Estimates of State and Local Government Revenue Losses from Pandemic Mitigation
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Appendix

I. Assumptions and limitations of the estimates

I have assumed that a 1 percent decline in earnings results in a 1 percent decline in income tax revenue. The OES earnings data reports on individuals, but income taxes are assessed by household. If the earnings losses are concentrated in lower-income households, those states that have progressive income tax brackets will continue to collect closer-to-normal amounts from higher-income households. I have implicitly assumed that investment income declines as much as earned income. Some states tax unemployment insurance benefits, so those states will receive some additional revenue from the CARES Act supplements to benefits.

I have not modeled the declines in revenue from sources such as gambling, tolls, and licensing fees. All of these must be expected to decline to some degree. The estimates do not reflect the variation in timing and extent of the mitigation restriction from state to state. I assume sales and income tax base declines are equal for all the jurisdictions in the same metro or rural area.

If the lost revenue estimated here were replaced, it is possible states would still have to cut budgeted spending because of increases in other expenses. Many recently unemployed people may become eligible for Medicaid and require additional state support. Also, states can borrow from the federal government to refill exhausted unemployment insurance (UI) trust funds, but the states may also consider transferring money from the general fund to the UI trust.

These estimates primarily reflect the mandated shutdowns. An unknown factor is how much consumers and businesses will pull back on their spending as a result of uncertainty and economic hardship caused by the pandemic. This loss of confidence could make any of the recovery scenarios worse. Recent past recessions are limited in what they can teach us because none has required adjusting to a need for social distancing. After September 11, 2001, consumers had to gain confidence that they would not be victimized by a terrorist attack, and in this case, the threat appeared, in theory, to be limited to or at least far more likely to occur at high-profile locations or events. However, COVID-19 is not limited by such parameters, but is both invisible and widespread. We do not know how costly it will be for factories, universities, airports, and concert venues to accommodate social distancing.

II. Estimating calculations

From the OES data before the pandemic, the number of employees in occupation *j* in state *s* is

$$employees_{js}$$

The CES employment declines from February to April assign a *covid_employment_reduction* to each industry *i*. These are translated into a reduced count of employees in occupation *j* in state *s* by multiplying the national shares of workers in occupation *j* that work in industry *i* and summing over all industries.

$$employees\_reduced_{js} = \sum_{i} [covid\_employment\_reduction_{i} * \frac{employees_{ji}}{employees_{j}} * employees_{js}]$$

The prepandemic income tax base in state *s* is the product of the employee count in occupation *j* in state *s* and the mean earnings of workers in occupation *j* in state *s*, summed over all occupations.

$$income\_tax\_base_{s} = \sum_{j} employees_{js} * mean\_earnings_{js}$$

The postpandemic income tax base in state *s* is estimated the same way, except the reduced employment count in occupation *j* in state *s* is used.

$$income\_tax\_base\_reduced_{s} = \sum_{j} employees\_reduced_{js} * mean\_earnings_{js}$$

The annual income tax revenue decline in state *s* is 1 minus the weighted combination of quarters when the full income tax base is available and quarters when the reduced income tax base is available. $recovery_d$ is a value defined by the scenario that reflects how much of the decline is in effect in the quarter *d*. When the economy is operating normally, $recovery_d = 1$. With a full shutdown in place, $recovery_d = 0$.

$$income\_tax\_revenue\_decline_{s} = \frac{1}{4}\sum_{d}\left((1 - recovery_{d}) * \left(1 - \frac{income\_tax\_base\_reduced_{s}}{income\_tax\_base_{s}}\right)\right)$$

The *recovery* values used in the scenarios are as follows:

Calendar Quarter	Fiscal Quarter (most common)	V-Shaped Recovery	Slow (Great Recession-like) recovery	Second Wave Recovery
2019:Q3	2020:Q1	1.00	1.00	1.00
2019:Q4	2020:Q2	1.00	1.00	1.00
2020:Q1	2020:Q3	1.00	1.00	1.00
2020:Q2	2020:Q4	0.00	0.00	0.00
2020:Q3	2021:Q1	0.50	0.25	0.50
2020:Q4	2021:Q2	1.00	0.50	0.00
2021:Q1	2021:Q3	1.00	0.75	0.25
2021:Q2	2021:Q4	1.00	1.00	0.50
2021:Q3	2022:Q1	1.00	1.00	0.75
2021:Q4	2022:Q2	1.00	1.00	1.00

The income tax revenue lost is the product of the income tax revenue decline and the annual income tax revenue for the state. This amount is reported in column 2 of tables 1 and 2.

$$income\_tax\_revenue\_lost_s = income\_tax\_revenue\_decline_s * income\_tax\_revenue_s$$

The *sales_reduction* variable is the decline in consumption for products subject to sales tax from 2019:Q4 to 2020:Q1. It is multiplied by 13/2 to reflect that the data cover only two weeks of lockdown spending during the quarter. Without data on local sales by product, or other geographic variation, I have to assume that the scenario's *sales_reduction* values are the same for all states.

$$sales\_reduction = \frac{13}{2}\left(1 - \frac{taxable\_sales_{2020Q1}}{taxable\_sales_{2019Q4}}\right)$$

Paralleling the decline in the income tax base, the sales tax revenue decline adjusts for the combination of regular quarters and pandemic-impacted quarters.

$$sales\_tax\_revenue\_decline_s = \frac{1}{4}\sum_d (\,(1 - recovery_d) * sale\_reduction)$$

The sales tax revenue lost is the product of the sales tax revenue decline and the annual sales tax revenue. This amount is reported in column 3 of tables 1 and 2.

$$sales\_tax\_revenue\_lost_s = sales\_tax\_revenue\_decline_s * sale\_tax\_revenue_s$$

The local government calculations are conducted in exactly the same way except for using OES employment and earnings measures by metro or rural area in place of the state-level values. The OES and COG data can be merged one to one by using the county. All metro and rural areas in the OES data are exclusive groups of counties.