Introduction to Modeling Social Security

This document summarizes the contents of the 2018 Social Security Trustees Report.

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Model Implications

We do not expect you to develop a full economic model with the same sophistication as that of the SSA OASDI model; instead, we would like you to focus on the specifics of the policy recommendations you propose. Nevertheless, you should accompany your proposal with substantive discussion of the ways your policies would affect relative metrics governing the financial solvency of the OASDI program. Feel free to integrate existing research when discussing these implications, or you can perform your own tests. The SSA uses a stochastic model as part of its OASDI testing; adapting this approach (such as letting parameters such as fertility rate or average earnings vary randomly and performing multiple trials) is one way of performing an analysis of the effects of your proposal. No matter how you choose to test your model and its consequences, your write-up should include a detailed description of your testing methods and results.

Modeling Assumptions:

The Trustees make basic assumptions for several of these factors based on analysis of historical trends, historical conditions, and expected future conditions. These factors include fertility, mortality, immigration, marriage, divorce, productivity, inflation, average earnings, unemployment, real interest rates, and disability incidence and termination. Other factors depend on these basic assumptions. These other, often interdependent, factors include total population, life expectancy, labor force participation, gross domestic product, and program-specific factors. Each year the Trustees reexamine these assumptions and methods in light of new information and make appropriate revisions.

-From The 2018 Annual Report, p. 80
Overview of Long-Range OASDI Projection Methodology

To help you get started, we provide a short overview of the factors used by the Social Security Administration (SSA) in designing its model. To create a highly effective policy proposal, it is NOT NECESSARY to reproduce the SSA’s quantitative analysis, and your presentation should focus on recommendations rather than refining SSA’s model; however, you should be prepared to comment on the effects your proposal would have on relevant demographic and economic assumptions. For further reading, as well as a detailed description of all formulas used in determining assumptions, the SSA’s model documentation is an excellent source.

SSA separates its modeling assumptions into four groups:

**Demography:** Concerns assumptions regarding the size and composition of the U.S. population over the 75-year projection period from 2018 to 2092. Inputs to these assumptions generally rely on government and other public data, and outputs of these assumptions affect assumptions in the remaining three groups.

**Economics:** Concerns assumptions regarding employment and income data over the projection period. Input to these assumptions involve the outputs of the Demographic assumptions, and outputs of these assumptions affect the inputs to Beneficiary and Trust Fund Operations/Actuarial Status assumptions.

**Beneficiaries:** Concerns assumptions regarding the size and composition of potential recipients of OASDI benefits. Input to these assumptions involve the outputs of the Demographic and Economics assumptions, and outputs of these assumptions affect the Economics and Trust Fund Operations/Actuarial Status processes.
**Trust Fund Operations/Actuarial Status:** Concerns the annual flow of income from taxes, taxation of benefits, and asset interest as well as costs of benefit payments, program administration, and railroad interchange.

### Long-Range Values of Key Assumptions for the 75-year Projection Period

<table>
<thead>
<tr>
<th>Demographic:</th>
<th>Long-range assumptions</th>
<th>Intermediate</th>
<th>Low-cost</th>
<th>High-cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total fertility rate (children per woman), for 2027 and later</td>
<td></td>
<td>2.0</td>
<td>2.2</td>
<td>1.8</td>
</tr>
<tr>
<td>Average annual percentage reduction in total age-sex-adjusted death rates from 2017 to 2092</td>
<td></td>
<td>.77</td>
<td>.41</td>
<td>1.15</td>
</tr>
<tr>
<td>Average annual net immigration (in thousands) for 2018 to 2092</td>
<td></td>
<td>1,272</td>
<td>1,607</td>
<td>952</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Economic:</th>
<th>Long-range assumptions</th>
<th>Intermediate</th>
<th>Low-cost</th>
<th>High-cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average annual percentage change in:</td>
<td></td>
<td>1.68</td>
<td>1.98</td>
<td>1.38</td>
</tr>
<tr>
<td>Productivity (total U.S. economy), for 2028 and later</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average wage in covered employment from 2028 to 2092</td>
<td></td>
<td>3.80</td>
<td>5.02</td>
<td>2.58</td>
</tr>
<tr>
<td>Consumer Price Index (CPI-W), for 2021 and later</td>
<td></td>
<td>2.60</td>
<td>3.20</td>
<td>2.00</td>
</tr>
<tr>
<td>Average annual real-wage differential (percent) for 2028 to 2092</td>
<td></td>
<td>1.20</td>
<td>1.82</td>
<td>.58</td>
</tr>
<tr>
<td>Unemployment rate (percent, age-sex-adjusted), for 2027 and later</td>
<td></td>
<td>5.5</td>
<td>4.5</td>
<td>6.5</td>
</tr>
<tr>
<td>Annual trust fund real interest rate (percent), for 2028 and later</td>
<td></td>
<td>2.7</td>
<td>3.2</td>
<td>2.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Programmatic:</th>
<th>Long-range assumptions</th>
<th>Intermediate</th>
<th>Low-cost</th>
<th>High-cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disability incidence rate (per 1,000 exposed, age-sex-adjusted) in 2092</td>
<td></td>
<td>5.4</td>
<td>4.3</td>
<td>6.4</td>
</tr>
<tr>
<td>Disability recovery rate (per 1,000 beneficiaries, age-sex-adjusted) in 2092</td>
<td></td>
<td>10.3</td>
<td>12.5</td>
<td>8.2</td>
</tr>
</tbody>
</table>
Demography Modeling Process

Number of Covered Workers per OASDI Beneficiary

The Social Security administration separates its Demographics assumptions into eight groups:
Fertility: Birth rates for American women have declined in recent years, leading to a long-term increase in retired populations relative to working populations. The Social Security administration projects that American total fertility rates (TFR) will stabilize at 2.0 lifetime births per mother in the year 2027 (a TFR above 2.0 generally signals a growing population, while a TFR below 2.0 generally signals a shrinking population).

Mortality: Largely driven by advances in medical care, mortality rates have decreased dramatically since OASDI was instituted. Lower mortality rates are associated with increased OASDI cost as they lead to the increase of retired populations relative to working populations.

Lawful Permanent Resident Immigration: Higher levels of legal immigration are associated with increased OASDI revenues relative to costs, both from tax revenues and the fact that immigrants are on average younger than natural-born citizens. Encouraging immigration has been a suggested solution to some countries facing aging populations (e.g. Japan).

Historical Population: The SSA analyzes historical data about U.S. demographics, including overall size by year and age, as well as breakdowns across factors such as immigration status and sexuality.

Other-than-LPR Immigration: Temporary and undocumented immigration is associated with increased OASDI revenues relative to costs. Temporary and undocumented immigrants pay into Social Security programs through taxes, but are ineligible to receive OASDI benefits.

Marriage: Marriage rates for young Americans are going down, associated with decreased fertility and therefore an increase of OASDI costs relative to revenues. Additionally, marriage is associated with decreased mortality, a factor taken into account by OASDI projections.

Divorce: Divorce rates have gone down in recent years, after having increased during most of the late 20th century. The SSA takes into account divorce rates when projected future marriages to refine predictions about fertility and mortality.

Projected Population: The ultimate output of the SSA’s demographics modeling, the projected population gives a granular estimate of future demographic trends in the United States. High-cost projections are associated with lower population growth, while low-cost projections are associated with higher population growth.
SSA separates its Economics assumptions into five groups:
**U.S. Employment:** SSA considers two aspects of U.S. Employment, the unemployment rate and the labor force participation rate. The unemployment rate calculates the percentage of people who have recently searched for a job but are unable to find one (known as unemployed workers), while the labor force participation rate calculates the labor force (employed and unemployed workers) as a percentage of total population. The SSA model takes into account the well-known economic phenomenon that a 1% increase in unemployment is associated with a 2% decrease in real GDP. Additionally, the SSA model integrates the effects of other-than-LPR employment on the economy.

**U.S. Earnings:** The SSA examines earnings by U.S. workers, disaggregated into wage and salary workers, self-employed workers, and unpaid family workers. Only the first two categories of workers directly pay into the Social Security payroll tax; moreover, self-employed workers pay the full 12.4% payroll tax, whereas non-self-employed workers split the tax evenly with employers.

**Covered Employment/Earnings:** This refers to the component of the labor force which pays into OASDI programs. SSA lists specific cases in its model documentation, such as railroad workers and election workers, as well as the specific policies which apply to these groups.

**Taxable Payroll:** This refers to the total income of covered workers up to the payroll tax cap. The SSA takes into account historical distributions of earnings to determine a granular estimate of the population at each earning level. The current model assumes that the earnings cap will only be adjusted to keep pace with inflation.

**Revenues:** The total cash inflow to the OASDI reserves due to the Social Security payroll tax. The SSA’s current model assumes that the 12.4% overall payroll tax will remain constant over the projection period.
Beneficiaries Modeling Process

Primary-Insurance-Amount Formula for Those Newly Eligible in 2018

OASI Maximum-Family-Benefit Formula for Those Newly Eligible in 2018
SSA separates its Beneficiaries assumptions into three groups:

**Insured:** This projection predicts the number of people who could be eligible for disability and retirement benefits during the 75 year projection period for OASDI.

**Disability:** This projects the incidence of disabled workers and the scale of the disability benefits they are projected to achieve. Though DI is technically a separate program from OASI with separate financial reserves, it is typically combined with OASI (which is much larger in scope) to analyze OASDI as a whole.

**Old-Age and Survivors:** The single largest component of the OASDI program, the growth in the OASI population is largely a function of demographic trends, including reduced fertility and mortality reductions; any policy recommendation regarding the OASDI program as a whole should focus on this component.
Taxation of Benefits: Above certain income levels, Social Security benefits are taxed; this projection keeps track of the cash inflows resulting from this taxation.

Awards: This projection takes into account projections of future earnings as well as the size of the OASI eligible population in order to estimate the future OASDI benefit award amounts. The SSA’s current predictions assume that the structure and process for awarding OASDI benefits does not change over the 75-year projection period.

Cost: This takes into account projected award amounts as well as other costs (e.g. fixed costs associated with administration) to determine the overall cost of the OASDI period over the 75-year projection period; your model should especially focus on the portion of OASDI cost associated with award payouts.
Leveraging Other Policy Recommendations

The United States Social Security Administration has created a webpage describing previous proposals to reform the OASDI program. Feel free to integrate any of these previously advocated policies when devising your final recommendations. Because you should be prepared to defend your ultimate policy proposal, you should also research the political debate around specific proposals. SSA has categorized these recommendations into nine broad groups:

**Cost of Living Adjustment (COLA):** These proposals would affect the method used to calculate the cost of living adjustment applied to OASDI benefit payments to keep pace with inflation.

**Level of Monthly Benefits (PIA):** These proposals would affect the base formula used to calculate OASDI benefits, such as the “bend points” in the PIA formula.

**Retirement Age:** These proposals would change the retirement age for certain populations to affect the total population of OASDI recipients in future years; the original OASDI retirement age was 65 but is currently 67.

**Benefits for Family Members:** These proposals would affect the way individuals could receive OASDI benefits based on a family member, such as a widow receiving OASDI benefits based on the account of a deceased spouse.

**Payroll Taxes:** These proposals would affect the tax which is the main source of OASDI revenue, including altering the 12.4% base rate and altering/eliminating the inflation-indexed tax cap.

**Coverage of Employment/Earnings:** These proposals would change the scope of work and income covered under OASDI programs, including applying a 6.2% tax to investment income.

**Investment in Marketable Securities:** OASDI programs are currently invested in special issue government bonds, as required by law. These proposals would change the nature of assets in which OASDI could be invested.

**Taxation of Benefits:** These proposals would alter the tax treatment of OASDI benefits, including taxing benefits as private pension income or as normal income.

**Individual Accounts:** This proposal would change the financing of the OASDI program from a national payout scheme to a prepaid account determined on an individual basis where participants can make their own investment decisions rather than relying on the national payment scheme.