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## Theory to Practice

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### Article

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## Public Administration Review

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## Betting on the Future with a Cloudy Crystal Ball? Revenue Forecasting, Financial Theory, and Budgets— An Expanded Treatment

### Fred Thompson and Bruce L. Gates

Thompson and Gates address an important topic in this *PAR* article: budgeting in the real world of volatile revenue. It is important because, as in many areas of economic life, unmanaged risk in government finances can be costly. It is costly because it can lead to unwise decisions and disrupt lives and planning inside and outside of government. These include deferred maintenance on bridges or a social service program that starts and stops, and starts again. Other disruptions may involve early retirement programs in down years followed by the hiring of inexperienced workers in up years, or a tax cut followed by a temporary surcharge followed by a return to the old tax structure. Clearly, reducing or

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managing revenue risks can lead to better decisions and better government.

One of the really nice features of this article is the way the authors organize and pull together different ways of evaluating and managing revenue volatility. They offer advice for policy-makers about forecasting and budgeting under uncertainty, drawing on four insights from research in financial theory. Their recommendations might be summarized as follows:

- Forecasters cannot predict revenue accurately. Don't focus on point estimates; focus instead on expected growth (average growth over history) and on the risk or volatility

around that average. Think about this risk as having two components: purely random risk unrelated to the economy, and risk associated with an economy that is hard to predict.

- Reduce random (unsystematic) risk by building a diversified revenue portfolio within the constraints of practical tax policy objectives.
- Use hedging, reserve funds, and other strategies to offset risk you cannot diversify away. Do this for risk associated with the underlying economy, as well as for unsystematic risk that is not practical to diversify away.
- Impose spending rules that will balance the budget over the long run, while allowing it to be unbalanced in any given year. Do this by balancing the present value of resources against the present value of spending over the long run or, second best, by balancing over the business cycle.

This series is about "theory to practice," so I want to explore two questions with *PAR* readers in this regard. First, are these recommendations useful and valuable? Second, how could we put them into practice and, if so, would we like the result? I am going to focus most of my comments on the first and last recommendations listed above. I argue that the answer to the first question is, "Yes, they are useful, but perhaps not in the way that the authors intended." Regarding the second, I argue that putting them into practice will be neither easy nor lead to the results the authors expect. I do not think these proposals will be as useful as, or have the advantages over, traditional methods that Thompson and Gates contend.

### **Insight 1: Budget Forecasters Should Focus on Expected Growth and Volatility**

Is the insight useful? Yes! Budget forecasters are torn. They know their forecasts are wrong. As professionals and as good advisors, they feel compelled to explain this. They want policymakers and politicians to understand that the point estimate will certainly be wrong. Policymakers and politicians need to understand these risks because, in the end, they will take much of the heat for the errors and choices made in response. Financial managers need to understand this because part of their job is to prepare for and respond to errors in forecasts, and to put some rabbits into hats just in case. Finally, there is a CYA (communicate your anxieties) element: it will be less painful when you are wrong later if you alert everyone up front, rather than insisting that "these are *the* numbers."

But forecasters also fear the consequences of letting on that the numbers will be wrong. They fear a slippery slope: "If I tell the governor that I am forecasting revenue growth of 6 percent, but also say that it might as easily be 4 percent or 8 percent, what will I do when she asks me whether I can allow her to spend 7 percent? Or 7.5 percent? Where will it stop?" In the end, professional forecasters understand that despite this fear, one of the most important parts of their job is to make sure that those elected officials who take the heat for errors understand the likelihood of errors.

The question is how to convey and manage this risk. One work that the authors cite refers to the perils of the revenue forecasting process:

The standard approach to revenue forecasting is inherently flawed. States gen-

erally use econometric models to forecast revenues. These models are often quite complex, with scores of exogenous and endogenous variables and constants. They can make a significant contribution to policy dialogue, especially where their components can be varied to show the consequences of alternative courses of action of interest to public officials. Unfortunately, as forecasts, they are not significantly better than naive extrapolations and are sometimes worse. (Dothan and Thompson 2006, 3)

This is too strong. Forecasters know more than this. First of all, much of the public part of budget forecasting is a short game: forecasting the remainder of the current year, plus the year ahead. Most states do longer-term forecasting as well, often keeping those numbers private, but sometimes publishing them. But the legal decision-making, unfortunately, centers almost exclusively on the short game. And in that time period, budget forecasters certainly can do better than extrapolate. For example, in the typical state with an income tax, a revenue forecaster in February or March knows at least a little bit about the current tax year—a calendar year—and virtually all of the payments on that tax year will be made by the time returns are filed a year hence in April. Forecasters can do far better by incorporating information in hand into the forecasting process than by assuming revenue is a random walk.

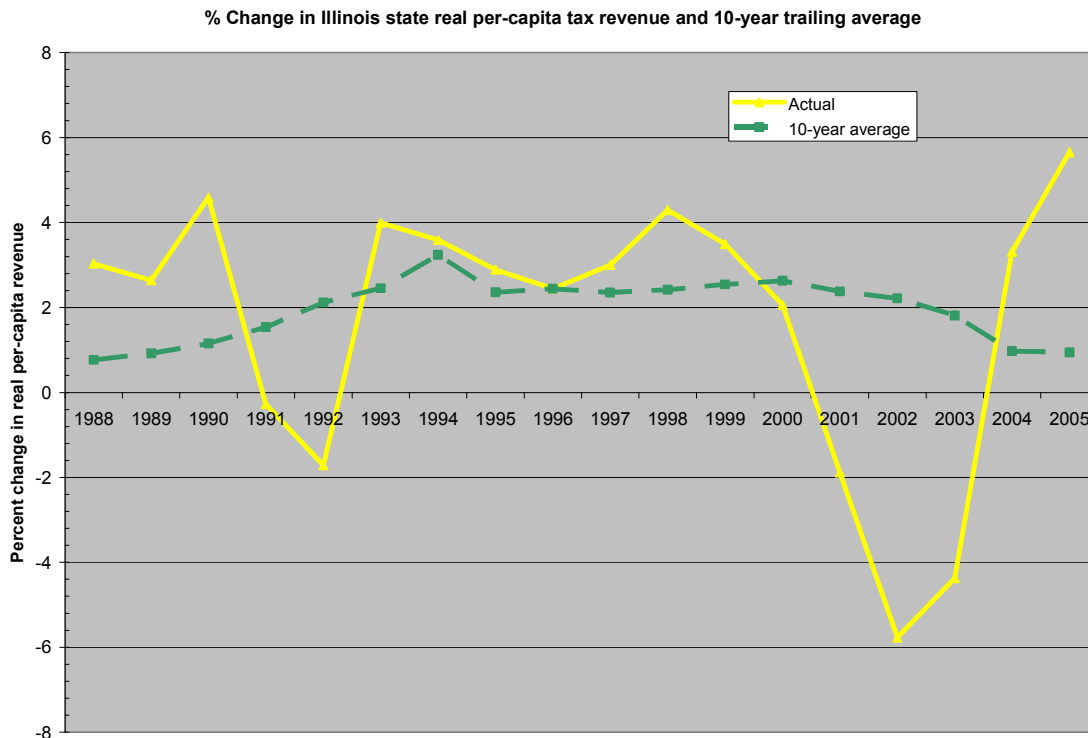
Perhaps this is just semantics, but the problem is not that forecasts are so bad, but rather that the *reasonable* range of error is always larger than the *acceptable* range. If a revenue forecaster could be assured of an error that was only 3 percent or even 5 per-

cent, there would be high-fives all around! From a technical perspective, when forecasting these kinds of series, that range is both very good and often achieved. But it is not acceptable politically. If a California forecaster crowed to a legislator, "I am right, plus or minus 3 percent," the legislator properly would say, "What!? You're right, plus or minus \$3 billion? How can you tell me we can't afford a program for children that will only cost \$500 million?" Errors that are small to a forecaster are large to a policymaker.

So there is a great need to highlight and use information about volatility. But how could we put this into practice? Thompson and Gates say, "Where the distribution of growth rates is stable over time and periodic growth rates are independent of one another, the simple average of past growth rates or the arithmetic mean is the best estimator of expected growth rates." How would we put that into practice? Would we actually use such a rule to forecast revenue? Let's pick a state and take a look. Figure 1 shows, for Illinois, actual percentage growth in real per-capita tax revenue (solid line) and the simple average of growth in the trailing 10 years (dashed line).

Pity the poor revenue forecaster in 2002, preparing the budget for 2003. The world is falling apart—real per-capita tax revenue declined by 1.9 percent in 2001 and is set to decline by 5.8 percent in the current year.<sup>1</sup> The stock market fell last year and is still falling like a stone. Illinois depends on this income. But the 10-year trailing average of revenue growth is 2.2 percent, and it's been pretty stable for at least a decade. And the standard deviation over the last 10 years—using information currently in hand—was

**Figure 1** Was the Mean Growth Rate the Best Estimator of Expected Revenue for Illinois in 2003?



2.1 percent. Let's go with that 2.2 percent growth forecast. What are the odds we'll be wrong by two standard deviations?

Unfortunately, real per capita tax revenue declined by 4.4 percent in 2003—6.6 percent below the simple average available at forecasting time and more than three standard deviations away. A similar but less dire situation occurred in 1992, where the average-based forecast was about 4 percentage points above the actual. Of course, the fact that an average-based forecast can be very wrong does not mean it is a bad forecasting method. The question is if more traditional methods could have done better. I contend they could have because budget forecasters in Illinois knew the stock market was falling and they understood their income tax. In the short game of budget forecasting, forces already in motion gave them more information about what was going to happen in the

budget year than did naive forecasts using past growth rates.

I think there are at least two ways in which average growth rates can be useful. First, they can help governments think about longer-term forecasts, where the short-term information advantage largely goes away. Second, they can be a pedagogical tool to help convey ideas about risk, and diversifiable versus non-diversifiable risk, exactly as the authors have done. Even there, however, I would be reluctant to use means as the only measure of longer-term growth. Forecasters tend to be better at forecasting demographic variables (e.g., the number of school-age children) than they are at forecasting incomes.

Quantifying the risk as the authors do—and examining how it changes as we get closer to the forecasted event—can be very useful

policy information. We have all seen how, when a hurricane is approaching, the National Hurricane Center establishes an uncertainty cone forecasting a geographic range in which the hurricane will make landfall. They don't commit to a point forecast, which they would have to change again and again as the hurricane approaches, but rather to a range that changes over time, usually with different colors to show most and least likely parts of the range. As the hurricane gets closer and forecasts become more certain, the Hurricane Center narrows the cone. Although they do not provide point estimates, they provide information that is more useful because it allows people to assess risks and take action. This is one way that forecasters could help convey risk—and the narrowing range of risk as the event gets closer—to policymakers.

The analogy to revenue forecasting is imperfect, of course. The Hurricane Center does not have to contend with loud voices insisting they know the exact landfall location, and that it will be *here*, above the midpoint of the uncertainty range. Governors who deal with strong legislatures *do* have to contend with this, and the proffered point forecast is almost always above the midpoint. But in any event, even if average growth rates and standard deviations are not used to produce budget forecasts—and I don't think they should be—they can be used to convey a better understanding of the risks around short and especially long-term forecasts.

#### **Insight 4: Establish Spending Rules to Help Offset Other Risk**

The tools I described above allow governments to have more stable spending either by reducing revenue volatility or by providing ways to manage that volatility. But Thompson and Gates also examine policies that would directly control or guide spending by molding it to the revenue stream and

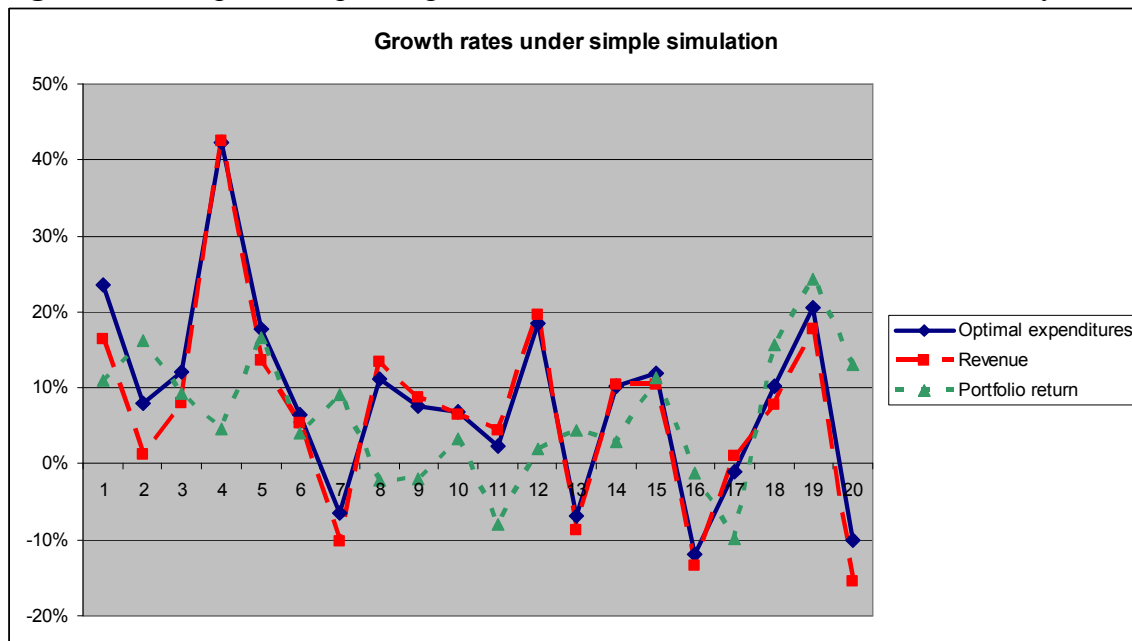
making spending sustainable over time. In this regard, they examine a paper that Thompson co-authored with Michael Dothan (2006) wherein an "optimal" spending rule is imposed on governments. It is optimal in that it forces the government to choose a spending level each year that is sustainable based on available facts. The spending rule offered by Dothan and Thompson makes reasonable assumptions about government decision-makers' preferences. It has them choose a spending path that maximizes their utility, while ensuring that the present value of spending equals the present value of revenue plus reserves—including investment income on those reserves (all adjusted for risk preferences). They add to or draw down reserves as needed and adjust their spending path each year to take into account actual revenue.

While it is true that this approach develops a sustainable path for spending each year, it is not a smooth path. The path is continually updated, and as a result, the yearly spending changes that result from establishing a new path can be very large, albeit not usually as large as swings in revenue. To examine this phenomenon, I developed a crude model to simulate this approach that did the following:

- Starting from an initial position, revenue grows each year based on its mean growth rate, its standard deviation, and a draw from a normal distribution.
- The reserve investment portfolio grows similarly, with its own draw from a normal distribution.<sup>2</sup>

Figure 2 shows one simulation, and it is clear that expenditures vary almost as much as revenue. Indeed, many additional simulations show similar results. In this particular simulation, the standard deviation of spend-

**Figure 2** An "Optimal" Spending Rule Would Still Entail Considerable Volatility



ing computed over 30 years was 87 percent of the standard deviation of revenue. In other words, while the approach reduced spending volatility somewhat, it did not reduce it by a lot.

While it sounds attractive to choose a sustainable spending path, this approach in fact does not smooth expenditures very much. Because the path is readjusted each year to reflect volatile revenue, spending can vary almost as much as revenue.

### Conclusion

This very interesting review of tools for reducing and managing revenue volatility that Thompson and Gates offer in their article makes it clear just how hard it will be to put theory to practice. Here is my take on the state of research and how practitioners can apply it:

- Growth analysis—decomposing revenue into average growth and average volatility—definitely can provide useful insights and can help revenue forecasters develop alternative scenarios. It also can

help them convey risks to policymakers and others. Personally, I don't see it as an alternative to traditional forecasting, at least for the kinds of short-run forecasts that underlie budgets.

- Diversification is important, and the tools of financial analysis can help governments assemble prototypical portfolios. But the big disadvantage of diversification is that it forces a government to adopt revenue policies that it might rather not adopt. In policymakers' minds, concerns about *tax equity* almost always trump concerns about stability.

- Governments can and should look for ways to offset and manage the risks they cannot diversify away. In this regard:

- Hedging revenue volatility could be very attractive if suitable instruments become available. It has the great benefit of being a pure financial approach—it does not force governments to change revenue or spending policies. But there will be significant

political and practical obstacles, so this is not a solution to the problem of revenue volatility anytime soon.

◦ Pooled reserve funds could allow governments to offset volatility with smaller aggregate balances than would be required if each government went it alone. But developing a cross-state pooled reserve would require either extraordinary cooperation among states or substantial federal leadership and support. Neither seems likely anytime soon. Establishing pooled funds within states is a different matter. Here, a single entity—the state government—could make and enforce the rules. Thus, there might be more hope that states can take advantage of the benefits of pooling within states.

- Finally, governments can impose expenditure rules on themselves—limits designed to ensure that a budgeted level of expenditures can be sustained over the long term. But the rules put forth so far would not add much stability to expenditures.

In sum, financial theory has developed some very powerful tools for managing revenue risk. For the reasons I have noted, plus those raised by the other commentators on this article, we are unlikely to see radical shifts in how state and local governments manage these risks for quite some time. Theory to practice, as envisioned by Thompson and Gates in this article, will not be a task easily accomplished. Nor will it necessarily add value to traditional methods in the ways these authors anticipate.

## Notes

1. Note that I have not adjusted any of these numbers for the impact of legislative changes on revenue, as that is beyond what is practical for this commentary. I think for the period and issue in question,

these numbers still convey the right general impression. But adjustments for legislative changes would be essential for any serious use of long-term average growth rates.

2. One way in which my model is crude is that the investment return and revenue growth are uncorrelated. In the Dothan/Thompson paper, they are correlated, although the correlation in their simulations was not large.

## References

- Dothan, Michael U., and Fred Thompson. 2006. Optimal Budget Rules: Making Government Spending Sustainable through Present-Value Balance. Association for Budgeting and Financial Management (ABFM) Annual Conference, Atlanta, GA, October 20. <http://ssrn.com/abstract=939815>.