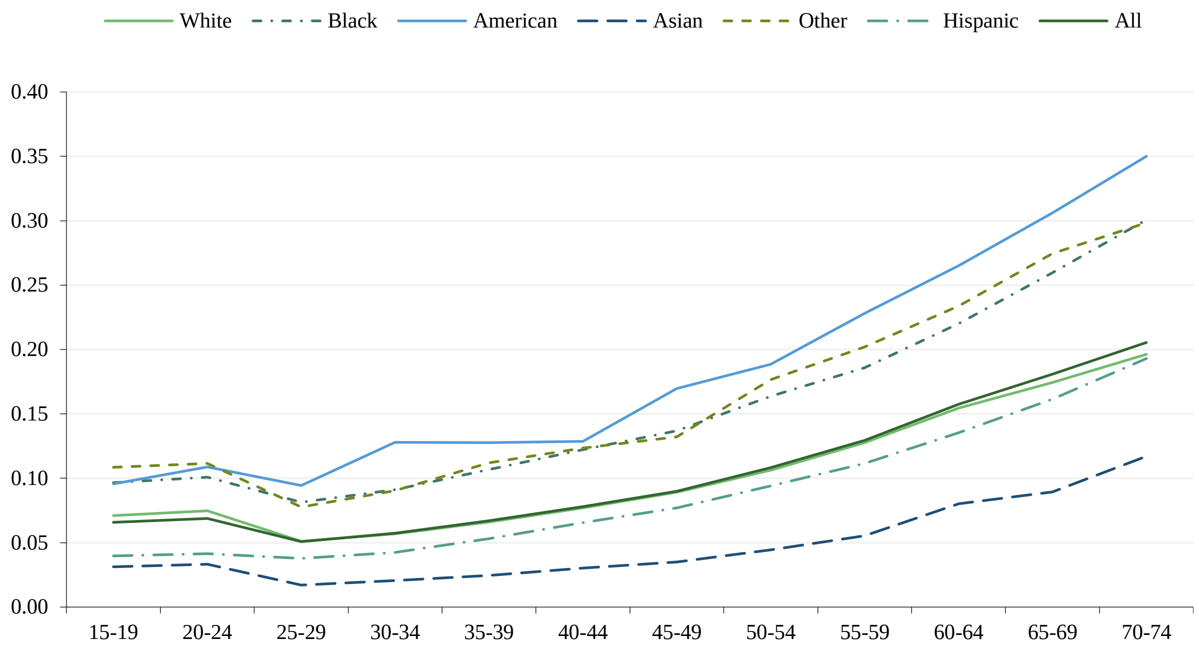
In general, the recent shifts in labor force participation patterns observed in Europe, which are absent in the U.S., indicate the potential responsiveness of labor force engagement to policy interventions. International experiences also underscore the importance of a meticulously crafted policy mix, instead of focusing solely on individual measures, such as raising the retirement age, as proposed by some scholars to address the consequences of demographic aging (Goh et al., 2023; Vogel et al., 2017). In this context, Berkman and Truesdale (2023) aptly argue that further raising the retirement age is unlikely to counteract the impacts of demographic aging, given the challenges posed by precarious working conditions, familial caregiving obligations, health issues, and age-based discrimination, which hinder the ability of many individuals to work into their late 60s and beyond. They advocate for a comprehensive range of policies aimed at enhancing the working conditions for older workers and bolstering the financial stability of those outside the labor force. Their focus on improving job quality, particularly through prioritizing the well-being of older workers, offers a pathway to improving their employment prospects. Additionally, research by Ameriks et al. (2020) reveals that increased job flexibility would lead many older Americans to extend their working lives. Our findings align with this perspective, highlighting that a concentration on worker health can elicit behavioral changes that remove the necessity for elevating the statutory retirement age. Moreover, fostering the overall health of the U.S. population is anticipated to yield dividends beyond the labor market, translating into investments in both physical and human capital.

Achieving convergence among groups and subsequently enhancing participation rates for minority group members necessitates addressing not just labor supply factors but also the labor demand aspects that impact labor market outcomes, particularly for younger and older workers. Consequently, policies must be formulated to account for both sides of the labor market. Successful policy frameworks mandate constant monitoring and adjustments. Certain policies may generate unintended consequences; for instance, over the past decade, the creation of jobs conducive to older workers' needs has surged, yet these positions have predominantly been occupied by younger individuals, particularly well-educated women (Acemoglu et al., 2022).

Growing recognition of the longitudinal nature of employment trajectories over the life course underscores the importance of considering long-term perspectives. Weisshaar et al. (2020) demonstrate that relatively advantaged groups enjoy greater access to stable high-employment trajectories, emphasizing the potential benefits of reshaping cultural gender expectations that curtail employment opportunities across the lifespan. Analogous to educational interventions that aim to level the playing field among social groups, such policies do not yield immediate changes in labor force participation but are indispensable for eradicating persistent disparities in employment patterns among racial/ethnic groups and genders. From a modeling standpoint, the long timelines of policy effects require the use of simulation tools capable of producing long-term projections to inform policy debate, promoting such a long-term perspective required for successful policy design in the long term.

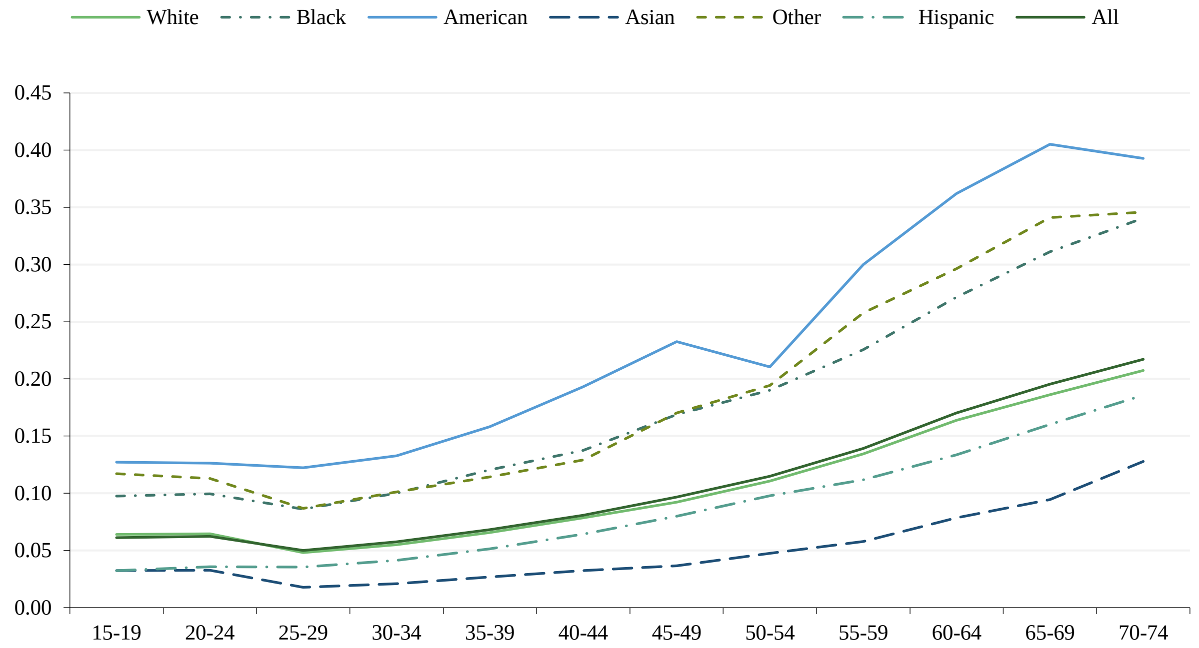
Appendix - Tables and Figures

Figure A 1: **Share of women with health limitations**



Notes: Own calculations based on ASEC 2017. Health limitation is defined as binary indicator taking the value 1 if respondents in the ASEC report health limitations implying work-limitations and zero otherwise.

Figure A 2: **Share of men with health limitations**



Notes: Own calculations based on ASEC 2017. Health limitation is defined as binary indicator taking the value 1 if respondents in the ASEC report health limitations implying work-limitations and zero otherwise.

Figure A 3: **LFP rates of women, by population group**

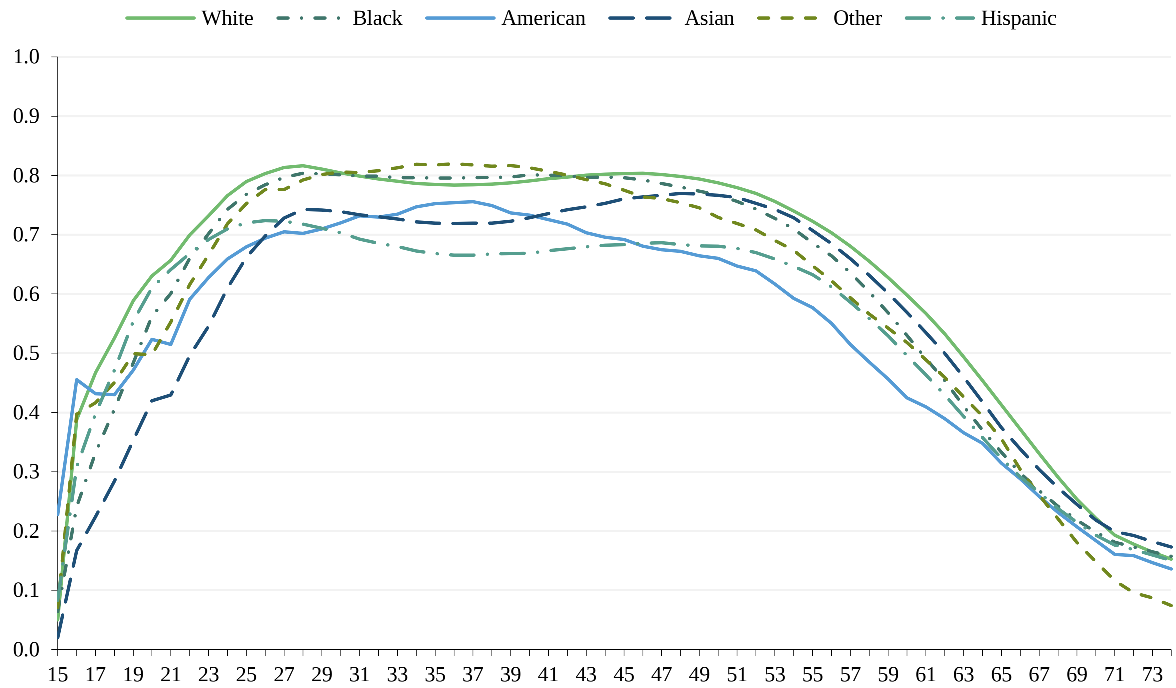


Figure A 4: **LFP rates of men, by population group**

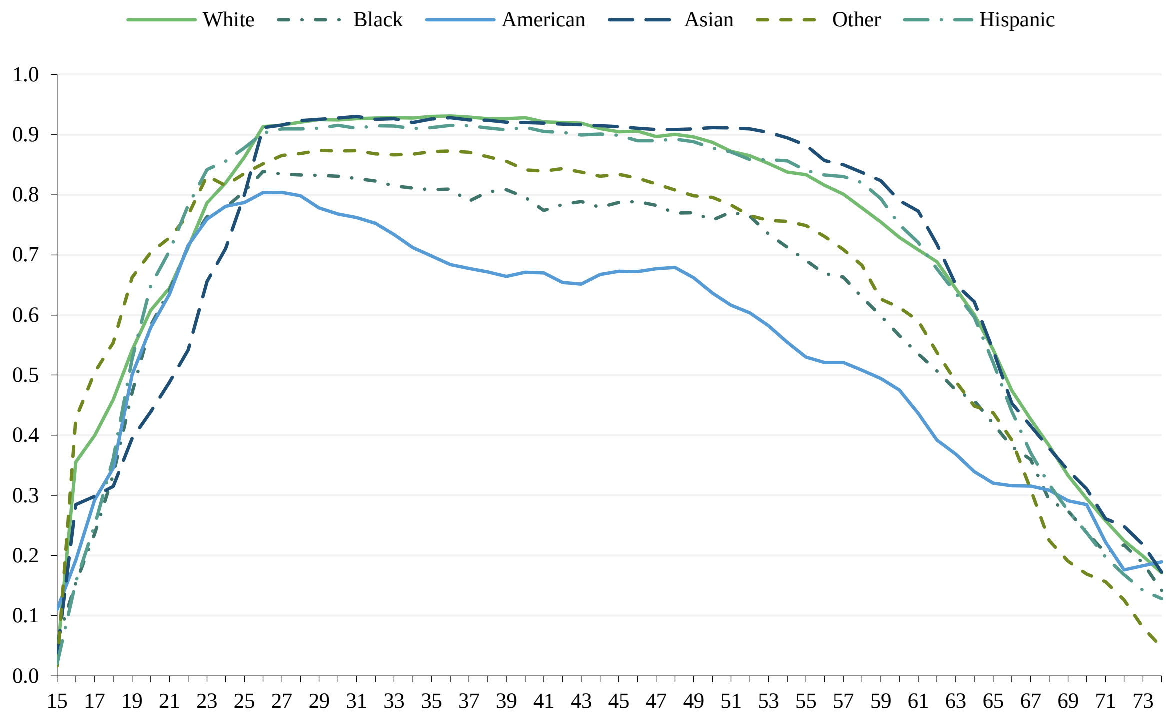


Figure A 5: **Labor force participation rates of men and women, Baseline and S1**

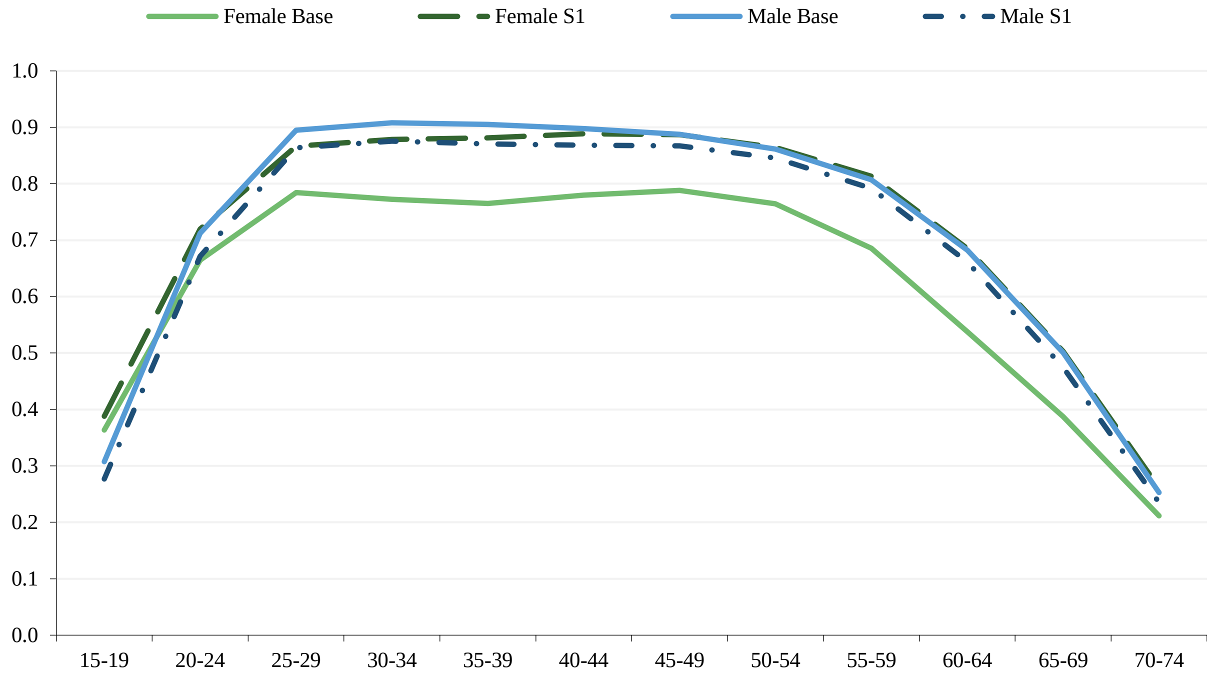


Table A 1: **Odds ratios from logistic regression for LFP, men**

	White	Black	American	Asian	Other	Hispanic
Currently in education (Base category: No)						
Yes	-2.069	-1.836	-1.443	-2.417	-2.192	-2.310
	(0.0014)	(0.0026)	(0.0146)	(0.004)	(0.0081)	(0.0023)
Highest level of education (base category: below highschool)						
Highschool	0.555	0.787	0.358	0.783	0.377	0.067
	(0.0014)	(0.0024)	(0.0104)	(0.0045)	(0.0089)	(0.0019)
College	0.675	1.211	0.231	1.032	1.127	0.467
	(0.0014)	(0.0026)	(0.0111)	(0.0045)	(0.009)	(0.0021)
University	1.114	1.519	1.815	1.427	2.240	0.467
	(0.0015)	(0.003)	(0.0147)	(0.0042)	(0.0113)	(0.0026)
Health status (base category: good)						
Bad	-3.080	-3.526	-4.302	-2.591	-2.637	-3.367
	(0.0011)	(0.0024)	(0.0124)	(0.0052)	(0.0068)	(0.0024)
Constant	-2.702	-2.230	-0.929	-2.826	-1.019	-2.286
	(0.0032)	(0.009)	(0.028)	(0.0148)	(0.027)	(0.0095)

Notes: Logistic regressions also include single year age indicators (not displayed).

Table A 2: **Odds ratios from logistic regression for LFP, women**

	White	Black	American	Asian	Other	Hispanic
Currently in education (Base category: No)						
Yes	-1.165	-1.055	-1.737	-1.470	-1.322	-0.872
	(0.0012)	(0.0022)	(0.0115)	(0.0033)	(0.0058)	(0.002)
Highest level of education (base category: below highschool)						
Highschool	0.643	0.389	1.064	0.512	0.298	0.568
	(0.0014)	(0.0023)	(0.01)	(0.0034)	(0.0077)	(0.0014)
College	0.940	0.837	1.701	0.893	0.619	1.084
	(0.0014)	(0.0024)	(0.0099)	(0.0034)	(0.0075)	(0.0015)
University	1.296	1.085	2.476	0.803	1.070	1.342
	(0.0014)	(0.0026)	(0.0118)	(0.0031)	(0.0081)	(0.0018)
Health status (base category: good)						
Bad	-2.143	-2.735	-2.500	-1.923	-2.469	-1.786
	(0.001)	(0.0022)	(0.0094)	(0.0047)	(0.0062)	(0.0022)
Age of youngest child in family (base category: none or at least 18 years of age)						
0-2	-1.045	-0.486	-0.533	-0.936	-1.600	-1.072
	(0.0013)	(0.0028)	(0.011)	(0.0036)	(0.0076)	(0.002)
3-5	-0.852	-0.310	-0.425	-1.055	-1.150	-0.789
	(0.0014)	(0.0027)	(0.0115)	(0.0034)	(0.0087)	(0.0019)
6-9	-0.398	0.226	0.757	-0.640	-0.570	-0.460
	(0.0014)	(0.0031)	(0.0144)	(0.0036)	(0.0105)	(0.002)
10+	-0.052	-0.059	-0.161	-0.206	-0.897	-0.111
	(0.001)	(0.0021)	(0.0088)	(0.0028)	(0.0069)	(0.0016)
Constant	-2.702	-2.230	-0.929	-2.826	-1.019	-2.286
	(0.0032)	(0.009)	(0.028)	(0.0148)	(0.027)	(0.0095)

Notes: Logistic regressions also include single year age indicators (not displayed).

Table A 3: **Parameters for polynomial estimations of age parameters**

	Constant	Age	Age^2	Age^3	Age^4	Age^5
	Women					
White	2.18	0.395	-0.035	0.0014	-0.000025	0.0000002
Black	1.04	0.533	-0.045	0.0018	-0.000033	0.0000002
American	1.24	-0.091	0.006	-0.0001	0.000001	
Asian	1.93	0.318	-0.027	0.0011	-0.000020	0.0000001
Other	2.11	0.114	-0.003			
Hispanic	1.14	0.484	-0.044	0.0017	-0.000030	0.0000002
	Men					
White	2.67	0.162	-0.004	0.0000	0.000000	0.0000000
Black	0.48	0.673	-0.057	0.0022	-0.000039	0.0000002
American	0.15	0.767	-0.068	0.0026	-0.000043	0.0000003
Asian	2.53	-0.082	0.041	-0.0034	0.000123	-0.0000020
Other	4.55	0.323	-0.051	0.0025	-0.000050	0.0000003
Hispanic	1.49	0.575	-0.039	0.0011	-0.000008	-0.0000002

Table A 4: **Change in labor supply by scenario and population group, 2022 to 2060**

	Baseline	S1	S1b	S2	S3	S4
	In million	In million, on top of baseline				
	Women					
White	-7.2	5.3	5.8	0.0	0.0	0.0
Black	2.0	0.8	0.9	0.4	0.5	0.9
American	0.0	0.1	0.1	0.1	0.0	0.1
Asian	3.4	1.7	2.1	1.4	-0.1	1.6
Other	2.8	0.4	0.8	0.1	0.1	0.3
Hispanic	10.7	5.3	5.8	1.7	0.8	2.3
	Men					
White	-7.6	-1.0	-0.5	0.0	0.0	0.0
Black	2.8	-0.2	0.0	1.3	0.8	1.9
American	0.1	0.0	0.0	0.1	0.1	0.2
Asian	3.9	-0.5	-0.1	0.4	0.0	0.4
Other	3.4	-1.0	-0.2	0.2	0.2	0.3
Hispanic	13.0	-1.0	-0.4	0.9	-0.1	0.9
Total	27.2	9.9	14.3	6.5	2.4	8.9

Table A 5: **Labor force participation rates by age and gender over the projection horizon (baseline)**

	2022	2030	2040	2050	2060
	Women				
15-19	0.369	0.368	0.366	0.366	0.363
20-24	0.671	0.671	0.667	0.667	0.664
25-29	0.784	0.784	0.787	0.786	0.784
30-34	0.769	0.768	0.771	0.773	0.773
35-39	0.757	0.760	0.760	0.765	0.765
40-44	0.768	0.775	0.775	0.776	0.780
45-49	0.777	0.782	0.783	0.784	0.788
50-54	0.751	0.756	0.759	0.761	0.765
55-59	0.664	0.673	0.683	0.684	0.686
60-64	0.509	0.525	0.532	0.538	0.538
65-69	0.328	0.365	0.378	0.389	0.387
70-74	0.168	0.181	0.199	0.209	0.211
All	0.622	0.626	0.636	0.638	0.633
	Men				
15-19	0.316	0.315	0.312	0.313	0.307
20-24	0.719	0.716	0.714	0.714	0.712
25-29	0.893	0.894	0.895	0.894	0.895
30-34	0.907	0.908	0.909	0.908	0.908
35-39	0.905	0.904	0.905	0.907	0.905
40-44	0.897	0.897	0.897	0.898	0.898
45-49	0.883	0.884	0.883	0.885	0.888
50-54	0.853	0.856	0.858	0.860	0.861
55-59	0.787	0.800	0.804	0.804	0.807
60-64	0.653	0.666	0.678	0.680	0.682
65-69	0.437	0.479	0.493	0.500	0.501
70-74	0.226	0.229	0.244	0.251	0.253
All	0.728	0.730	0.737	0.737	0.730

Literature

Acemoglu, D., Mühlbach, N. S., & Scott, A. J. (2022). The rise of age-friendly jobs. *Journal of the Economics of Ageing*, 23, 1-13.

Albanesi, S., & Kim, J. (2021). Effects of the COVID-19 recession on the U.S. labor market: Occupation, family, and gender. *Journal of Economic Perspectives, 35*(3), 3-24.

Ameriks, J., Briggs, J., Caplin, A., Lee, M., Shapiro, M. D., & Tonetti, C. (2020). Older Americans would work longer if jobs were flexible. *American Economic Journal: Macroeconomics*, 12(1), 174-209.

Amann, J., Böheim, R., Horvath, T., Leoni, T. & Spielauer, M. (2021). The microWELT-US microsimulation model for projections of the U.S. labor force participation accounting for education and health, Technical Report - Project NB21-17, Austrian Institute of Economic Research, Vienna.

Arias, E., Xu, J., Tejada-Vera, B., Murphy, S. L., & Bastian, B. (2022). U.S. State life tables, 2020. *National Vital Statistics Reports, 71*(1), Hyattsville, MD: National Center for Health Statistics. http://dx.doi.org/10.15620/cdc:118271.

Autor, D., Figlio, D., Karbownik, K., Roth, J., & Wasserman, M. (2019). Family disadvantage and the gender gap in behavioral and educational outcomes. *American Economic Journal: Applied Economics, 11*(3), 338-381.

Atella, V., Belotti, F., Kim, D., Goldman, D., Gracner, T., Mortari, A. P., & Tysinger, B. (2021). The future of the elderly population health status: Filling a knowledge gap. *Health Economics, 30,* 11-29.

Avendano, M., Glymour, M. M., Banks, J., & Mackenbach, J. P. (2009). Health disadvantage in US adults aged 50 to 74 years: A comparison of the health of rich and poor Americans with that of Europeans. *American Journal of Public Health*, 99(3), 540-548.

Baumberg Geiger, B., Böheim, R., & Leoni, T. (2019). The growing American health penalty: International trends in the employment of older workers with poor health. *Social Science Research, 82,* 18-32. https://doi.org/10.1016/j.ssresearch.2019.03.008.

Berger, B., Garcia, I. L., Maestas, N., & Mullen, K. J. (2022). *The link between health and working longer: Disparities in work capacity.* National Bureau of Economic Research working paper 30036.

Berkman, L. F., & Truesdale, B. C. (2023). Working longer and population aging in the U.S.: Why delayed retirement isn't a practical solution for many. *Journal of the Economics of Aging, 24,* 100438.

Blau, F. D., & Kahn, L. M. (2013). Female labor supply: Why is the United States falling behind?. *American Economic Review, 103*(3), 251-256.

Bloom, D. E., Chatterji, S., Kowal, P., Lloyd-Sherlock, P., McKee, M., Rechel, B., Rosenberg, L., & Smith, J. P. (2015). Macroeconomic implications of population aging and selected policy responses. *Lancet*, 385(9968): 649-657. https://doi.org/10.1016/S0140-6736(14)61464-1.

Böheim, R. & Leoni, T. (2018). Sickness and disability policies: Reform paths in OECD countries between 1990 and 2014. *International Journal of Social Welfare*, 27(2), 168-185. https://doi.org/10.1111/ijsw.12295

Böheim, R., Horvath, T., Leoni, T., & Spielauer, M. (2023). The impact of health and education on labor force participation in aging societies: Projections for the United States and Germany from dynamic microsimulations. *Population Research and Policy Review, 42*(3): 39.

Browne, I., & Misra, J. (2003). The intersection of gender and race in the labor market. *Annual Review of Sociology, 29*(1), 487-513.

Chavez, K., Weisshaar, K., & Cabello-Hutt, T. (2022). Gender and racial discrimination in hiring before and during the COVID-19 pandemic: Evidence from a field experiment of accountants, 2018–2020. *Work and Occupations, 49*(3), 275–315.

Cherchye, L., Rock, B. D., & Vermeulen, F. (2012). Married with children: A collective labor supply model with detailed time use and intra-household expenditure information. *American Economic Review, 102*(7), 3377-3405.

Chetty, R., Hendren, N., Jones, M. R., & Porter, S. R. (2020). Race and economic opportunity in the United States: An intergenerational perspective. *Quarterly Journal of Economics*, 135(2), 711-783.

Collins, W., & Michael, M. Q. (2017). *Racial differences in American women's labor market outcomes: A long-run view.* NBER Working Papers No 23397. National Bureau of Economic Research.

Daly, M. C., Hobijn, B., & Pedtke, J. H. (2020). Labor market dynamics and black–white earnings gaps. *Economics Letters, 186,* 17.

European Commission (2021). *The 2021 aging report: Economic and budgetary projections for the E.U. member states (2019-2070).* Institutional Paper 148, Publications Office of the European Union. Luxembourg. https://doi.org/10.2765/84455

Farré, L., & González, L. (2019). Does paternity leave reduce fertility?. *Journal of Public Economics*, 172, 52-66.

Fogli, A., & Veldkamp, L. (2011). Nature or nurture? Learning and the geography of female labor force participation. *Econometrica, 79*(4), 1103-1138.

García-Gómez, P., Van Kippersluis, H., O'Donnell, O., & Van Doorslaer, E. (2013). Long-term and spillover effects of health shocks on employment and income. *Journal of Human Resources, 48*(4), 873-909.

George, E. E., Milli, J., & Tripp, S. (2022). Worse than a double whammy: The intersectional causes of wage inequality between women of colour and White men over time. *Labour*, 36(3), 302-341.

Goh, S. K., McNown, R., & Chen, L. J. (2023). Long-run macroeconomic consequences of Taiwan's aging labor force: An analysis of policy options. *Journal of Policy Modeling*, 45(1), 121-138.

Hummer, R. A. (2023). Race and ethnicity, racism, and population health in the United States: The straightforward, the complex, innovations, and the future. *Demography, 60*(3), 633-657.

Johnson, S. (2020). *A changing nation: Population projections under alternative immigration scenarios.* Current population reports, 25-1146, U.S. Census Bureau.

Juhn, C., & Potter, S. (2006). Changes in labor force participation in the United States. *Journal of Economic Perspectives, 20*(3), 27-46.

Loichinger, E., Hammer, B., Prskawetz, A., Freiberger, M., & Sambt, J. (2017). Quantifying economic dependency. *European Journal of Population, 33,* 351-380.

Mauro, M., Allen, D. S., Dauda, B., Molina, S. J., Neale, B. M., & Lewis, A. C. (2022). A scoping review of guidelines for the use of race, ethnicity, and ancestry reveals widespread consensus but also points of ongoing disagreement. *American Journal of Human Genetics, 109,* 2110–2125.

Mays, V. M., Ponce, N. A., Washington, D. L., & Cochran, S. D. (2003). Classification of race and ethnicity: Implications for public health. *Annual Review of Public Health, 24,* 83-110.

Moen, P., Flood, S. M., & Wang, J. (2022). The uneven later work course: Intersectional gender, age, race, and class disparities. *Journals of Gerontology: Series B, 77*(1), 170-180.

Montes, J. (2018). CBO's Projection of Labor Force Participation Rate, Working Paper 2018-04, Working Paper Series Congressional Budget Office Washington, D.C. https://www.cbo.gov/publication/53616.

Morris, Z. (2016). Constructing the need for retrenchment: Disability benefits in the United States and Great Britain. *Policy & Politics*, 44(4), 609-626.

OECD (Organization of Economic Co-operation and Development) (2003). *Transforming Disability into Ability*. OECD Publishing, Paris.

OECD (Organization of Economic Co-operation and Development) (2010). *Sickness, disability and work. Breaking the barriers*. Synthesis report. OECD Publishing, Paris.

OECD (Organization of Economic Co-operation and Development) (2023), Old-age dependency ratio (indicator). https://doi.org/10.1787/e0255c98-en (Accessed on 30 April 2023)

OECD.Stat (2023). Educational attainment and labor-force status: Employment, unemployment and inactivity rate of 25-64 year-olds, by educational attainment. https://stats.oecd.org/index.aspx?queryid=93190.

Patnaik, A. (2019). Reserving time for daddy: The consequences of fathers' quotas. *Journal of Labor Economics*, 37(4), 1009-1059.

Paul, M., Zaw, K., & Darity, W. (2022). Returns in the labor market: A nuanced view of penalties at the intersection of race and gender in the U.S. *Feminist Economics, 28*(2), 1-31.

Perez-Arce, F., & Prados, M. J. (2021). The decline in the U.S. labor force participation rate: A literature review. *Journal of Economic Surveys, 35*(2), 615-652.

Ross, P. T., Hart-Johnson, T., Santen, S. A., & Bibler Zaidi, N. L. (2020). Considerations for using race and ethnicity as quantitative variables in medical education research. *Perspectives on Medical Education, 9*(5), 318-323.

Sanderson, W. C., & Scherbov, S. (2015). Are we overly dependent on conventional dependency ratios?. *Population and Development Review, 41*(4), 687-708.

Smock, P. J., & Schwartz, C. R. (2020). The demography of families: A review of patterns and change. *Journal of Marriage and Family*, 82(1), 9-34.

Spielauer, M., Horvath, T. & Fink, M. (2020a). microWELT - A Dynamic Microsimulation Model for the Study of Welfare Transfer Flows in Ageing Societies from a Comparative Welfare State Perspective. WIFO Working Paper 609/2020. https://www.econstor.eu/bitstream/10419/225206/1/1735146943.pdf

Spielauer, M., Horvath, T., Hyll, W. & Fink, M. (2020b). microWELT: Socio-Demographic Parameters and Projections for Austria, Spain, Finland, and the UK. WIFO Working Paper 6011/2020. https://www.econstor.eu/bitstream/10419/227494/1/1735917516.pdf

Tamm, M. (2019). Fathers' parental leave-taking, childcare involvement and labor market participation. *Labour Economics*, 59, 184-197.

TPAM (Technical Panel on Assumptions and Methods) (2019). Report to the Social Security Advisory Board. https://www.ssab.gov/wp-content/uploads/2020/04/TPAM-2019-FINAL-REPORT_508.pdf.

U.S. Census Bureau (2018). Main Projections Series for the United States, 2017-2060. U.S. Census Bureau Population Division: Washington, DC.

U.S. Census Bureau (2019). Current Population Survey Design and Methodology. Technical Paper 77, October 2019, https://www2.census.gov/programs-surveys/cps/methodology/CPS-Tech-Paper-77.pdf.

Van Hook, J., Bélanger, A., Sabourin, P., & Morse, A. (2020). Immigration selection and the educational composition of the U.S. labor force. *Population and Development Review*, 46(2), 321-346.

Vézina, S., & Bélanger, A. (2020). Literacy skills as an explanation for labor market imbalances by occupational type in Canada: Microsimulation projections for 2014–2024. *Population Research and Policy Review*, 39, 1019-1049.

Vogel, E., Ludwig, A., & Börsch-Supan, A. (2017). Aging and pension reform: Extending the retirement age and human capital formation. *Journal of Pension Economics & Finance*, 16(1), 81-107.

Wahrendorf, M., Reinhardt, J. D., & Siegrist, J. (2013). Relationships of disability with age among adults aged 50 to 85: Evidence from the United States, England and continental Europe. *PloS One, 8*(8), e71893.

Walker, R. J., Williams, J. S., & Egede, L. E. (2016). Influence of race, ethnicity and social determinants of health on diabetes outcomes. *American Journal of the Medical Sciences, 351*(4), 366-373.

Weisshaar, K., & Cabello-Hutt, T. (2020). Labor force participation over the life course: The long-term effects of employment trajectories on wages and the gendered payoff to employment. *Demography*, 57(1), 33-60.

Woolf, S. H., & Aron, L. Y. (2013). The U.S. health disadvantage relative to other high-income countries: Findings from a National Research Council/Institute of Medicine report. *Jama, 309*(8), 771-772.

Zaidi, A., & Rake, K. (2001). Dynamic microsimulation models: A review and some lessons for SAGE. Discussion Paper no. 2, Simulating Social Policy in an Ageing Society (SAGE), London.

Zimmerman, F. J., & Anderson, N. W. (2019). Trends in health equity in the United States by race/ethnicity, sex, and income, 1993-2017. *JAMA network open, 2*(6), e196386-e196386.