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# Memo

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**To:** Luke Teater and Meredith Moon, Governor's Office of State Planning and Budgeting

**From:** Josh Goodman, Airlie Loiaconi, and Dana Westgren, The Pew Charitable Trusts

**Date:** March 12, 2021

**Subject:** Measuring revenue volatility in Colorado

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At the request of Colorado's Office of State Planning and Budgeting, this memo provides information on how measuring revenue volatility can help Colorado determine the level of budget reserves it needs to be prepared for economic downturns. For more information or any questions about this memo, please reach out to Angela Oh, senior manager, State Fiscal Health, at [aoh@pewtrusts.org](mailto:aoh@pewtrusts.org).

## Why Savings Targets Matter

When economic activity slows during a downturn, tax collections often decline, while certain spending demands increase. As a result, states may face budget shortfalls. Unlike the federal government, states cannot routinely engage in deficit spending during downturns. Instead, reserves are states' best line of defense against budget shortfalls. By saving money in good years, states can have money to close budget gaps, lessening the need for tax increases, spending cuts, or temporary budget maneuvers—such as fund sweeps and payment delays—that harm the state's long-term fiscal position. While the case for building budgetary reserves is strong, states also want to avoid saving more than is necessary to deal with cyclical budget shortfalls.

Thus, it is important for states to set reserve targets that are based on informed estimates of the size of the budget shortfalls they are likely to face. The most important factor is how volatile the state's revenue are. States with relatively stable revenue sources require lower reserve levels than states with more volatile revenue sources.

## Revenue Volatility

Revenue volatility differs across states, due to each one's unique industry makeup and tax structure. For example, personal income taxes—especially those with high rates for high income households—are typically more volatile than sales taxes. Taxes on corporate income, oil and gas extraction, and capital gains are typically highly volatile. Also, two states with similar tax structures could have different volatility based on factors such as industry mix, natural resource availability, demographics, population growth, and frequency of natural disasters. Finally, how volatile revenue is in one state versus another depends on the character of a recession: a recession induced by a financial crisis may have large impacts on states with revenue structures that rely heavily on financial markets, while a recession characterized

by sharp declines in tourism, such as the current recession, may have large impacts on states where tourism is a major part of the tax base.

Using a broad measure, Colorado currently has the [tenth highest level](#) of revenue volatility in the country, but high volatility isn't necessarily a problem. The key is establishing policies that set aside money when revenue is unusually high to smooth out the losses during downturns. For example, [Alaska—which has the most volatile revenue system](#) in the country—experienced a 75 percent decline in revenues in fiscal 2015 due to a drop in oil prices. The state had to draw down \$3.8 billion in reserves, or 63 percent of the general fund budget, to offset those declines.

### How Much to Save

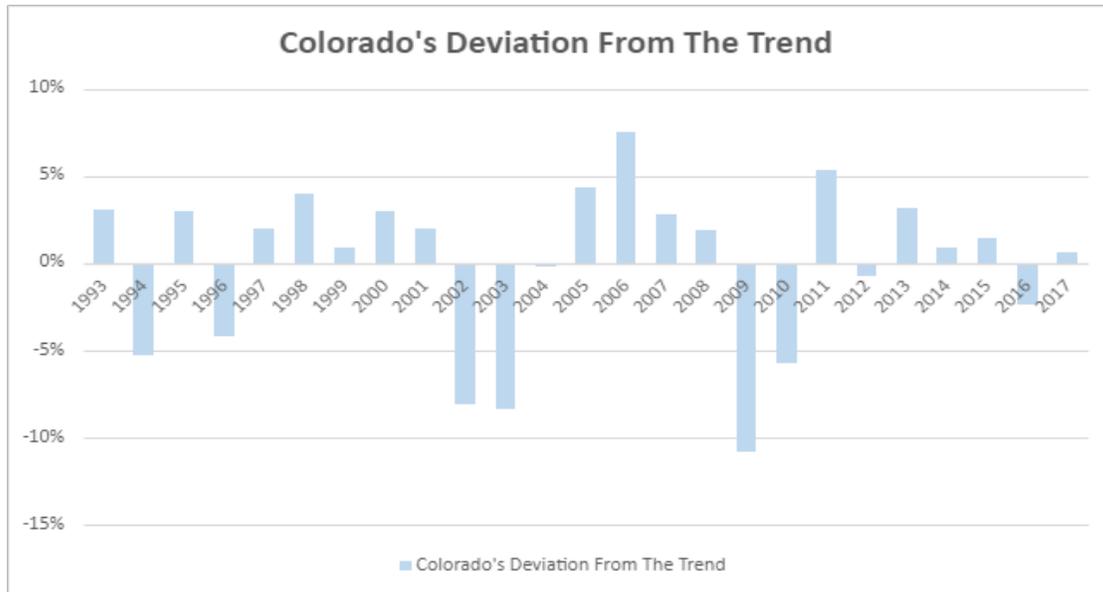
Conducting regular volatility studies can help states determine the optimal size of their reserve fund. For example, in Utah economists in the legislative and executive branches jointly study revenue volatility once every three years.

One option is to base a savings target on the assumption that future revenue volatility will be similar to that in the past. The first step is to measure the extent of volatility in past years. The idea of a rainy day fund is to be prepared for unexpected swings in revenue outside of policymakers' immediate control. Long-term growth in revenue due to increases in population and inflation or a sudden drop because of a tax cut should be excluded from consideration because these changes are predictable.

Using nationally available data, we did not exclude the impact of tax policy changes in our initial analysis of Colorado. However, using a statistical technique often used in economic research, we have estimated how far from the long-term trend Colorado's revenue growth was in each year from 1993 to 2017 (Figure 1).<sup>1</sup> Business cycles increase revenue during recoveries and decrease revenue during recessions. For example, in 2006, revenue growth was about 7.5% above long-term trend growth, but was nearly 11% below trend in 2009. The sum of all these bars is zero; if Colorado had put aside the above-trend revenue, it would have been enough to cover the below-trend years.

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<sup>1</sup> For this graph we calculated a trendline for revenue growth. Determining this trendline requires calculating the growth rate of own-source revenue in each year—using log changes, which are approximately the same as calculating the percent change—and generating a trend in this growth rate using a Hodrick-Prescott (HP) filter. By calculating the difference between actual revenue growth for each year and the trendline's predicted growth, we capture deviations from trend growth.



States including [Connecticut](#), [Minnesota](#), [Montana](#), [Texas](#), [Utah](#), and [Wyoming](#) have used data and methods such as these to set reserve targets. In the preliminary data above (which does not include the pandemic recession), reserves of 11% would have covered the full budget gap of any single-year drop in Colorado revenue growth and 17% would have covered any two-year recession period. This data offers a starting point for setting a reserve target, but Colorado policymakers would also need to decide what level of risk they are comfortable with. They may want to prioritize having enough reserves for the first year in order to buy time to make decisions about how to close budget gaps. Or they may want to have enough money to cover 75% of a two-year gap.

A weakness of this approach is that it assumes future recessions will look like those in the past. However, the current COVID-19 recession and the Great Recession both seem extraordinarily unusual.

Another option is to start by considering possible economic scenarios and then estimating how they would impact revenue. This can be done by analyzing revenue elasticity, which is a measure of the change in tax collections in response to a change in economic variables such as state GDP or income. This method could be employed to analyze past volatility and predict future levels by varying the economic parameter used to estimate the short-run elasticity. The elasticity method may also be used to estimate how revenue would respond to recessions of different magnitudes, which could be informative for setting rainy day fund targets.

Although very common in the economic literature, this approach is not as widely used in states as the previously described method. Our initial research shows that [California](#) has used components of short-run elasticities in volatility measures, but we are not aware of any states that have purely used short-run elasticity measures to create models that determine ideal reserve levels. The elasticity method has its

own shortcomings. It glosses over the extreme swings in revenue that can occur in some kinds of recessions. For example, in recessions in which the stock market falls, the elasticity of tax revenue to GDP in states that rely heavily on capital gains (including Colorado) may be far greater than the elasticity in recessions in which the stock market is more stable. An average elasticity computed over periods that include multiple recessions may give a good view of how the revenue system will behave on average but understate risk to the state if the stock market falls, too.

Because no method is perfect, it may be a good idea to examine the results of more than one methodology to set a reserve target. Pew is currently undertaking research to better understand revenue elasticity and how it can be used to improve states' preparation for downturns.

### Stress-Testing Savings Targets

While revenue volatility is a primary factor for states to set evidence-based reserve targets, there are other relevant considerations. For example, governments often face increased spending demands during downturns. When incomes fall, more residents qualify for means-tested programs, raising costs. For states, Medicaid is by far the largest means-tested program. States can study how much spending is likely to increase during downturns (absent policy changes), considering the design of their Medicaid program and other countercyclical programs.

Furthermore, states should consider the potential duration of budget stress. Often, during and after downturns, revenue will remain depressed—and spending pressures heightened—for multiple fiscal years. With that in mind, states should consider not only the reserve level needed to close the budget gap for a single year, but also to sufficiently cover potential shortfalls until the situation improves.

Finally, policymakers' appetite for risk matters. To develop reserve targets, states ultimately must decide what percentage of potential budget gaps they want reserves to cover, recognizing the downsides to having reserve levels that are too high or too low. For example, policymakers might determine that they want enough in savings to cover the entire projected shortfall for a mild recession but not for a severe recession—recognizing that the federal government is likely to step in with aid in the latter scenario. In thinking through these decisions, states should consider what options they have if reserves prove inadequate. Cataloging and prioritizing these options in advance has benefited [Utah](#) in responding to the pandemic.

Budget stress tests are one strategy for states to consider these factors, estimate the size of potential budget shortfalls, and ultimately set savings targets. By studying how budget conditions change over time under plausible adverse economic scenarios (e.g. a mild recession or a severe one), states can estimate the probability of shortfalls of various sizes and use these estimates to set savings targets that reflect policymakers' appetite for risk.



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## Reaching the Target

Once policymakers have identified a reserve target, the next step is to enact policies to meet this goal. One way to reach a target is to link rainy day fund deposit rules to one-time or extraordinary revenue growth. Connecticut, for instance, historically had difficulty saving enough to adequately weather downturns. In 2015, the state amended its rainy day deposit rules so they were linked to revenue volatility. Thus, if revenue came in above [the state's historical average](#), as determined by the state's volatility study, excess revenue would automatically be deposited into the fund. Because of this rule change, [Connecticut](#) was able to save \$3 billion as of September 2020, 15.1 percent of general fund appropriations. Policymakers in the state avoided large cuts for fiscal year 2021, and Governor Ned Lamont has proposed using rainy day funding to plug budget gaps rather than raising taxes or cutting programs for [fiscal years 2022 and 2023](#).

Similarly, executive branch economists in Minnesota analyze the level of reserves necessary to offer 95% confidence that the reserves could offset a biennial deficit caused by revenue volatility. The state's [rainy day fund deposit rule](#) links directly to this analysis: When the state experiences a budget surplus, up to a third of the extra money is deposited in the fund until the reserve target is reached. Due in part to this policy, in fiscal year 2020 Minnesota reached its reserve target of \$2.3 billion.