Informed Decision-Making through Forecasting: A Practitioner's Guide to Government Revenue Analysis by Shayne C. Kavanagh and Daniel W. Williams

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Kavanagh and Williams work should be on the bookshelf of every public budgeting director and finance officer. A comprehensive and rational guide to forecasting revenues, it takes the reader through each topic in step-by-step processes that can be understood and applied to the revenue sources of virtually any size government. While any application of statistical methodologies can be dense reading, the authors go to great lengths in explaining each formula to make them as easy to comprehend as possible.

The authors' selection of basic and advanced forecasting techniques is likely to improve the perspectives of almost every budgeting professional. Further, the examples are not dependent upon sophisticated specialized software. They use the data analysis tool in Microsoft Excel, which is commonly available in budget and finance offices. A reader may wish to start by reading the conclusion (Chapter 19). This may help them prepare for evaluating their organization's own forecasting processes in comparison with the suggested best management practices.

There is good news and bad news. The bad news is that anyone less than comfortable with statistical methods will still have to engage in their practice to successfully apply much of the knowledge in this work. The good news is that the authors augment their statistical methodologies with understandable plain language descriptions that explain the processes. Further good news is their emphasis on the fact that the simpler methodologies often produce results that are as good, or better, than the more complex methodologies. This is reinforced through a comprehensive test of the methods using Excel and some commonly available automatic forecasting software.

After being led through recommended forecasting processes, readers are treated to a discussion of the primary types of forecasting. The authors then address, in substantial depth, selection of an appropriate forecasting method and its implementation. They also aid the user in using and evaluating the forecasts that are generated by the processes that they advocate, along with recommendations on how to present the forecast results to policymakers. Kavanagh and Williams also follow-through on their proposals using applied examples of several well-documented case studies.

Basic Preparation for Producing Good Forecasts

Every forecaster should deliver what his or her ultimate audience wants to know. To determine where effort is best spent, specific questions also must be answered. Determining the most important revenue sources, most volatile revenues, the potential for future growth, and which sources that may be impossible to forecast will likely influence where that effort is best focused.

The forecast's foundation is the database from which it is made. It's not only the historical data that are important. It is often the structure of how the forecaster thinks about the revenue source and how its causal forces affect the revenue source. The reader is led through processes that express these aspects. "Influence Diagrams," describing these perspectives, are often a good investment of time and are suggested. They force forecasters to determine the interplay between the revenue and other environmental influences such as statutes, general economic conditions, and specific economic sectors. The STEEP framework (the social, technological, economic, ecological, and political events and trends) is another structured approach that will introduce additional perspectives. This helps organize forecasting and assures all aspects of the process are accounted for.

A final step recommended in the initial preparation is exploratory analysis of the data. This process visualizes the data (graphing and charting to expose patterns and trends); establishes a set of descriptive statistics (to establish central tendency, distribution of data, variance, and rates of change in data); and accomplishes disaggregation (the deconstruction of large, complex, problems into smaller, easily analyzed issues). Exploratory analysis reveals business cycles and seasonality in the forecasts (which the authors provide techniques for correcting) and the correlation of the variables with their power of revenue prediction.

Types of Forecasts

Forecasting methods are described as being judgmental or quantitative. Judgmental forecasting depends primarily upon the knowledge of the forecaster and familiarity with the revenue source. Quantitative forecasting depends upon data describing the revenue source combined with statistical techniques.

Expert judgment can make positive contributions to forecasts. However, when there is too little reinforcement by source data, predictive power can suffer. Its dependence upon a "feel" for the revenue source limits transparency and is often impossible to replicate. However, under the appropriate circumstances, experts can apply knowledge from experience that is not available to quantitative models. This may produce greater forecast accuracy. It can be subject to a range of cognitive biases but techniques are presented that can reduce judgmental errors. Included are group processes, such as the Delphi method, and the construction of nonstatistical models to deconstruct the process.

Quantitative forecasting is divided into extrapolation and regression methodologies. Each type is covered individually with a number of methods. Those presented include moving average, moving average of the trend, exponential smoothing, Holt exponential smoothing, and damped trend exponential smoothing. It is suggested that extrapolation techniques will be most effective in predicting repetitive governmental revenue sources such as through sales and income taxes. Regression forecasting is limited to the modeling of economic data. Regression produces a line-of-best-fit of data-points created by the revenue and economic variables. Use of the equation for a straight line allows projections of future values. There is extensive discussion of preparation of data for use in regression forecasting and use of Excel in the process. Interpretation and

comprehension of the output from the Excel Data Analysis Tool are described in sufficient detail; even a novice should be able to employ it.

Selecting a Forecasting Method

Kavanagh and Williams address which methods perform the best through a "Forecasting Competition." They utilize a number of revenue sources and apply the techniques using both Excel and automatic forecasting software. The tests are applied using periodic data and annual data. The most consistently accurate results (lowest mean absolute percentage error) came using periodic data with one of the automatic forecasting software packages. However, the test confirmed the simpler forecasting methods performed well and no one technique performed best in all situations. The authors suggest using several methods applied to your own data, holding out the most recent length of time representing the period that needs to be predicted. Then, results can be compared with the actuals and their relative accuracy and bias statistics compared.

Implementing a Method

There are additional steps that can improve forecast results. A three-phase implementation is suggested. Prior to submitting them to a decision process, results obtained from several different methods can be averaged together, often improving accuracy. A second phase is adjusting the forecast on a judgmental basis. While these adjustments can improve accuracy, it is also possible to make unwarranted adjustments. Adjustments should be made in accordance with a predetermined structure, not randomly. Further, each adjustment should be documented. The final phase is testing the forecast to ensure it produces nominally accurate results. Three testing options are discussed. The first is subjecting it to a group peer review. When controlled appropriately, its multiple perspectives can benefit the forecast, and the issues that arise from group deliberation can be avoided. A second option would be a comparison with the results of extrapolation forecasting on the same data. The third option is the comparison with other similar governments' results.

A significant issue in budgeting and finance is uncertainty. We are reminded that, although single-point forecasts are desired, a budget is a plan, and all plans are uncertain. For this reason, budget and finance officers make conservative estimates. Such facts need to be communicated to elected policymakers. The referencing of forecasts as "estimates" and the presentation of the assumptions on which forecasts are constructed can assist this. There are two basic types of uncertainty: routine uncertainty, from the basic inability to project exact outcomes like taxable sales; and event-related uncertainty, ranging from economic downturns to natural disasters. Constructing a prediction interval is suggested to present the upper and lower limits of the most likely outcomes.

Using and Evaluating Forecasts

The primary focus for using a forecast is the consistent recognition of their value in achieving goals and objectives. It is suggested that budgetary principles be established to guide managers and decision-makers. This can be approached through the establishment of financial policies. Beginning with the commonly practiced requirement of a balanced budget, governments can also implement policies stipulating minimum reserves, uses for one-time or inconsistent

revenues, and use of long-term financial planning in guiding spending. For those considering major changes in organizational culture, techniques such as target-based budgeting, priority-based budgeting, and strategic planning and visioning are covered.

Probably the most critical event for a forecast is its presentation to its audience. A common error often made is expecting that, because the forecaster understands the issues, the audience also understands them. Key points needing to be made to the audience are offered to help focus presentations. The time factor also is emphasized. Most presentations are time-limited, and the forecaster must be certain to cover every important issue. This means focusing on the essential issues and keeping the audience's attention. Different ways of helping the audience to comprehend the results (usually stated in numerical form) are suggested. While graphical portrayals are also covered, the suggestions go beyond them. Some more powerful methods include making the numbers reflect personal scales (such as "per resident" costs/revenues or increases/decrease in property tax bills) and relating revenues through "street-level" examples that are related to the revenue source (a decrease in available developable property might affect future tax revenue growth). Another suggestion is the use of interactive forecasts that can be altered to reflect the effect of changes to key assumptions in the forecast. This can keep the audience engaged and improve their retention of the presentation.

In that economic events and forecasts are not always in perfect sync, it may be advantageous to monitor actual revenue inflows and periodically update forecasts throughout the year. Methods for monitoring actual inflows for comparison with forecasts are presented. Simple algorithms viewing the year as monthly percentages-of-total allow a comparison between actual receipts and forecasts. At times, contractual or statutory terms stipulate when payments must be made. In such cases, non-mathematical approaches can reflect periodic percentages-of-total. Another consideration addressed is how to deal with seasonalized revenues when trying to make relatively accurate percentage-of-total comparisons. A factor useful to monitoring forecasts also addressed is the determination of effective economic indicators that are precursors to revenues.

Evaluating Forecasts

Improvement in forecasting only comes from the forecaster's personal commitment to improve his or her own accuracy and revising one's assumptions, where warranted. To improve accuracy, suggestions include keeping the prior forecasts and the work documents indicating assumptions and how they were made. Along with this, the record of the actual revenues is necessary for comparison purposes. The construction of an ongoing forecast database also is recommended. It should contain a historical record of the original forecast values for each revenue source, the critical assumptions used, and the forecasting data from which they were constructed.

It is requisite that the forecaster takes stock of whether his or her work is meeting the requirements of the elected decision-makers. If the expectations of decision-makers are not being met, it is likely that either elected officials will view forecasts as having little use or the forecaster will overestimate the value of the work he or she is contributing to the decision process, or both. To avoid this situation, a suggested set of rules for evaluating forecasts' effective utilization in the decision process is provided.

Disclosure Statement

The author declares that there are no conflicts of interest that relate to the research, authorship, or publication of this article

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Joseph Vonasek has a BS and MBA in business management and a Ph.D. in public administration, all from Florida State University. For over 25 years, he served as a local government executive and senior staff member and as a consultant to state and local governments. As a local government management and budget director for full service governments, Joe was responsible for the preparation and administration of annual budgets of approximately $700 million. He teaches undergraduate and graduate classes in public budgeting, finance, and public policy. His research interests include public budgeting and finance, public financial decision- making, public management, and administrative ethics.