These appendices are supplemental to a Commonwealth Fund publication, Bryce Ward, *The Impact of Medicaid Expansion on States' Budgets* (Commonwealth Fund, May 2020), available on the Fund's website at https://www.commonwealthfund.org/publications/issue-briefs/2020/may/impact-medicaid-expansion-states-budgets.

Appendix A. Difference-in-Differences Analyses

In this appendix, we provide additional details about the difference-in-differences analyses reported throughout the report. We build on the difference-in-difference analysis of the effects of Medicaid expansion on state budgets presented in Sommers and Gruber (2017). The Sommers and Gruber analysis only examined the effects through the first year-and-a-half of expansion.[1] We add more data and focus explicitly on traditional Medicaid spending.

1. National Association of State Budget Officers (NASBO) data

At several points in the report, we examine NASBO State Expenditure Report data.[2] These data include reports of state spending and revenue for several broad categories, including Medicaid. These data divide spending for each category into several components — total spending, total federal spending, total state general fund spending, spending from other state funds (e.g., expenditures from a dedicated revenue source), and expenditures from the sale of bonds.

It is important to note that these data are self-reported and do not undergo official audit or review, so they may contain errors. However, they are regularly used by policymakers and analysts.

The NASBO data are reported for state fiscal years. While the state fiscal year starts on July 1 in 46 states, it starts on April 1 in New York, September 1 in Texas, and October 1 in Alabama and Michigan. Medicaid expansion typically went into effect on January 1. However, it was implemented on April 1, 2014, in Michigan; August 15, 2014, in New Hampshire; February 1, 2015, in Indiana; September 1, 2015, in Alaska; and July 1, 2016, in Louisiana. With the exception of Louisiana, every state expanded Medicaid in the middle of their fiscal year. Because of that, we exclude the partial first fiscal year of expansion from the analysis.

Primarily, we focus on the data for state fiscal years 2013 through 2019. While data are available for years prior to 2013, during the Great Recession the federal government paid for a larger share of Medicaid than usual. These payments ended in 2012. To avoid conflating these changes with Medicaid expansion, we focus on the post-2012 period. Including years before 2013 yields slightly larger estimates and does not change our conclusions.

Our analysis of NASBO data builds from Sommers and Gruber's 2017 analysis of the same data.[3] Similar to Sommers and Gruber, we regress the natural log of Medicaid spending on dummy variables that equal one in expansion states in years after expansion, state and year fixed effects, and controls for the

[1] Benjamin D. Sommers and Jonathan Gruber, "Federal Funding Insulated State Budgets from Increased Spending Related to Medicaid Expansion," *Health Affairs,* published online May 1, 2017.
[2] These data are available from: https://www.nasbo.org/mainsite/reports-data/state-expenditure-report/ser-download-data.
[3] Sommers and Gruber, "Federal Funding Insulated," 2017.

natural log of personal income per capita and the unemployment rate. The data for the control variables cover calendar years. We average these measures across the two calendar years in each fiscal year.

In oversimplified terms, the two-by-two matrix below illustrates the mechanics of a difference-in-differences analysis. For each outcome and each group (expansion or nonexpansion), we compute the change after expansion. Then, we subtract the change in nonexpansion states from the change in expansion states.

	Before	After	Change
Expansion states	A	B	X = B-A
Nonexpansion states	C	D	Y = D-C
Difference-in-differences			X-Y

The key assumption for a difference-in-differences analysis is that Medicaid spending in expansion states would have followed the trajectory of nonexpansion states in the absence of expansion. That is, in the absence of expansion, the change in expansion states would also have equaled Y. Sommers and Gruber present analysis that suggests that Medicaid spending in expansion states moved in parallel with nonexpansion states before expansion. While no analysis can demonstrate what would have happened in the absence of expansion, this analysis at least suggests that expansion and nonexpansion states were moving together prior to expansion.

The first three columns of Table A1 present the results from Exhibit 1 in the issue brief. The fourth and fifth columns present results that break state spending into state general fund spending and spending from other state funds. While the results in last two columns are not statistically significant, they suggest that Medicaid expansion is associated with declines in spending on Medicaid from state general funds and increases in spending from other dedicated funds. Given that Medicaid spending from other state funds often reflects Medicaid spending from dedicated Medicaid taxes, the positive coefficients are consistent with the discussion of revenue growth in the brief.

Table A1. Effect of Medicaid Expansion on Total Medicaid, Federal Medicaid, and State Medicaid Spending

	Ln(Total Medicaid)	Ln(Federal Medicaid)	Ln(State Medicaid)	Ln(State General Medicaid)	Ln(State Other Medicaid)
Expansion*2015	0.22***	0.39***	-0.06*	-0.09	-0.09
	(0.000)	(0.000)	(0.046)	(0.119)	(0.328)
Expansion*2016	0.23***	0.39***	-0.05	-0.07	0.12
	(0.000)	(0.000)	(0.191)	(0.270)	(0.474)
Expansion*2017	0.24***	0.38***	-0.02	-0.03	0.05
	(0.000)	(0.000)	(0.597)	(0.604)	(0.713)
Expansion*2018	0.25***	0.39***	0.01	0.01	0.12
	(0.000)	(0.000)	(0.762)	(0.899)	(0.467)
Expansion*2019	0.22***	0.35***	0.01	-0.01	0.11
	(0.000)	(0.000)	(0.883)	(0.830)	(0.525)

Notes: Regressions include state and year fixed effects and controls for ln (personal income per capita) and unemployment rates. Standard errors clustered on state in parentheses.

2. Federal Medicaid Management Reports

We also use data from Federal Medicaid Management Reports (FMR) from 2012 to 2017.[4] While these data are only available through federal fiscal year 2017, unlike the NASBO data, these data separate expansion spending from nonexpansion spending. This allows us to analyze the impact of Medicaid expansion on traditional Medicaid separate from the expansion. These data extend only through federal fiscal year 2017 (i.e., Q3 2017), so we cannot estimate more recent effects. We use the same basic specification as with the NASBO data; however, we focus on a simple indicator that equals one in all years after expansion and zero otherwise because we expect the effect on traditional Medicaid to be relatively constant across years. As discussed in the text, we present two specifications. One specification uses all expansion states and years. The other excludes states that expanded between 2015 and 2017. We exclude these states because it takes a couple of years for Medicaid expansion enrollment and savings to stabilize. By excluding these observations, we avoid downward bias from states that are undergoing these changes.

Table A2. Results from Difference-in-Differences Analysis of the Impact of Medicaid Expansion on States' Traditional Medicaid Spending

	Federal Medicaid Management Reports (FMR), all states	FMR, excluding states that expanded during 2015-2017	Medicaid Budget and Expenditure System, excluding 2014 expansion states
Effect of Expansion	-0.04* (0.02)	-0.05* (0.02)	-0.09* (0.04)

Notes: Coefficients from difference-in-differences regression of natural log of state spending on traditional Medicaid on a variable equal to one in expansion states in years after expansion, state and year fixed effects, and controls for the natural log of personal income per capita and the unemployment rate. Robust standard errors clustered at state-level in ( )'s.
* $p < 0.05$.

3. Medicaid Budget and Expenditure System

Table A2 also presents results from an additional robustness analysis using data from the Medicaid Budget and Expenditure System (MBES) from 2013 to 2018.[5] The MBES data are not available before January 1, 2014. Therefore, we cannot examine the change in Medicaid expenditure for states that expanded in 2014. However, we can examine the effects for states that expanded after 2014. Using the same specification used for the FMR data, we find larger effects. Medicaid expansion was associated with a 9 percent reduction in state traditional Medicaid spending in late-expanding states.

While the different data sets yield different estimates, these analyses suggest that Medicaid expansion generate significant savings to states' traditional Medicaid programs.

[4] These data are available from: https://www.medicaid.gov/medicaid/financial-management/state-expenditure-reporting-medicaid-chip/expenditure-reports-mbescbes/index.html.
[5] Specifically, we use Medicaid CMS-64 New Adult Group Expenditures Data Collected through MBES obtained from: https://www.medicaid.gov/medicaid/financial-management/state-expenditure-reporting-medicaid-chip/expenditure-reports-mbescbes/index.html.

4. State Prison Health Spending

While not formally presented in the main report, we also conducted a similar difference-in-differences analysis on total state corrections health spending data adjusted for inflation for the state fiscal years 2010 to 2015. These data were obtained from Table C.1 in *Prison Health Care: Costs and Quality—How and Why States Strive for High-Performing Systems*.[6] Using the method of Sommers and Gruber to test for pre-expansion trends, we do not observe any difference in the trend in prison health care spending between expansion and nonexpansion states prior to expansion. Table A3 presents the results of this analysis.

Table A3. Results from Difference-in-Differences Analysis of the Impact of Medicaid Expansion on States' Correctional Health Spending

	Ln(State correctional health spending)
Effect of Expansion	-0.06+ (0.04)

Notes: Coefficients from difference-in-differences regression of natural log of state spending on corrections health care on a variable equal to one in expansion states in years after expansion, state and year fixed effects. Robust standard errors clustered at state-level in ( )'s.
+ $p < 0.1$.

[6] Retrieved from Kil Huh et al., *Prison Health Care: Costs and Quality — How and Why States Strive for Higher Performing Systems* (Pew Charitable Trusts, Oct. 2017).

Appendix B. Common Ways Medicaid Expansion Reduces State Medicaid Spending

Existing research identifies several types of expansion beneficiaries who would likely receive traditional Medicaid in the absence of expansion.[7] The populations affected vary from state-to-state depending on the specifics of each states' traditional Medicaid programs. Below are some common types of people who transfer from traditional Medicaid to the expansion.

Who	With expansion	Impact
Expansion-eligible childless adults or parents who do not qualify for traditional Medicaid but who qualify for limited benefit coverage through a section 1115 waiver	Qualify for new adult group and receive enhanced match	Fewer individuals enrolled through waiver, or state eliminates waiver entirely
Expansion-enrolled women who become pregnant	Continue to receive expansion coverage and enhanced match until renewal	Shorter duration of covering pregnant women at higher traditional Medicaid rate
Medically needy individuals with income above medically needy threshold but below 138% of federal poverty level (FPL)	Qualify for new adult group without having to "spend down" income or resources to qualify for traditional Medicaid	Fewer high-need, high-cost individuals enrolled in traditional Medicaid
Uninsured people under age 65 with income up to 138% FPL in need of treatment for breast or cervical cancer	May enroll in new adult group before diagnosis and receive enhanced match	Fewer individuals enrolled in Breast and Cervical Cancer Treatment Program
Disabled individuals with incomes up to 138% FPL	Qualify for expansion without needing to seek disability determination	Fewer people seek disability determination and fewer people enrolled in disability-based Medicaid
Expansion-eligible individuals who modified their behavior so that they qualified for traditional Medicaid (e.g., they kept their income low to qualify)	Qualify for expansion without needing to modify their outcomes to qualify	Fewer people enroll in traditional Medicaid

[7] See, for example, Deborah Bachrach et al., *States Expanding Medicaid See Significant Budget Savings and Revenue Gains* (Robert Wood Johnson Foundation, Mar. 2016); and Stan Dorn et al., *The Effects of the Medicaid Expansion on State Budgets: An Early Look at Select States* (Henry J. Kaiser Family Foundation, Mar. 2015).

Appendix C. Sources and Assumptions for Tables 4, 5, and 6

Tables 4, 5, and 6 summarize savings and revenues attributed to Medicaid expansion from prior studies. In this appendix we present the source information and the assumptions relevant for each state in these tables. Table 4 uses information from the "Savings within Medicaid," "Projected 2020 state Medicaid spending," and "Traditional state Medicaid spending" rows. Table 5 uses information from the "Savings outside Medicaid" and "Traditional state Medicaid spending" rows. Table 6 uses information from the "Medicaid taxes" and "Traditional state Medicaid spending" rows.

Savings data are often for fiscal years before 2020. We assume that savings remain at that level in 2020. This may overstate savings within traditional Medicaid because the state saving falls as the state share of Medicaid expansion increases. It may also understate savings because it does not account for medical inflation. For many states, we do not have official Medicaid expansion spending projections for 2020. In those cases, we assume the cost for Medicaid expansion in 2020 equals 10 percent of the cost of Medicaid expansion in 2018, the most recent year available. As such, the estimates for savings as a percent of expected expansion spending are intended to be illustrations of the general magnitude of potential savings, not precise estimates.

Arizona

Medicaid taxes	JLBC Staff Program Summary — Expansion of Medicaid Eligibility (Updated Aug. 22, 2019)
Projected 2020 state Medicaid expansion spending	

Arkansas

Savings within Medicaid	*Arkansas Health Reform Legislative Task Force Final Report*
Savings outside Medicaid	
Medicaid taxes	
Projected 2020 state Medicaid expansion spending	
Traditional state Medicaid spending	Projection based on 2018 MBES data

Colorado

Savings within Medicaid	Bachrach et al. (2016)
Savings outside Medicaid	
Medicaid taxes	Medicaid Expansion in Colorado: An Analysis of Enrollment, Costs and Benefits — and How They Exceeded Expectations
Projected 2020 state Medicaid expansion spending	
Traditional state Medicaid spending	Projection based on 2018 MBES data

Indiana

Medicaid taxes	HIP 2.0 Financing Overview

Kentucky

Savings within Medicaid	Bachrach et al. (2016)
Savings outside Medicaid	
Projected 2020 state Medicaid expansion spending	Projection based on 2018 MBES data
Traditional state Medicaid spending	Projection based on 2018 MBES data

Louisiana

Medicaid taxes	Louisiana Legislative Auditor (2019) Financial Audit Services Management Letter Issued Oct. 16, 2019
Projected 2020 state Medicaid expansion spending	Projection based on 2018 MBES data

Maryland

State savings outside Medicaid	Bachrach et al. (2016)
Projected 2020 state Medicaid expansion spending	Projection based on 2018 MBES data

Michigan

Savings within Medicaid	Koorstra (2018)
Savings outside Medicaid	
Medicaid taxes	
Projected 2020 state Medicaid expansion spending	
Traditional state Medicaid spending	Projection based on 2018 MBES data

Montana

Savings within Medicaid	Montana Legislative Fiscal Division (2018)
Savings outside Medicaid	Medicaid Expansion: How It Affects Montana's State Budget, Economy, and Residents and Ward and Bridge (2019)
Medicaid taxes	MTN News (Mar. 28, 2019)
Projected 2020 state Medicaid expansion spending	Montana Legislative Fiscal Division (2018)
Traditional state Medicaid spending	Projection based on 2018 MBES data

New Hampshire

Medicaid taxes	New Hampshire Fiscal Policy Institute (2018) Medicaid Expansion in New Hampshire and the State Senate's Proposed Changes

New Jersey

Savings within Medicaid	Department of Human Services FY2016-17 Discussion Points
Traditional state Medicaid spending	Projection based on 2018 MBES data
Projected 2020 state Medicaid expansion spending	

Ohio

Savings within Medicaid	Ohio Office of Budget and Management analysis (July 2018)
Savings outside Medicaid	
Medicaid taxes	
Projected 2020 state Medicaid expansion spending	
Traditional state Medicaid spending	Projection based on 2018 MBES data

Oregon

Savings within Medicaid	Bachrach et al. (2016)
Traditional state Medicaid spending	
Projected 2020 state Medicaid expansion spending	Projection based on 2018 MBES data

Virginia

Savings within Medicaid	Virginia DMAS (2018)
Savings outside Medicaid	Virginia DMAS (2018)
Medicaid taxes	Official Consensus Forecast for Virginia General Medicaid, Behavioral Health, and Long-Term Care Expenditures (2019)
Projected 2020 state Medicaid expansion spending	Commonwealth of Virginia (2019) Official Consensus Medicaid Forecast
Traditional state Medicaid spending	

Washington

Savings within Medicaid	Bachrach et al. (2016)
Savings outside Medicaid	
Projected 2020 state Medicaid expansion spending	Projection based on 2018 MBES data
Traditional state Medicaid spending	Projection based on 2018 MBES data