

Estimating Marginal Tax Rates Using a Microsimulation Model: Technical Appendix

Brief #5 in the ASPE Marginal Tax Rate Series

March 2019

By Linda Giannarelli¹, Kye Lippold¹, Elaine Maag¹, C. Eugene Steuerle¹, Nina Chien², and Suzanne Macartney²

This technical appendix walks through the assumptions made and steps taken to develop marginal tax rate estimates. The analytic sample, derived from nationally-representative survey data, includes 63,493 households with able-bodied householders or spouses ages 18 to 64 who were not students. Although some taxes and benefits were computed at the family level, the unit of analysis is the household and all analyses used household weights. Computing each household's marginal tax rate proceeded using the following steps:

1. Compute baseline resources.
2. Assign earnings increases.
3. Apply assumptions about behavioral responses to increased earnings.
4. Recalculate eligibility and benefit levels for programs. Re-compute total resources.
5. Compute marginal tax rates.

A common approach to estimate marginal tax rates is called the *hypothetical family approach*.³ This approach estimates marginal tax rates for hypothetical families varying in characteristics such as household composition, household income, state of residence, and program receipt. Our analysis uses a different approach, the *distributional approach*,⁴ which uses survey microdata to estimate marginal tax rates for each household, and then aggregates the data to estimate marginal tax rates for the population (or a subpopulation) of U.S. households. This approach takes into account the actual distribution of household characteristics and actual rates of program receipt. See box below for more information.

The Distributional Approach to Estimating Marginal Tax Rates

The hypothetical family approach answers questions such as: “What is the marginal tax rate for a single parent household with two children earning \$20,000, in Colorado, assuming that they receive a given set of benefits for which they are eligible?” This approach uses program rules to compute marginal tax rates for each “hypothetical family.” Drawbacks to this approach include over-simplifying assumptions that capture some – but not all – families. In particular, analysts typically assume any income in the house is received in equal increments over the course of the year, which typically exaggerates the actual marginal rates faced by many households.⁵ This is the more common approach used for examining marginal tax rates.

The distributional approach answers questions such as: “What is the median marginal tax rate for all households with children?” This approach uses survey data and actual program participation rates to compute marginal tax rates for each survey household, which in turn are compiled to estimate marginal tax rates for the population (or a subpopulation) of U.S. households. This is the approach we use.

¹ Urban Institute

² ASPE

³ E.g., see Maag, E., Steuerle, C.E., Chakravarti, R., and Quakenbush, C. (2012). “How Marginal Tax Rates Affect Families at Various Levels of Poverty.” *National Tax Journal*, December, 65 (4): 759-782.

⁴ This approach was used by Mok, S. (2015). “Effective Marginal Tax Rates for Low- and Moderate-Income Workers in 2016.” Congressional Budget Office.

⁵ Maag, E., Steuerle, C.E., Chakravarti, R., and Quakenbush, C. (2012). “How Marginal Tax Rates Affect Families at Various Levels of Poverty.” *National Tax Journal*, December, 65 (4): 759-782.

Data

Analysis was performed using the Transfer Income Model, Version 3 (TRIM3), on data from the Current Population Survey's Annual Social and Economic Supplement (CPS-ASEC) for calendar year 2014 (the survey was conducted in spring of 2015). TRIM3 models each family's eligibility for and receipt of various assistance programs, including state-level variations in the eligibility rules, and uses administrative data targets to correct for the underreporting of programs and benefit levels.⁶ The following programs modeled by TRIM3 were included in this analysis:

- Supplemental Security Income (SSI)
- Temporary Assistance to Needy Families (TANF)
- Low-Income Home Energy Assistance Program (LIHEAP)
- unemployment insurance⁷ (UI)
- child support⁸
- Supplemental Nutrition Assistance Program (SNAP)
- Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)
- housing assistance
- Medicaid and Children's Health Insurance Program (CHIP)
- Child Care and Development Fund (CCDF) child care subsidies
- payroll taxes (employee share), federal income taxes and credits, and state income taxes and credits

Step 1: Compute Baseline Resources

First, we summed each household's baseline resources, which include:

- earned income
- SSI
- TANF cash benefits
- value of LIHEAP
- unemployment insurance
- child support income
- value of SNAP
- value of WIC
- value of housing assistance
- value of Medicaid and CHIP⁹
- Social Security¹⁰
- all other types of unearned income captured in the CPS
- federal and state income taxes (including refundable tax credits)
- minus out-of-pocket child care expenses
- minus the employee's portion of payroll taxes

⁶ For more information on the TRIM3 microsimulation model, see: <https://aspe.hhs.gov/system/files/pdf/205341/TRIM.pdf>, or the project's website, <http://trim3.urban.org/T3Welcome.php>

⁷ The baseline simulation of unemployment insurance benefits does not change the survey-reported annual amount of the benefit, but it allocates that amount across the months of the year based on weeks of unemployment and state-specific minimum and maximum weekly benefits. In alternative simulations, in months where earnings were added, unemployment insurance benefits were removed.

⁸ The Child Support baseline simulation allocates survey-reported child support across children and across months of the year. It also corrects for underreporting by TANF recipients of the amount of child support paid by the absent parent.

⁹ Valued at half the per-person program cost to government, informed by research such as: Finkelstein, Amy, Nathaniel Hendren, and Erzo F.P. Luttmer. (Forthcoming) "The Value of Medicaid: Interpreting Results from the Oregon Health Insurance Experiment." *Journal of Political Economy*.

¹⁰ Reported in the CPS and included as a resource, but does not change in the earnings scenarios.

Resources are similar but not identical to those used for the Supplemental Poverty Measure.¹¹ One difference is with respect to health insurance. First, we included an estimated value of Medicaid and CHIP which is not included in the Supplemental Poverty Measure. Second, we did not subtract out-of-pocket health spending (we did not estimate changes in medical out-of-pocket spending that would result from earnings increases).

Step 2: Assign Earnings Increases: \$2,000, \$5,000, and \$10,000

We conducted three separate “earnings scenarios” in which each household is given an earnings increase of \$2,000, \$5,000, and \$10,000 (one amount for each earnings scenario). These annual earnings increases were assigned to specific potential workers in specific months, so that we could use TRIM3 to most accurately calculate changes in transfer benefits.

Whose Earnings Were Targeted for an Increase?

Heads of household who were not disabled and their spouses, ages 18 through 64, were assigned earnings increases in the simulation. Older and disabled adults were not included in the simulations because the conditions surrounding earnings increases for these individuals tend to be different than those for prime-age workers without disabilities. Also, we did not model Social Security and Social Security Disability Insurance payments which affect marginal tax rates for older adults and individuals with disabilities. Students were also excluded from being assigned a wage increase, because we assumed students would continue to forgo wages in exchange for increasing education. Although we excluded these individuals from getting an earnings increase, they may still experience a change in SNAP benefits, for example, if someone in their household increased his or her earnings and benefits were based on household income.

How Earnings Were Increased

To determine precisely how to increase earnings for workers (i.e., via increased hours of work, increased weeks of work, or increased wages), we looked first at the number of hours worked per week and the number of weeks worked, as reported (at baseline). For individuals with part-time and/or part-year work, we first increased their hours to full time (40 hours) at the current wage. If this was insufficient to reach the desired earnings increase of \$2,000/\$5,000/\$10,000, we increased weeks worked to achieve the desired increase. If the hourly wage was below the \$7.25 federal minimum wage, it was raised to that minimum as part of this process.

In the case of married couples, earnings were added first to the primary earner and then the secondary earner. All increases were limited to heads of household and their spouses.

Finally, for workers and their spouses (if any) who already worked full-time, full-year, we increased wages to achieve the desired earnings increase.

Assigning Jobs to Non-workers

In some households (e.g., households where one spouse is already working full-time, full-year), it was necessary to assign work to non-workers to achieve the desired earnings increase. To do so, we assumed that previously non-working adults obtained full-time jobs at the federal minimum wage of \$7.25 an hour and added weeks of work to reach the

¹¹ The Supplemental Poverty Measure published by the Census Bureau takes into account taxes and government programs for low-income families, and can be considered a more comprehensive measure of available family resources than the Official Poverty Measure.

desired earnings increase. Note that this may have resulted in an overestimate of work hours, particularly in states and localities that have a higher minimum wage.

Step 3: Behavioral Responses to Earnings Increases

We applied a set of assumptions about behavioral responses to earnings increases:

- *Continued program participation:* A household (or program assistance unit) that received a benefit in the baseline would continue to receive the benefit in the earnings scenario, even if the benefit were lower. However, if a unit were no longer eligible for a benefit, the unit would not receive it for the earnings scenario.
- *Persons newly eligible for SNAP:* In many states, able-bodied adults without dependents (ABAWDs) face SNAP work requirements. If an ABAWD became eligible for SNAP benefits due to a change in work status (from not working to working), the newly eligible individual would participate in SNAP at the same rate as similarly-situated people.
- *Persons newly eligible for child care subsidies:* If a parent became newly eligible for child care subsidies due to increased hours of work, the newly-eligible family would participate in CCDF at the same rate as similarly-situated families. For example, newly eligible children in poor, single-parent households were assumed to have the same probability of participating in CCDF as existing eligible children in poor, single-parent households.
- *Housing costs:* We did not alter the cost of rent. We assumed that following an earnings increase, the household would not move to more expensive housing.
- *Child care expenses for households losing child care subsidies:* Child care subsidies were not added as a resource in the baseline resource measure. Rather, child care subsidies were captured indirectly by lowering child care expenses, such that if a family were to lose some or all of their child care subsidy following an earnings increase, the value of the lost subsidy would be directly reflected in *increased* out-of-pocket expenses.¹²
- *Child care expenses for new workers:* For new workers, we used equations developed with data from the Survey of Income and Program Participation to estimate whether someone who started working would have child care expenses, and if so, and how much those child care expenses would be.

Step 4: Recalculate eligibility and benefit levels

Following each earnings scenario, eligibility and benefit levels for programs were recalculated. Then each household's total resources were summed using the methodology described under the previous section, *Compute Baseline Resources*. Each household had three re-summed total resources estimates, one for each earnings scenario.

¹² For households who become totally ineligible for a subsidy, this approach computes their marginal tax rate by assuming they began to pay the entire value of the previously-subsidized care out-of-pocket. However, in most cases, households losing subsidized care would locate less expensive care. Therefore, for the purpose of computing child care deductions and credits following the hypothetical earnings increases, the simulations assume that households losing child care subsidies pay child care expenses consistent with real-world data for similarly-situated households.

Step 5: Compute Marginal Tax Rates

The marginal tax rate was computed using the baseline resource and re-computed total resources. In conceptual terms, the marginal tax rate is the share of the new earnings *not* retained by the household, due to increased taxes and/or reduced benefits. Mathematically,

$$\text{Marginal tax rate} = 1 - \left[\frac{\text{(the increase in net resources)}}{\text{(the increase in earnings)}} \right]$$

For example, assume for a household, earnings increased by \$2,000, but *net* household resources increased by only \$1,600, due to a total loss of \$400 from reduced benefits or increased taxes. Applying the formula gives:

$$1 - [1600/2000] = 1 - 0.8 = 20\%$$

In this case the household “keeps” 80 percent of the new earnings, and the marginal tax rate is 20 percent.

For the current analysis, we computed three separate marginal tax rates for each household:

1. following a \$2,000 earnings increase
2. following a \$5,000 earnings increase
3. following a \$10,000 earnings increase

Limitations

Health insurance exchanges not modeled. The 2014 version of TRIM3 modeled the Affordable Care Act (2010) provisions related to eligibility for Medicaid. However, the simulation did not identify individuals who received insurance through the exchanges. In some cases, health insurance exchanges would have reduced Medicaid and CHIP benefit cliffs, but this is not captured in our model.

Medicaid/CHIP receipt is underreported. For most modeled programs, adjustments were made to the reported number of participants in each program such that the final caseload came close to administrative totals. However, Medicaid and CHIP were not aligned and rely on CPS-reports only. As such, Medicaid and CHIP receipt were underreported in our model.¹³

Tax program participation is not aligned to administrative data. Additionally, no alignment between survey reports and administrative totals were made for any tax programs or tax credits, except for the alignment of the child care credit and the credit for the elderly or disabled in the federal income tax system. The amount of federal Earned Income Tax Credit identified by the model falls short of the real-world figure, as in other CPS-based models.¹⁴

Individuals excluded from the analysis. Adults with a disability and adults ages 65 and older were not assigned an earnings increase. These individuals may face very high marginal tax rates because going to work would result in a loss of benefits, which we do not capture here. The issues surrounding likely employment for these two groups extend beyond our current project. Other individuals excluded from the analysis include persons not sampled by the CPS (e.g., institutionalized persons, homeless persons) and students.

¹³ For research on Medicaid underreporting, see: Davern, M., Klerman, J.A., Baugh, D.K., Call, K.T., and Greenberg, G.D. (2009). “An Examination of the Medicaid Undercount in the Current Population Survey: Preliminary Results from Record Linking.” *Health Services Research* 44 (3): 965–87. <https://doi.org/10.1111/j.1475-6773.2008.00941.x>. Also see: Klerman, J.A., Davern, M., Call, K.T., Lynch, V., and Ringel, J.D. (2009). “Understanding The Current Population Survey’s Insurance Estimates and the Medicaid ‘Undercount.’” *Health Affairs* 28 (6): w991–1001. <https://doi.org/10.1377/hlthaff.28.6.w991>

¹⁴ See Wheaton, L. and Stevens, K., “The Effect of Different Tax Calculators on the Supplemental Poverty Measure.” May 2016, Urban Institute Research Report to the U.S. Bureau of the Census.

Amount and mechanism of earnings increase may not reflect individual behavior. Increasing earnings by only \$2,000 (or \$5,000) may not be realistic for households where a non-worker turns into a worker. For many individuals, taking on a new job would result in earnings totaling more than \$2,000 (or \$5,000) over the course of one year. Also, we made assumptions about the mechanism by which individuals would increase earnings (e.g., adding hours of work up to 40 hours before adding weeks of work), but individuals may increase earnings in ways that differ from these model assumptions.

Assumptions about behavioral responses to earnings increases may not reflect individual behavior. Under Step 3, we apply a set of behavioral assumptions about what people would do following an earnings increase (e.g., that people would continue to receive benefits for which they are eligible for; that families newly eligible for SNAP and child care would receive those benefits at the same rate as similarly-situated people; that some people would begin to pay for child care). However, people may behave in ways that differ from these model assumptions.

Model applies only “first-order” changes. That is, immediate changes are modeled (e.g., reduction in housing subsidies), but next-order effects are not modeled (e.g., moving to more or less expensive housing).

Unreported earnings are not captured. Our model is based on the CPS, so to the extent that some earnings may not be reported on the CPS (e.g., babysitting), our model does not capture these earnings. Some individuals may turn to unreported earnings for additional income, and such earnings would generally not correspond with a reduction or loss of benefits.

Not all programs are modeled. Not every federal program is modeled (e.g., Head Start). Also, with the exception of state income taxes and credits, our model does not capture state or local programs (e.g., state-funded preschool).

Data reflects 2014. Our data is from calendar year 2014. Economic, demographic, and policy changes have occurred since that time, which may alter results.

Model provides picture at national level. This is a national model with results that apply at the national level. There are likely regional variations, including between states and within states by urbanicity, which we do not capture.

For more marginal tax rate topics see <https://aspe.hhs.gov/marginal-tax-rate-series>.

