



# Budget Model

## COVID-19 Learning Loss: Long-run Macroeconomic Effects Update

**Summary:** Using recently available data on learning loss from pandemic school closures, PWBW estimates that projected 2051 GDP is 1.4 percent lower than it would have been without the learning loss. Extending the 2021-22 school year for all public schools by one month would cost \$78 billion and limit the reduction in 2051 GDP to 1.0 percent—a net present value gain in GDP of more than \$1 trillion over the next three decades, equal to a \$15.14 return for each \$1 invested.

### Introduction

Because of pandemic school closures and the shift to remote education during the 2020-2021 school year, it is widely accepted that [students have suffered various levels of learning loss](#). Studies have found that remote education reduces learning outcomes for students and that [current students are likely to earn less in future wages](#) as a result of their lower labor productivity. Since labor productivity affects the production of goods, services, and wealth in an economy, current cohorts of students with reduced education and lower productivity will be a drag on the future GDP of the United States for decades.

This study updates our [previous work](#) where we projected long-run macroeconomic effects of school closure policies. [New estimates](#) of learning loss based on new data of student academic performance show a smaller average loss than estimates used in our prior analysis, an average of 0.4 years of math education lost versus the previous estimate of 0.8 years lost by the end of the 2020-2021 school year.

Since some students suffered more learning loss than others, we separate labor productivity effects by a student's current grade in school and by the student's family economic background. With this distribution of labor productivity effects by demographic group, we project aggregate effects of pandemic learning loss on the whole U.S. economy as cohorts of affected children join the workforce. We find that GDP in 2051 is 1.4 percent lower relative to a scenario where pandemic school policies did not alter the amount of in-person schooling.

The federal government allocated \$22 billion in 2021 toward learning loss abatement<sup>1</sup> as part of COVID relief legislation. For comparison, a remediation policy which extends the 2021-22 school year by one month costs \$78 billion. We project that the GDP reduction is limited to 1.0 percent in 2051 under the one-month school year

extension policy. This policy implies a net present value gain through 2051 of \$1.04 trillion so that each dollar spent on this learning loss abatement policy returns \$15.14 dollars in additional economic output.

## Learning loss

With academic performance data from the 2020-21 school year now available, we update our estimates of learning loss from remote and hybrid learning. In our previous work, we used [studies on remote learning](#) which indicated no benefit to math scores from fully virtual school and imputed a linear benefit growth with increased in-person education.<sup>2</sup> The average student was exposed to roughly 50 percent of the 2020-21 school year as in-person schooling.<sup>3</sup> Our previous linear interpolation for math education thus estimated that students lost about 0.3 years of schooling in spring 2020 and 0.5 years of schooling during the 2020-2021 school year, for a cumulative loss of about 0.8 years. The [IES 2021 monthly school reopening national survey](#) provides levels of in-person school exposure by grade. We used differential exposure to in-person schooling to project group-specific learning loss—for example, students from economically disadvantaged family backgrounds (34 percent of students)<sup>4</sup> had less in-person schooling exposure and thus more projected learning loss.

The past year has provided the first available empirical data on remote learning outcomes at a large-scale (national) level, which we use to update our learning loss estimates for this analysis. NWEA's MAP Growth reading and math assessment data on 5.5 million public school students shows that students made smaller learning gains during the pandemic than the historical average during normal schooling. NWEA tests students in the fall, winter, and spring, providing data on achievement from the beginning and end of the 2020-2021 school year. By converting NWEA's grade-specific achievement score gains into an estimate of loss in effective years of schooling, we find that students ended the 2020-2021 school year with 0.42 fewer years of education in reading and 0.43 fewer years in math, a smaller loss than our previous interpolation-based estimate. Star test data on 3.3 million students by [Renaissance](#) shows similar-sized educational losses. That study estimates that, at the end of the spring 2021 semester, elementary and middle school students were 4-7 weeks behind pre-pandemic expectations for reading, and 8-11 weeks behind for math.

Most available data have not shown that students dropped out of school during the pandemic school closures at a higher rate. Although [NCES](#) finds that public school enrollment in the 2020-2021 school year was 3 percent lower than it was in the previous school year, the decline was concentrated among lower grade levels, with the steepest change in kindergarten, where the enrollment dropped by more than 10 percent. While many of those disenrolled elementary and middle school students may have shifted to home schooling, private schools, and other education alternatives, some entering kindergarteners delayed entry to school, implicitly reducing their post-education time in the workforce. Some students who skipped kindergarten to begin schooling for the first time in first grade often lack the educational preparation benefit that early education provides.

The Elementary and Secondary School Emergency Relief Fund (ESSER) provision of the \$1.9 trillion COVID relief bill passed in March 2021 provides approximately \$22 billion for public schools to address learning loss. This money is directed to be spent on summer school, extended school days, an extended school year, after-school programs, or other enrichment, and has been distributed based on the Title I fund allocation formula. Using our estimated cost of one month of public school, together with the [composition data of Title I participants](#), we make the assumption that this spending provides 60 percent of disadvantaged students and 40 percent of non-disadvantaged students approximately 0.07 years of additional education during the 2021-22 school year to help

offset the learning loss from lack of in-person schooling. This assumption may be an overestimate of the aggregate educational benefit since many programs were optional (for instance, additional after-school homework help), and thus less likely to address learning loss in the broad student population.

## Economic consequences

In the PWBM model, an individual's labor productivity changes throughout their lifetime. Individuals are born with different levels of productivity, but this level changes as productivity follows a stochastic process. Average productivity rises and then falls as a worker ages, peaking in late middle age.

Depending on the individual's demographic group and age, we apply different reductions to this lifetime process using our estimates of learning loss. Table 1 shows our updated projections of macroeconomic effects of school closures relative to a counterfactual where learning was never disrupted by the pandemic. These estimates do not account for other school closure effects such as reduced work and productivity of students' parents and caregivers as well as any post-secondary schooling effects.

As cohorts of affected students enter the workforce, average labor productivity decreases relative to the counterfactual without learning loss. The aggregate effect is muted initially, with labor productivity decreasing by 0.45 percent in 2031 relative to the counterfactual scenario. As the affected cohorts age, making up a larger proportion of the workforce and approaching their peak earning years, the relative drop in labor productivity increases to 0.98 percent in 2041 and 1.12 percent in 2051.

Table 1: Projected Percent Changes in Macroeconomic Indicators due to Learning Loss from COVID-19 School Closures

*Percent Change from Baseline*

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| <b>Year</b> | <b>Output</b> | <b>Capital Stock</b> | <b>Labor Productivity</b> | <b>Hourly Wages</b> | <b>Hours Worked</b> | <b>Government Debt</b> |
|-------------|---------------|----------------------|---------------------------|---------------------|---------------------|------------------------|
| 2031        | -0.37         | -0.30                | -0.45                     | 0.04                | 0.04                | 0.16                   |
| 2041        | -0.96         | -0.91                | -0.98                     | 0.03                | -0.01               | 1.15                   |
| 2051        | -1.40         | -1.75                | -1.12                     | -0.18               | -0.10               | 2.21                   |

A drop in productivity drags down economic growth and wages, leading to a 1.4 percent decrease in GDP and a 0.18 percent increase in hourly wages by 2051 relative to the counterfactual scenario where there had been no learning loss. With lower labor income, government tax revenues decline and government debt cumulates more quickly. Higher debt along with less total savings by individuals with lower incomes leads to a lower real capital stock, lowering wages and GDP further. By 2051, the nation's capital stock will be 1.75 percent lower and government debt will be 2.21 percent higher.

Table 2 displays percent losses for each group in terms of labor income, measured as annual labor income.<sup>5</sup> Students from disadvantaged backgrounds who were in grades K-5 during the 2020-2021 school year will have on average 2.87 percent lower labor income in 2051 than was expected before the closures, while those in grades 6-12 from disadvantaged backgrounds will have 4.93 percent less labor income. Although there are higher returns to schooling for younger students, primary schoolers experienced more in-person learning and less learning loss than older students during the pandemic. Economically disadvantaged students' losses are higher than those of non-disadvantaged students, due to less exposure to in-person schooling.

Table 2: Percent Change in Labor Income for Current Primary and Secondary School Students due to Learning Loss from COVID-19 School Closures

[DOWNLOAD DATA](#)

| Group                                 | Labor Income |       |       |
|---------------------------------------|--------------|-------|-------|
|                                       | 2031         | 2041  | 2051  |
| Disadvantaged primary schoolers       | -            | -3.07 | -2.87 |
| Disadvantaged secondary schoolers     | -4.83        | -4.63 | -4.93 |
| Non-disadvantaged primary schoolers   | -            | -2.60 | -2.68 |
| Non-disadvantaged secondary schoolers | -4.46        | -4.36 | -4.63 |

## School year extension

We examine a school year extension policy which may address the anticipated declines in affected students' labor productivity. We consider extending the school year one month into the summer of 2022. Although those students who graduated or dropped out of school are not treated by the policy, the rest of the student population will benefit. Using [enrollment](#) and [expenditure data](#) from the U.S. Department of Education's National Center for Education Statistics, we estimate the cost to operate all public schools for all K-12 students for one additional month in 2022 to be about \$78 billion. We assume the U.S. federal government provides these funds and finances the expenditures through increased debt.

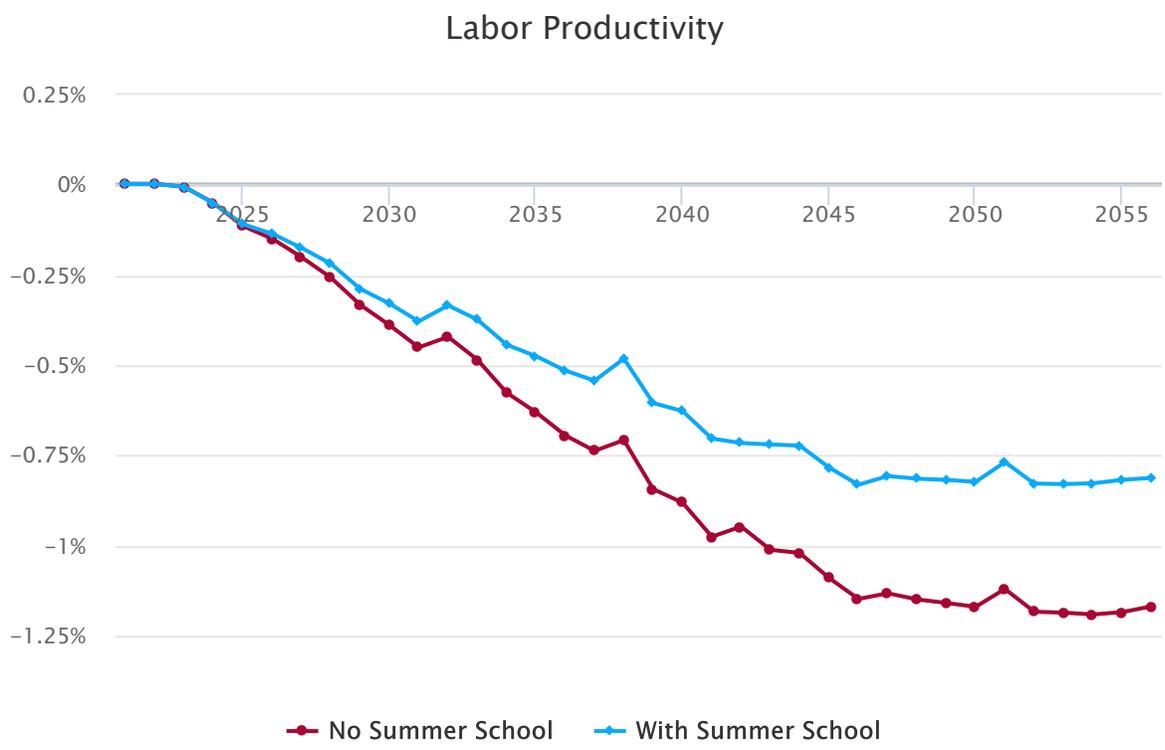
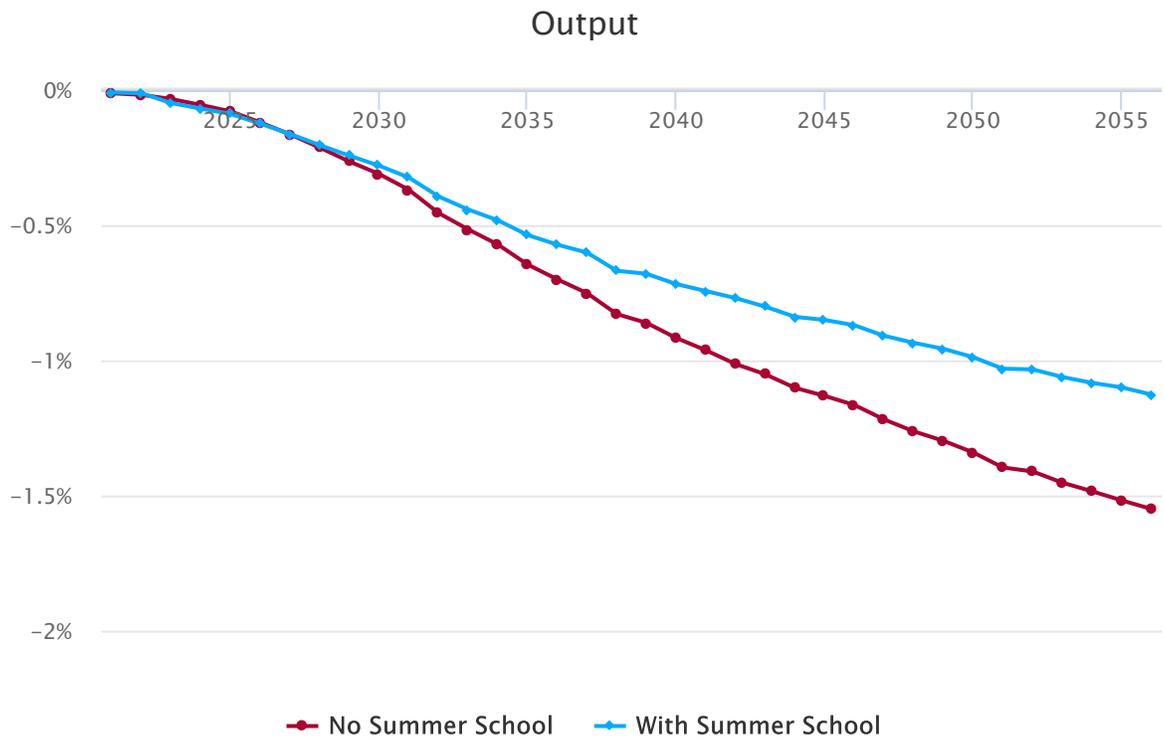
Figure 1 shows the macroeconomic results of the school year extension policy in the PWBM dynamic model, as well as the current baseline with learning loss. The percent losses shown are relative to a counterfactual scenario where schools had remained open and no learning loss occurred.

# Figure 1: Projected Macroeconomic Results of School Extension

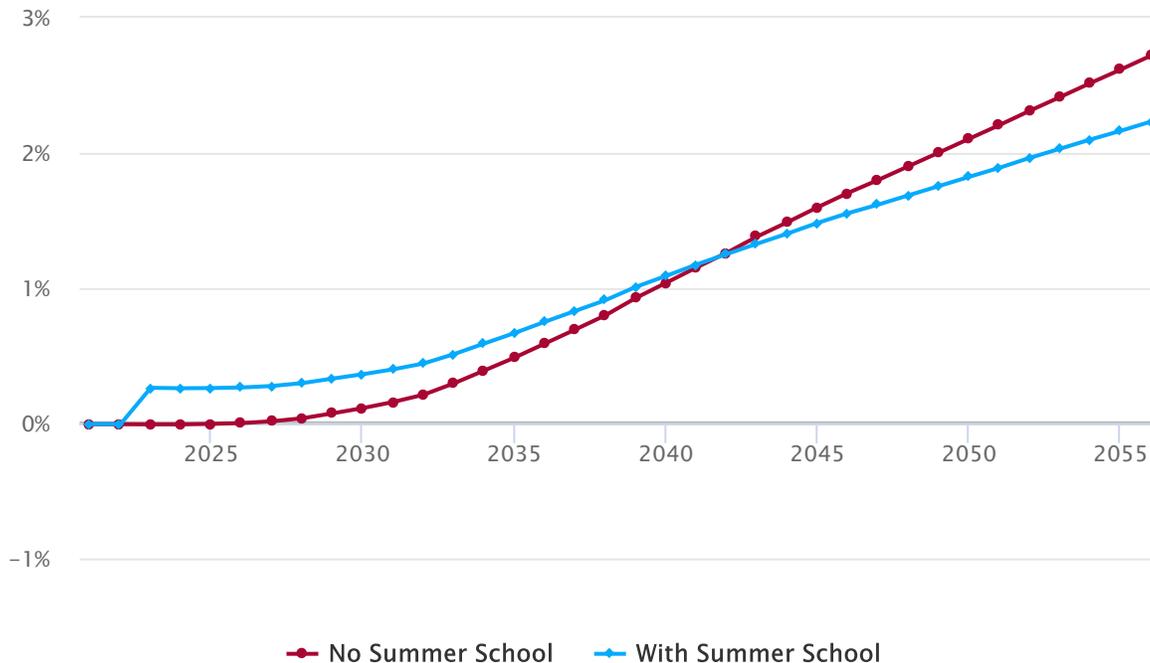
Percent Change from No Learning Loss Counterfactual Scenario

[DOWNLOAD DATA](#)

Output ▼



### Government Debt



By 2051, the school year extension policy reduces the decline in GDP from 1.4 percent to 1.03 percent. Government debt is 0.32 percentage points lower under the policy, even with the initial outlay of nearly \$78 billion for school year extension.

Table 3 shows the changes to labor income for current students from a school year extension. By 2051, the subgroup of primary schoolers from disadvantaged backgrounds recovers 1.16 percentage points of their labor income (i.e., they would have 1.71 percent lower labor income, compared to 2.87 percent lower labor income).

Table 3: Percent Change in Labor Income for Current Primary and Secondary School Students under School Extension Policy

[DOWNLOAD DATA](#)

| Group                                 | Labor Income |       |       |
|---------------------------------------|--------------|-------|-------|
|                                       | 2031         | 2041  | 2051  |
| Disadvantaged primary schoolers       | -            | -1.98 | -1.71 |
| Disadvantaged secondary schoolers     | -4.23        | -4.04 | -4.24 |
| Non-disadvantaged primary schoolers   | -            | -1.47 | -1.53 |
| Non-disadvantaged secondary schoolers | -3.87        | -3.75 | -3.95 |

With our projections for GDP changes, we calculate the net present value gain<sup>6</sup> in GDP from government expenditures on a school year extension. The policy has a net present value of \$1.04 trillion. Per dollar spent, the policy provides a return of \$15.14.

*This analysis was conducted by [Daniela Viana Costa](#), [Maddison Erbabian](#), and [Youran Wu](#) under the direction of [Efraim Berkovich](#). Prepared for the website by [Mariko Paulson](#).*

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1. Approximately \$123 billion was allocated toward Elementary and Secondary School Emergency Relief (ESSER) in the American Rescue Plan passed in March 2021. A portion of these funds, [totaling \\$22 billion](#), were earmarked to address learning loss. [↩](#)
2. Our assumption of no mathematics learning gains from virtual schooling was based on empirical findings from a [Stanford CREDO \(2015\) study of virtual charter schools](#), which was the best available estimate of the effectiveness of virtual schooling at the time since virtual schooling was not widespread prior to the onset of the Covid-19 pandemic. [↩](#)
3. Data from [IES's Monthly School Survey](#) indicates approximately a national average of 50 percent in-person schooling over the spring 2021 semester. Data from Burbio's [K-12 School Opening Tracker](#) and Parolin and Lee's (2021) [U.S. School Closure and Distance Learning Database](#) suggest that the level of in-person instruction may have been even higher than 50 percent over the 2020-2021 school year. [↩](#)
4. Percentage according to the most recent [American Community Surveys](#) data. [↩](#)
5. We do not calculate losses for current primary schoolers in 2031, since that cohort is just entering the workforce at that time. [↩](#)
6. We discount nominal dollar differences in GDP between the no-policy and policy scenario from 2021 to 2051. The discount rate is the portfolio return to households in the model. [↩](#)