2.1. U.S. EMPLOYMENT (USEMP)

2.1.a. *Overview*

The Bureau of Labor Statistics (BLS) publishes historical monthly estimates for civilian U.S. employment-related concepts from the Current Population Survey (CPS). The principal measures include the civilian labor force (LC) and its two components – employment (E) and unemployment (U), along with the civilian noninstitutional population (N). The BLS also publishes values for the civilian labor force participation rate (LFPR) and the civilian unemployment rate (RU). The LFPR is defined as the ratio of LC to N, while the RU is the ratio of U to LC, expressed to a base of 100. For many of these concepts, the BLS publishes historical data disaggregated by age, sex, marital status, and presence of children.

For various disaggregated groups[1], USEMP projects quarterly and annual values for these principal measures of U.S. employment and population. Equations 2.1.1 through 2.1.6 outline the subprocess' overall structure and solution sequence for the total economy. We project that the military population (M) will remain constant over the projection horizon. We also project that the sum of N and M will grow at the same annual rate projected for the Social Security area population (P) (see Demography Process input).

$$M^{t} = M^{2021} \quad (2.1.1)$$

$$N^{t} = [(N^{t-1} + M^{t-1}) * (P^{t} / P^{t-1})] - M^{t} \quad (2.1.2)$$

$$RU = RU(\cdot) \quad (2.1.3)$$

$$LFPR = LFPR(\cdot) \quad (2.1.4)$$

$$LC = LFPR * N \quad (2.1.5)$$

$$E = LC * (1 - RU / 100) \quad (2.1.6)$$

Note: the superscript t represents the projection year.

The Demography Process estimates historical values for the total Social Security area population (P) and an important component, the temporary or unlawfully present population (OP). OP is further disaggregated into components by visa status: those temporarily authorized to reside or work in the US (OP_A), those who have overstayed their authorization (OP_NA), and those who were never authorized to reside or work in the US (OP_NO). Similarly, USEMP projects annual values for E and employed OP (EO), including its visa-status components (EO_A, EO_NA, EO_NO). USEMP also separates EO to those whose earnings are reported and posted to the Master Earnings File (EO_MEF), those whose earnings are reported posted to the Earnings Suspense File (EO_ESF), those in the underground economy (EO_UND). A further subgroup of

[1] Group disaggregation includes age and sex. Some groups are additionally disaggregated by marital status and by presence of children.

EO_MEF is also calculated: those who are OASDI covered (EO_MEFC). Equations 2.1.7 through 2.1.14 outline the overall structure of the subprocess used to estimate EO and its sub-components.

$$\text{EO\_A} = \textit{EO\_A}(\cdot) \quad (2.1.7)$$

$$\text{EO\_NA} = \text{E} * \text{OP\_NA} / \text{N} \quad (2.1.8)$$

$$\text{EO\_NO} = \text{E} * \text{OP\_NO} / \text{N} \quad (2.1.9)$$

$$\text{EO} = \text{EO\_A} + \text{EO\_NA} + \text{EO\_NO} \quad (2.1.10)$$

$$\text{EO\_MEF} = \textit{EO\_MEF}(\cdot) \quad (2.1.11)$$

$$\text{EO\_MEFC} = \textit{EO\_MEFC}(\cdot) \quad (2.1.12)$$

$$\text{EO\_ESF} = \textit{EO\_ESF}(\cdot) \quad (2.1.13)$$

$$\text{EO\_UND} = \text{EO} - \text{EO\_MEF} - \text{EO\_ESF} \quad (2.1.14)$$

Finally, for each age/sex group, USEMP projects total "at-any-time" employed temporary or unlawfully present population (TEO). EO represents the average weekly employment of the temporary or unlawfully present population during a calendar year. TEO represents the total number of individuals in the temporary or unlawfully present population who had any employment during the calendar year. (EO can be roughly viewed as the average number of jobs worked by OP during a calendar year, while TEO represents the total number of individuals who worked those jobs.) Effectively, Equations 2.1.15 through 2.1.19 convert every EO age-sex sub-component to an at-any-time TEO age-sex sub-component counterpart.

$$\text{TEO\_MEF} = \textit{TEO\_MEF}(\cdot) \quad (2.1.15)$$

$$\text{TEO\_MEFC} = \textit{TEO\_MEFC}(\cdot) \quad (2.1.16)$$

$$\text{TEO\_ESF} = \textit{TEO\_ESF}(\cdot) \quad (2.1.17)$$

$$\text{TEO\_UND} = \textit{TEO\_UND}(\cdot) \quad (2.1.18)$$

$$\text{TEO} = \text{TEO\_MEF} + \text{TEO\_ESF} + \text{TEO\_UND} \quad (2.1.19)$$

2.1.b. *Input Data*

Long-Range OASDI Projection Data

These data are updated each year.

Demography

1. Social Security area population as of year-end (1941-2105) by age, marital status (single, married, widowed, divorced) and sex (M, F)
2. Temporary or unlawfully present population as of year-end (1964-2105) by age, sex (M, F), and visa status (OP_A, OP_NA, and OP_NO)
3. Number of children by age of child and age of mother (1960-2105)
4. Life expectancy by age and sex (1950-2105)
5. Exit rates (probability of leaving the "temporary or unlawfully present population by other than death) by age and sex.
6. Mortality rates by age and sex (1941-2105)
7. Civilian noninstitutionalized population by age, sex and marital status (2010-2105)

Trust Fund Operations and Actuarial Status – The Trust Fund Operations and Actuarial Status Process provides no direct input to the Economic Process sections. However, the LFPRs generally use input based on the Outgo Process from the prior year's Trustees Report. For example, the projected LFPRs for the 2021 Trustees Report used input from the 2020 Trustees Report. This is acceptable practice as long as the ultimate disability incidence rate assumption is not changed from the prior year. (When this assumption is changed, projected disability prevalence rates (item 8 below) are adjusted to reflect the change.) This input includes:

8. projections for the disability prevalence rates by age and sex (originally from the Beneficiaries subprocess)
9. projections for the disability-insured population (originally from the Beneficiaries subprocess)
10. primary insurance amount (PIA) replacement rates by age and sex.

The disability prevalence rate is defined as the ratio of the number of disabled worker beneficiaries to the disability-insured population. The PIA replacement rate is defined as the ratio of a hypothetical medium-scaled worker's PIA to his/her career-average indexed earnings level.

Trustees' Assumptions

Each year the Board of Trustees of the OASDI Trust Funds sets the ultimate average annual growth rate values for key economic variables:

11. Real wage
12. Total economy productivity
13. Average hours worked
14. Ratio of wages to compensation (RWSD)

15. Ratio of compensation to GDP (RWSSY)
16. GDP deflator (PGDP)
17. Consumer Price Index (CPI)

The Board also sets ultimate values for:

18. Annual trust fund real interest rate
19. Unemployment rate

These ultimate values are typically reached during the last half of the short range (first 10 years) of the projection horizon. Earlier projected values are set to provide a smooth transition from the latest actual historical values to the assumed long-range ultimate ones. As a by-product of this process, values for real GDP and potential GDP are set. The ratio (RTP) of real to potential GDP is an important summary measure of the economic cycle.

The Trustees also agree on the assumed short-range values for the listed variables.

Addfactors

20. Addfactors are adjustments that move an estimate closer to an expected value. They may be used for a variety of reasons associated with data availability, structural changes in the data and/or model, and perceived temporary aberrations in recent historical data. Addfactors were included on male and female LFPRs starting around age 40 to reflect the effects of projected changes in life expectancy. Addfactors are also used to modify LFPRs of several specific age-sex groups to ensure a reasonable shape of the age-LFPR profile. Another addfactor is applied to the labor force in the first few projection years to phase out the differences between the model-predicted values and recent historical data.

Other input data

21. U.S. armed forces (EDMIL) by age and sex, estimated by the Department of Defense and published by the Census Bureau on a monthly basis (1948-2000) by single year of age (17 to 64) and sex. These data are no longer produced by Census.

22. EDMIL by age and sex, estimated by the Economic Process as the difference in monthly resident plus Armed Forces overseas population and the monthly civilian population. These two populations are available from the Census Bureau on a monthly basis (April 2000 through December of the year prior to the Trustees Report) by single year of age (16 to 69) and sex. These data are updated once a year.

23. Data for the mobilized military reservist population, by branch of service (September 2001-September 2016) are reported by the US Department of Defense weekly. These data are no longer reported by the Department of Defense.

24. Data from the March Supplement of the Joint BLS/Census Current Population Survey (CPS) by year (1968 to the year prior to the Trustees Report), for levels of the civilian noninstitutional population, labor force, military, and unemployment. These data are

available from the U.S. Census Bureau by single year of age (16 to 85+), sex, marital status (never married, married with a spouse present, and married with no spouse present), and presence of children. These data are updated by the U.S. Census Bureau for the BLS annually. This subprocess updates the data every year.

25. Data from the March Supplement of the CPS by year (1992 to the second year prior to the Trustees Report), for levels of the civilian noninstitutional population. These data are available from the U.S. Census Bureau by single year of age (16 to 80+), sex, and educational attainment level. These data are updated by the U.S. Census Bureau for the BLS annually. This subprocess updates the data every year, if time availability allows.

26. Data from the CPS (January 1948 through November of the year prior to the Trustees Report) for levels of civilian employment, civilian labor force, civilian unemployment, civilian noninstitutional population, and the rates of unemployment and labor force participation. These data are available from the BLS by age group and sex. These data are updated by the BLS monthly. This subprocess updates the data several times a year.

27. Data from the CPS by year (January 1994 through September of the year prior to the Trustees Report), for the civilian noninstitutional population. These data are available from the BLS by single year of age (16 to 90+), sex, marital status, labor force employment status, and (for those not in the labor force) reason for not being in the labor force. These data are updated by the BLS monthly. Monthly data are used to calculate annual averages. This subprocess updates the data every year, if time availability allows.

28. Data from the Current Employment Statistics survey (CES) (1964 (varies) through November of the year prior to the Trustees Report) for establishment employment, average hourly earnings, average weekly earnings, and average weekly hours. These data are available from the BLS by sector. These data are updated by the BLS monthly. This subprocess updates the data several times a year.

29. Unpublished data from the CPS (1965 through October of the year prior to the Trustees Report) for male and female civilian labor force participation rates for older workers. These data are available from the BLS by single year of age (ages 55-79) and by group (75 and over, and 80 and over). These data are updated by the BLS monthly. This subprocess updates the data several times a year.

2.1.c. *Development of Output*

Equation 2.1.3 - Unemployment Rate (RU)

The RU is disaggregated by age and sex. The age groups include 16-17, 18-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, and 75 and over. Thus, USEMP contains 28 RU equations, 14 for men and 14 for women. Each disaggregated RU is

specified using a first-difference model that depends on the distributed lag in the change in the ratio of real to potential GDP (RTP) and an adjustment to ensure that values converge to its estimated trend level. Coefficients are estimated by regression. Furthermore, projections are constrained to the ultimate age-sex-adjusted RU set by the Trustees. The aggregate age-sex-adjusted RU is dependent on the projected distribution of the labor force by age and sex. See Appendix 2-1 for details on the equations.

Equation 2.1.4 - Labor Force Participation Rate (LFPR)

The LFPR is disaggregated by age and sex. Age groups include 16 to 17 (i.e., 16-17), 18-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55, 56, ... 99, 100 and over. For age groups between 20 and 54, male and female LFPRs are further disaggregated by marital status, categories of which include never married, ever married with spouse present, and ever married with spouse absent (which includes separated, widowed, and divorced). Female LFPRs disaggregated by age (between 20 and 44) and by marital status are further disaggregated by presence of own child. The groups for presence of own child include women with at least one child under the age of six and women without a child under the age of six. Thus, USEMP contains 153 LFPR equations, 69 for men and 84 for women. See Appendix 2-1 for details on the equations.

Given the level of demographic disaggregation, the aggregate LFPR is dependent on the projected distribution of the population by age, sex, marital status, and presence of own child. Each disaggregated LFPR, however, is dependent on the input variables that are most relevant to the demographic group. For example, only the LFPRs for relevant older workers are dependent on changes to the normal retirement age (NRA). Specific examples of the impact of input data on the disaggregated LFPRs are presented below.

- Disability prevalence ratio (RD) is defined as the ratio of disabled worker beneficiaries to the disability-insured population. An increase in RD lowers the LFPR because disabled worker beneficiaries tend to exit the labor force. To reflect this, projected LFPRs for each age-sex group are adjusted for disability by dividing them by (1+RD). This adjustment implicitly assumes that disability can strike any person in a given age-sex group with equal probability. For ages 62 to NRA, RDs are not "pure" RDs in that they are subject to the confounding effect of the availability of retirement benefits. For example, at age 62, a marginally disabled individual may opt to begin receiving retirement benefits rather than go through an uncertain disability application/appeals process. For ages NRA and above, RDs are unavailable because at the NRA all disabled-worker beneficiaries become retired-worker beneficiaries. To avoid these problems, RDs for ages 62-74 are set to their cohort RD at age 61. For example, the RD for men age 62 in year (t) is set to the RD for men age 61 in year (t-1). For those ages 75 and older, the lagged cohort variable provides information on the influence of disability prevalence rates on labor force participation.
- The unemployment rate (RU) is a measure of the economic cycle. An increase in the lagged and current unemployment rate leads to a decrease in the LFPR. The RU affects LFPRs for ages up to 54.
- The normal retirement age (NRA) is assumed to affect the LFPRs for those age 62 through 69 through an earnings test and replacement rate. The replacement rate is defined

as the ratio of a hypothetical worker's PIA to career-average wage level. This value is projected for hypothetical workers with medium-scaled earnings patterns[2] who retire at ages 62 through 69. The replacement rate is adjusted to include the reduction for early retirement and the delayed retirement credit. An increase in the NRA decreases the adjusted replacement rates, which, in turn, leads to increases in the LFPRs for those between the ages of 62 and 69. The potential earnings test tax rate (POT_ET_TXRT) is used in LFPRs between 62 and 69. It is defined as a tax rate on monthly retirement benefits faced by an individual who opts to collect Social Security benefits before reaching NRA while continuing to work and earn income. An increase in the NRA from 66 to 67 leads to an increase in the potential tax rate for those age 66, which, in turn, leads to a decrease in their LFPR.

- The level of educational attainment affects LFPRs for ages 55 and older for men and 50 and older for women. As the average level of educational attainment in any given age-sex group rises, LFPRs generally increase.
- The composition of population by marital status also affects LFPRs. For ages up to 54, LFPRs are disaggregated by marital status. For ages 55 to 74 (both men and women), the effect of marital status is captured by the proportion of people in any given age group who are married with spouse present.
- Lagged cohort variables affect LFPRs for age 75 and over.
- For those approximately age 40 and over, an increase in life expectancy leads to an increase in LFPRs.

Equation 2.1.7 to 2.1.19 – Employed Temporary or Unlawfully Present Population (EO) and At-Any-Time Employed Temporary or Unlawfully Present Population (TEO)

EO is estimated by sex and single-year of age from 16 to 100 based on OP and estimated employment-to-population ratios by visa-status component (OP_A, OP_NA, OP_NO). For this purpose, OP_A is further disaggregated into subgroups by visa type that differ in employment patterns or OASDI coverage status. The other two components are assumed to have equal employment-to-population ratio as the LPR population of the same age and sex. This portion of USEMP contains 4,250 equations, for 85 ages, 2 sexes, and 25 components and subgroups. We separate EO_NO into those who worked in 2001 and earlier and those who began working in 2002 and later, since we believe that those who worked in 2001 and earlier are more likely to have OASDI covered wages. Each component is then further separated into EO_MEF, EO_MEFC, EO_ESF, and EO_UND.

Every EO sub-component by age, sex, and visa status is converted to its age-sex TEO sub-component counterpart using an age-sex conversion weight. For example, if the sub-component of EO is for never authorized men age 20 to 24, the conversion weight is defined as the ratio of total economy-wide at-any-time employed men age 20 to 24 (TEM2024) to the sum of military and CPS civilian male employment age 20 to 24. For authorized workers and students on temporary visas, conversion weights take into account their partial presence in the year of arrival and the year of departure.

[2] More details on the hypothetical scaled workers are provided in Actuarial Note 2025.3, located at: www.ssa.gov/OACT/NOTES/ran3/index.html.