

REVENUE FORECASTING ACCURACY IN OHIO LOCAL GOVERNMENTS

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ABSTRACT. Fiscal stress has forced Ohio local governments to pay increasing attention to the importance of revenue forecasting. This paper identifies and examines two Ohio local governments' revenue forecasting approaches and forecasting accuracy using the case study method. It compares the differences in forecasting methods used. This research finds that informal forecasting methods are used by the county and formal forecasting methods are used by the city, that forecast accuracy varies by level of revenue aggregation using the informal method, and that depending on the revenue source, simple methods are more appropriate than complex methods.

INTRODUCTION

The accuracy of revenue forecasting became a topic for public budgeting research in the 1990s when investigators studied local governments that had experienced severely declining financial performance for a long period of time. They observed that some local governments were able to regain fiscal health but others were never able to recapture their pre-downturn level of financial health. Recurring fiscal emergencies have forced Ohio local governments to give increasing attention to future revenue trends and have increased the importance of revenue forecasting (Beckett-Camarata, 2004). Until recently, most Ohio local revenue forecasting was based on best-guess revenue estimates and was very short-term. Further, the center of attention

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during times of fiscal problems predominately focused on how to cut expenditures and balance the current budget rather than incorporating revenue forecasts into the fiscal solution.

Accurate revenue forecasting can assist local governments in determining both long term and short term revenue streams. This is especially true for Ohio local governments who must take into account their reliance on local income and sales taxes. It is important for local governments to know if their tax revenue base is shrinking or increasing in order to be able to accurately plan for future expenditures and to ensure that the budget is in balance. There are several variables that specifically affect Ohio local income and sales taxes. Examples of these variables are population, income per capita, property value, employment, business activity and interest rates (Nollenberger, 2003). It is important to be able to forecast the effects that changes in these variables will have on future revenue in order to accurately plan and budget for the future. "In modern economics, forecasts are evaluated on the basis of whether or not they are "rational"-e.g., do the forecasts optimally incorporate all information that is available at the time they are made?" (Feenberg, Gentry, Gilroy & Rosen, 1989, p. 300).

Closer scrutiny of the accuracy of local government revenue forecasting is important for several reasons. First, accurate local government revenue forecasts form the parameters necessary for high quality budget deliberations. "In public-sector budgeting, the availability of resources circumscribes discussions of all expenditure considerations. As these discussions intensify in the face of mounting fiscal duress, reliable and informative revenue forecasts become critical elements in the [effective] budgetary process" (Agostini, 1991, p. 13). Second, local governments rarely forecast revenues systematically for longer periods than the forthcoming budget year.

This paper examines the forecast environment in Ohio local governments and discusses revenue forecasting practices in two Ohio local governments, Summit County, Ohio, and the city of Canton, Ohio. Once the revenue forecasting environment is specified, the factors affecting forecasting accuracy are discussed. A case study of two local governments is used to illustrate the paper's thesis. This study makes an important contribution to the literature by describing how forecasting is developed in an Ohio county government and comparing that forecast

approach to one used by a city government in Ohio. Previous research did not address the actual forecasting practices in different forms of government and the accuracy of those forecasts in Ohio local governments.

LITERATURE REVIEW

This research focuses on the forecasting environment in two local governments in Ohio. In terms of formal and informal forecasting environment, "Effective local government financial management cannot be based solely on information about the present: it requires revenue and expenditure forecasts, which play an important role not only in fiscal management but also in the overall policy-making process" (Nollenberger, 2003, p. 99). Forecasting reflects the emphasis placed on its use, whether formal or informal, since forecasting is applied to almost all public policy decision making in organizations. Bretschneider and Gorr noted that "limited resources and lack of forecasting expertise led to a high reliance on qualitative techniques" (Bretschneider & Gorr, 1987, p. 120). Welch, Bretschneider and Rohrbaugh (1998) argue that human judgment is widely used in forecasting because a mathematical model may be viewed as a "black box" with mechanisms not fully understood or controlled relative to one's own assessment of a situation.

Previous research (McCullough & Frank, 1992; Shkurti, 1990) examines four broad classes of forecasting methods used in revenue forecasting: human judgment, time-series extrapolative methods, regression-based models and econometric models. This stream of research demonstrates that model use depends on what revenue sources are forecasted, for what purpose and what type data are utilized. While formal approaches clearly outperform informal, judgmental approaches, more complex formal approaches may not be better than simple formal approaches. It would almost seem intuitively obvious that the more sophisticated the models utilized for revenue forecasting, the more accurate the forecast would be. McCollough and Frank (1992), however, support the argument that simple formal methods are generally as accurate as or even more accurate than complex methods. They further argue that for forecast horizons of six months or more, regression or econometric approaches are likely to be more accurate than time series methods such as moving averages, exponential smoothing, or Box-Jenkins.

The results of some prior studies (Bretschneider, Bunch & Gorr, 1992; McCollough & Frank, 1992) found that officials in small local governments use predominantly human judgment and lack any substantial use of formal methodological approaches. Such local officials may feel more comfortable with a less than accurate judgmental forecast rather than a more accurate quantitatively derived forecast (Wildavsky, 1986). The fact that most local governments' rely solely on human judgment may explain why there is a lack of research in this area. In support of this claim, a finding from a national survey of 290 local finance officers (McCollough & Frank, 1992) found that upwards of 75 percent of local governments do not utilize formal revenue forecasting. Formal revenue forecasting in local governments is far less advanced methodologically than that at the state or federal levels (McCollough & Frank, 1992). According to McCollough and Frank, "forecasting development is indeed quite backward at the local level" (McCollough & Frank, 1992, p. 409).

For the purposes of this article inaccuracy is defined as any actual revenue source figures that are documented as being above 5 percent of the estimated figure. The more the actual revenue is documented above 5 percent, the less accurate it is considered (Frank, 1988; MacManus & Groethe, 1989).

The research reported in this article builds on the existing knowledge about revenue forecasting approaches and the accuracy of the forecast by identifying and profiling revenue forecasting accuracy in one city and one county in Ohio. This research also extends the forecasting accuracy literature in two ways. First, this research studies forecasting accuracy in the context of local government form. Second, while the forecasting accuracy literature seeks to evaluate the extent to which forecasting methods influence specific forecasting of revenue sources, this article describes how forecasting is accomplished in an Ohio county government compared to a similar city government in Ohio. Few empirical investigations have been conducted on forecasting in different forms of government in Ohio local governments.

Bretschneider, Bunch and Gorr (1992) examined revenue forecasting errors in 2,572 Pennsylvania local governments' budgets with some interesting results, especially in terms of the difference between forecasting errors between city and county governments. In this regard, a substantial number of the 209 finance officers surveyed (see Table 1)

TABLE 1
Table of Revenue Forecasting Utilization (N = 290)

| Forecasting Technique | Percent Response | |
|--------------------------|------------------|------|
| | Yes | No |
| Regression | 23.8 | 76.2 |
| Exponential Smoothing | 9 | 91 |
| Moving Averages | 36.2 | 63.8 |
| Box-Jenkins | 2.4 | 97.6 |
| Trend-Line | 48.6 | 51.4 |
| Classical Decompositions | 9 | 91 |
| Econometric | 20 | 80 |
| Judgmental | 75.9 | 24.1 |

Source: McCollough and Frank (1992, p. 409).

relied on trend and judgmental techniques. Only one-fifth of the respondents claim to use causal approaches such as regression or econometric methods. Such a claim might well indicate that education and training of local fiscal officers might be beneficial. McCollough and Frank (1992) found that empirical comparisons of quantitative and judgmental forecasts have generally shown the former to be more accurate than the latter. Most individuals involved in judgmental forecasting tend to stay locked into a set of assumptions about the operating environment long after these assumptions apply and remain relevant to the situation at hand (McCollough & Frank, 1992).

In many cases an argument can be made that for forecast horizons of six months or more, regression or econometric methods are likely to be more accurate than time series methods such as moving averages, exponential smoothing, or Box-Jenkins. This assumption is dangerous in today's dynamic or rapidly changing economy. No model can be expected to be 100 percent accurate. Matt Filipic, former director of Ohio's Legislative Budget Office, describes the limits of forecasting, "The only thing we know for sure is that this forecast will be wrong. We don't know how much or in which direction, but it will be wrong." (Shkurti, 1990) This does not mean that the forecast he was presenting was a bad forecast. Instead it points out that there is an inherent uncertainty in any forecast and that predictive accuracy is often relative.

TABLE 2
Comparison of Canton and Summit County Forecast Accuracy

| Year | City of Canton | | | Summit County | | |
|------|----------------|----------------|----------|---------------|----------------|----------|
| | Forecast | Actual Revenue | Variance | Forecast | Actual Revenue | Variance |
| 1993 | \$32,133,850 | \$33,932,029 | 5.30% | NA | NA | NA |
| 1994 | \$33,388,200 | \$34,835,862 | 4.16% | NA | NA | NA |
| 1995 | \$35,165,825 | \$38,948,408 | 9.71% | NA | NA | NA |
| 1996 | \$37,928,000 | \$39,948,408 | 3.48% | \$78,931,917 | \$79,392,941 | 1.22% |
| 1997 | \$40,085,000 | \$41,841,863 | 4.20% | \$78,018,006 | \$83,743,189 | 14.36% |
| 1998 | \$41,847,504 | \$43,875,206 | 4.62% | \$85,817,510 | \$96,491,418 | 15.19% |
| 1999 | \$44,252,000 | \$44,738,350 | 1.09% | \$88,348,233 | \$100,472,534 | 18.31% |

On the other hand, regardless of how simple or sophisticated a model may be, with its inherent uncertainty, it still has to capture the relationship between a dependent variable, such as sales tax revenue, and an independent variable (or variables) such as personal income. Econometric models usually provide a better opportunity to capture this phenomenon than a time series or moving average, but econometric models are by no means foolproof (Shkurti, 1990). Most local government managers place little emphasis on the importance of how to quantify the relationship between the dependent and independent variables (Shkurti, 1990). Perhaps the reason is that each local government uses its own set of variables and with the diversity in variable use there is no one way to quantify the relationship. The accuracy of the revenue forecast depends largely on the correct solution and quantification of the independent variable all based on the forecaster's knowledge of the factors impacting his/her government (Jones, Bretschneider & Gorr, 1997).

Prior research (Bretschneider, Bunch & Gore, 1992) indicates that while cities do a very good job of forecasting taxes, they do a very poor job of formal revenue forecasts in terms of intergovernmental grants and other local sources of revenue. Interestingly, within the categories of Intergovernmental and Other Sources, counties and cities each exhibited opposite patterns. Counties had more than 40 percent error for other revenues and less than 30 percent for intergovernmental sources, while cities exhibited more than 40 percent error for intergovernmental revenues and less than 30 percent for other sources. This can be attributed to the differential reliance faced by counties and cities on these

two sources as well as the difference in the composition of this aggregation of sources (Bretschneider, Bunch & Gorr, 1992). Counties rely more heavily on intergovernmental sources and therefore become more sensitive and aware of the composition of the source. Concomitantly they have a greater incentive to forecast accurately while cities rely less on intergovernmental sources and focus more on user fees and other revenues (Bretschneider, Bunch & Gorr, 1992). MacManus and Groethe (1989) found that fiscally stressed counties have improved forecast accuracy using more sophisticated revenue forecasting methods and processes.

Bretschneider, Bunch and Gorr (1992) note that there are three distinctly different, major categories of local government revenue sources with roughly a third of total revenues coming from each revenue category. The three major categories of local government revenue sources are local taxes, other local sources, and intergovernmental grants and transfers. The authors explored revenue sources at both city and county government levels and examined the accuracy level of each category. They concluded that counties have fewer problems forecasting tax revenues than in forecasting intergovernmental and other revenues. These results suggest that county governments forecast tax receipts with relatively little error. Since property tax is the single largest revenue source, Bretschneider, Bunch and Gorr (1992) come to the conclusion that there is a tendency to focus their attention on this revenue source when forecasting.

RESEARCH METHODOLOGY

A descriptive case study approach was used to investigate and explicate the use and accuracy of formal and informal forecasting approaches. The study describes the forecasting process in two local governments in Ohio: Summit County and the City of Canton. Summit County was selected since they have a County Executive form of government. The City of Canton was selected because they have a Mayor-Council form of government. Other characteristics that made these two local governments attractive are that both have stability in terms of leadership and both have the same fiscal year that begins on July 1 and ends on June 30. The budget documents were examined in both the county and the city to compare what information is presented concerning forecasted versus actual revenue. As Bretschneider, Bunch and Gorr (1992, p.730) argue, revenue forecasts embedded in the budget

document are the “end result of a complex interaction of forecast techniques and organizational dynamics.”

Compared to Canton, Summit County is informal in its approach to revenue forecasting. There are similarities between organizational structures in each local government. For example, both local governments' budget offices prepare forecast estimates and work closely with the fiscal office in developing the forecast. An important caveat in considering this research is that this is a study of two Ohio local governments and may not be reflective of all local governments in Ohio. Therefore, more comprehensive research is needed in local government revenue forecasting in the future and a study of all Ohio local government revenue forecasting approaches and accuracy is planned as a follow up to this research.

THE REVENUE FORECASTING ENVIRONMENT IN OHIO

The organizational structure of local governments in Ohio is one where authority is diffused among a number of relatively autonomous elected officials. Competing demands from these officials place tremendous pressure on the budget of the city. There is great pressure for more optimistic forecasting, both from union groups and from elected officials. Pessimistic forecasts may result in lower wage packages for the unions, and reduce funding for needed programs.

There are several issues that impact the forecasting environment in Ohio government.

- First, revenue forecasting provides the basis for budgeting expenditures, devising strategies for collective bargaining, setting rates for taxes and fees; and is the foundation of long-term fiscal planning. In order for a local government to budget effectively, it must have a clear understanding of which resources will be available to it. Budgeting revenues and expenditures become difficult without reliable estimates of revenues. If the estimate is too low, the local government may not budget enough to provide the highest level of services possible; if the estimate is too high, the local government runs the risk of budget deficit, which is illegal in Ohio. Accurate revenue forecasting is a crucial part of the budget process.
- Second, reliable revenue forecasting is also critical for collective bargaining. For most local governments, human resource costs are

the greatest single expense. In Ohio, most public sector employees have the right to organize and bargain collectively with their employers. The ability of local governments to fund wage and fringe benefits it negotiates with its unions is legally required. Higher revenue forecasts may help employee unions secure higher wages; lower forecasts may result in lower wages. If a local government is to make a reasonable offer to its employees, it must be able to substantiate what it can and cannot afford. Revenue forecasting is the most important element of establishing ability to pay.

- Third, reliable revenue forecasts are important in the determination of rates and fees charged to citizens. Local governments must charge taxpayers and consumers only what is necessary to provide an adequate level of public services. Revenue forecasting, along with expenditure forecasting, is necessary for setting water and sewer rates, fees for licenses and permits, ambulance fees and the income tax rate.
- Fourth, revenue forecasting is important for purposes of long-term planning. Revenue resource availability is a major determinant of program viability, and long-term revenue forecasts can help local governments make policy decisions for future programs. An integral part of a strategic management system is a financial plan that includes accurate revenue forecasts.
- Fifth, revenue forecasts play a critical role in determining the fiscal health of a local government. A recent study of Ohio indicates that closer attention has to be paid to revenue forecasting because of fiscal problems resulting from (1) increased costs associated with state mandated programs, and (2) local plant closings (Beckett-Camarata, 2004). The increasing level of fiscal problems that local governments are facing is not based on short-term fluctuations, but instead on fundamental structural shifts in economic relationships that have occurred over an extended period of time (Wong, 1995). Thus, one important determinant of a government's ability to manage its finances is the quality of its revenue forecasts.

THE REVENUE FORECASTING ENVIRONMENT IN SUMMIT COUNTY

Summit County was formed in 1840. For 139 years, it operated under a three-commissioner form of government. In 1979, voters

decided it was time for change to a more open progressive county government and adopted a charter form of government that made it the first, and thus far, only county in Ohio to do so. The charter established a division of powers, similar to state and federal governments. This means that in areas where the traditional three commissioners have both administrative and legislative control, the county executive has the responsibility for the administrative duties while county council handles the legislative duties.

The executive oversees human services programs and a variety of essential service-oriented departments. While the county government is responsible for law enforcement and the justice system, assessment and collection of taxes, keeping of official records, and the maintenance and construction of roads and bridges, these operations are under the direction of independent officeholders elected by the people of Summit County.

The adoption of the charter granted Summit County home rule provisions. Counties without a home rule charter are governed by the Ohio Constitution and by the Ohio Revised Code provisions for county government. This is relevant to revenue forecasting because the citizens of Summit County voted in the late 1980s that the county should do five-year revenue forecasts. This is the first indication of the internal as well as external support to revenue forecasting in the county. Summit County does not use formal statistical models, but relies on historical data with human judgment.

The director and assistant director of the Office of Management and Budget were interviewed and their answers, along with relevant budgetary documentation, were used to arrive at the accuracy of revenue forecasting in Summit County. The assistant director of Summit County's Office of Budget and Management is in charge of producing a five-year revenue forecast on all general operating revenue and expenditures. The general fund revenue is outlined in Table 3. The main source of revenue for Summit County is sales tax, which is 30% of the total revenue. Other taxes such as property tax and property transfer tax also make up a high percentage of revenue, with little revenue in the licenses and permits. As McCollough and Frank (1992) noted, the high reliance of county governments on tax revenue translated into a higher emphasis on the forecasting accuracy of the source. Thus, the high

TABLE 3
Main Sources of Revenue: Summit County

| Revenue Source | 1998 Actual Total | Percentage of Total Revenue |
|------------------------|-------------------|-----------------------------|
| Sales Tax | \$28,651,349 | 30 |
| Taxes | \$22,718,927 | 24 |
| Licenses/Permits | \$63,884 | 0.06 |
| IGR Receipts | \$11,380,863 | 12 |
| Charges for Services | \$15,866,096 | 16 |
| Fines/Forfeitures | \$596,755 | 0.61 |
| Other Revenue | \$965,909 | 1.00 |
| Other Financing Source | \$5,154,904 | 5 |
| Interest Revenue | \$11,090,623 | 0.002 |
| Transfers-In | \$2,112 | 0.002 |
| Total | \$96,493,420 | 100 |

percentage of the tax revenue of Summit County would give an indication of a greater emphasis on forecasting accuracy of these sources.

Approach Used in the Summit County's Five-Year Revenue Forecast

According to the budget director, Summit County uses past trend analysis when generating its revenue forecast. It uses quarterly updates from its investment advisor on changes in investment income. While the indicators for the five-year revenue forecast are not specifically stated, assumptions are made on the increases expected for each revenue source, which are stated in the five-year revenue-forecasting document.

Summit County does not use any one specific model in its revenue forecast. The revenue forecasts are built mainly on historical trend data with special attention given to the general overall trends in the economy. Summit County uses various data sources, but no specific models are routinely used. The budget director works very closely with the fiscal director to keep abreast of changes in the revenue receipts and continually communicate with the real estate offices to keep current on changes in housing. They closely monitor changes in state laws that affect fees. Once the county official has gathered the historical data, economic indicators, and environmental factors affecting the county, the revenue forecast is assembled. Once the budget director's office

approves the estimated revenue, the document becomes the official five-year revenue forecast for the county.

The Accuracy Level of Summit County's Forecast

The 1996-2000 revenue forecast is the forecast used in this study. Table 4 illustrates the estimated revenue figures of the five-year revenue forecast for Summit County. The total estimated revenue for 1998-2000 is lower than actual revenue figures. This is despite certain assumptions in the revenue forecast of overall increases, such as a 3 percent rise in sales and user tax, or 2.2 percent rise in real estate and tangible personal property tax.

TABLE 4
Results of Prior Summit County Revenue Forecasts

| Year | Forecast | Actual | Variance |
|------|--------------|---------------|----------|
| 1997 | \$78,931,917 | \$79,392,941 | 1.22% |
| 1998 | \$78,018,006 | \$83,743,189 | 14.36% |
| 1999 | \$85,817,510 | \$96,491,418 | 15.19% |
| 2000 | \$88,348,233 | \$100,472,534 | 18.31% |

Monitoring and Reviewing the Summit County Revenue Forecast

Once the revenue forecast has been approved, it is reviewed on a monthly basis. The further out the forecast is into the future, the less accurate and reliable it can become. Summit County has an informal monitoring process. As mentioned previously, Summit County is a charter county that gives more power to the citizens than other forms of county government. Summit County is also different in another aspect in that revenue forecasting is a charter requirement. The charter states that a formal revenue forecast should be performed and state law dictates how it is done for certain revenue sources. The charter requirement was voted on in 1995, but Summit County had been producing revenue forecasts before that time. Thus, Summit County is required by the charter to "support" the revenue forecast.

Factors Affecting Forecasting Accuracy in Summit County, Ohio

Licenses and permits factors such as non-materializing of licenses and/or permit increases, changes in Ohio Revised Code procedures, and

lack of enforcement on collection of such revenue affect every forecast. As mentioned earlier, Intergovernmental Revenue (IGR) is difficult to forecast because departments really do not know beforehand precisely what the Federal/State government is going to award them. Several sources can be assessed in order to develop guidelines for Summit County.

Analysis of Forecasting in Summit County, Ohio

The further out into the future a forecast is, the less accurate it becomes. This is clearly the case with respect to Summit County. As Table 5 demonstrates, main sources of revenue sales tax and other taxes are within 10 percent of actual over estimates. This can be contributed to the fact that the more reliant a government is on a source of revenue, the more accurately the revenue will be forecasted. Fines and forfeitures are recorded at 15 percent of actual over estimates. Although this is not a large revenue source, more accurate forecasting of the revenue source would help provide better allocation of resources at budgeting time. Differences are even more pronounced when looking at Other Financing sources. According to Table 5, actual revenue collected for this source was -81 percent under estimated revenue. This suggests that funds that

TABLE 5
Weighted Revenue Forecasts Compared to Actual 2000

| Revenue Source | Forecasts | % Forecast | Actual | Variance | %Variance |
|-------------------------|--------------|------------|---------------|---------------|-----------|
| Sales Tax | \$27,689,490 | 31 | \$30,432,170 | \$2,741,680 | 10 |
| Taxes | \$22,000,964 | 25 | \$23,711,052 | \$1,710,088 | 8 |
| License/Permits | \$71,000 | 0.08 | \$56,886 | (\$14,114) | -10 |
| IGR Receipts | \$9,891,628 | 11 | \$14,288,733 | \$4,397,105 | 44 |
| Charge for Services | \$14,659,549 | 17% | \$16,232,012 | \$1,572,463 | 11 |
| Fines/Forfeitures | \$493,733 | 1 | \$567,321 | \$73,588 | 15 |
| All Other Revenue | \$1,045,772 | 1 | \$3,483,860 | \$2,880,809 | 233 |
| Interest Income | \$7,490,880 | 8 | \$10,371,689 | \$2,880,809 | 38 |
| Other Financing Sources | \$5,005,217 | 6 | \$962,156 | (\$4,053,061) | -81 |
| General Fund | \$0 | 0 | \$376,655 | \$376,655 | - |
| Total | \$88,348,233 | 100% | \$100,472,534 | \$12,124,301 | |

depend on revenue from this Other Financing sources will be underfunded and cuts need to be made in expenditures. Some programs or agencies that used the revenue forecast for planning purposes will continue to be unable to actualize some of their functions or programs planned, or at least have to do some sort of maneuvering of funds to actualize already anticipated activities.

Licenses and permits become even more inaccurate in Table 5 where actual revenue collected is 10 percent less than estimated. The funding source demonstrating the lowest accuracy levels are Other Financing Sources with actual collected -81 percent of estimated. On the other hand the main sources of revenue are still fairly accurate with actual collected being less than 10 percent of estimated. What is more important, the main sources of revenue are close to estimated revenue. This leads one to conclude that on average, Summit County's five-year revenue forecast for main revenue sources can be considered fairly accurate, but this also takes into account the inadequate performance of some individual revenue sources in individual years, as Table 5 demonstrates.

THE REVENUE FORECASTING ENVIRONMENT IN THE CITY OF CANTON

The City of Canton is located in Stark County, approximately 58 miles southeast of Cleveland. It was incorporated as a village in 1828 and became a city in 1854. In 1990, the US Census estimated its population at 84,161, making it the ninth largest city in the state. The city's population has steadily declined since 1950, when there were an estimated 116,119 residents. Canton is a rust-belt city that has suffered long economic decline with the move of US steel manufacturing abroad. The city struggled to generate revenue because of the resulting high unemployment, poverty, poor housing stock and a thriving suburban neighborhood. The City of Canton is subject to the structural arrangement contained in the Ohio Revised Code. Canton is dominated by one industry, Timken, which is extremely sensitive to fluctuations in industrial production in the world economy.

Approach Used in the City of Canton's Five-Year Revenue Forecast

Various officials have an impact on revenue forecasting. The City Treasurer, for example, is responsible for the collection and

administration of the income tax. The Treasurer is also responsible for the investment strategies of the City. The Board of Health sets its own rate for fees, while City Council, a body of twelve elected officials, sets most other rates in the City.

In Canton, politics dominates the decision-making process. This erects barriers and challenges open communication between elected officials each of whom has a great deal of influence over revenue and expenditures. Such diffusion of authority and interests makes organized and uniform action, as well as planning, a difficult task. Further, the official fiscal officer is the Auditor, who is elected by a popular vote. It is his or her statutory obligation to estimate annual revenues, and to submit those estimates to the County Budget Commission for certification. These estimates are the legal basis on which all appropriations are made. These projections are submitted at the beginning of each fiscal year and are revised throughout the year. There is no statutory obligation for multiyear forecasts, and no such effort has been made in recent history.

The city is also required in July of each year to submit a Tax Budget for the next fiscal year to the County Budget Commission. The Tax Budget has three purposes: (1) to establish the need for property tax levies for the next fiscal year; (2) to determine relative need for the distribution of Undivided Local Government Funds (an assortment of state collected taxes redistributed to each County and its subdivisions); and (3) to provide the basis for the initial Certificate of Estimated Resources, which is subsequently amended when the City Auditor submits his estimates at the beginning of the fiscal year. The Tax Budget

TABLE 6
Results of Prior City of Canton Revenue Forecasts

| Year | Actual Revenues | Auditor's Official Certificate | Auditor's Certificate Variance | Mayor's Tax Budget | Mayor's Tax Budget Variance |
|------|-----------------|--------------------------------|--------------------------------|--------------------|-----------------------------|
| 1993 | \$33,932,029 | \$33,500,000 | (1.27%) | \$32,133,850 | (5.30%) |
| 1994 | \$34,835,862 | \$34,908,268 | 0.21% | \$33,388,200 | (4.26%) |
| 1995 | \$38,948,408 | \$36,860,000 | (5.35%) | \$35,165,825 | (9.71%) |
| 1996 | \$39,948,408 | \$37,632,444 | (4.22%) | \$37,928,000 | (3.48%) |
| 1997 | \$41,841,863 | \$38,694,513 | (7.52%) | \$40,085,000 | (4.20%) |
| 1998 | \$43,875,206 | \$41,391,699 | (5.66%) | \$41,847,504 | (4.62%) |
| 1999 | \$44,738,350 | \$43,020,000 | (3.84%) | \$44,252,000 | (1.09%) |

is prepared and submitted by the Mayor's Office. As a result there are two different sets of revenue forecasts each fiscal year. Both sets of forecasts rely heavily on a combination of qualitative and simple deterministic methods. Both sets of estimates tend to be conservative, reflective of the underlying trend for local governments identified by McCollough and Frank (1992). The following table details General Fund Revenue Forecasts by both offices and their relationship to actual revenues.

The Accuracy Level of Canton's Forecasts

The table suggests a tendency toward underestimation of revenues and supports Wildavsky's view that some local officials may feel more comfortable with a less than accurate judgmental forecast than a more accurate quantitatively derived forecast (Wildavsky, 1986.) The underestimation of revenues may be motivated by a desire to maximize windfalls and to minimize shortfalls. Shortfalls in revenue may require a mid-year reduction in appropriations, which would be politically undesirable. The Official Certificate was underestimated by an average of 3.95% from 1993 to 1999, and the Tax Budget was underestimated by an average of 4.65 % over the same period. Forecasts did not anticipate the massive economic recovery of the mid-1990s. However, the tendency toward underestimation continues, even in light of the improved economic climate. While conservatism may be prudent forecasting policy, narrowing the margin of error would provide the City with better more accurate planning tools.

Factors Affecting Forecasting Accuracy in the City of Canton

One important impediment to forecasting is the quality and quantity of available data. Annual revenue data is available but the city does not maintain monthly data. Thus, seasonal trends are smoothed out in annual revenue numbers. An analysis of seasonal trends in General Fund revenue data will not be possible with the current data available, though better record keeping may allow for the creation of forecasting tools that will facilitate any needed mid-year corrections to annual forecasts.

Another impediment to forecasting accuracy comes from the city tax code. Each year the city requires payment of corporate income taxes based on estimated income. The code also allows for retroactive tax breaks on capital investment. In the years before and during economic expansion, profits were almost always underestimated. However, an

economic slowdown in the city's major industries has resulted in large over-estimations in income, and record-level refunds in corporate taxpayers. One company alone received a \$600,000 refund in 1998, and another received a \$350,000 refund at the end of 1999. Companies are adjusting their estimates, resulting in huge reductions in corporate receipts in the current period. For example, one company sent \$700,000 less in income taxes than it had just one year earlier. These post periods adjustments distort the historical data, and make reliable future projections difficult.

DISCUSSION

The methods used in Canton range from very simple to relatively complex. Each method required some degree of qualitative analyses, which is not unusual for any forecast. The analyst must have a basic understanding of the revenue sources and their interrelationships, of factors that do not appear in the raw data and of the laws and agreements that affect revenues. This kind of qualitative knowledge is essential for every method of revenue forecasting. In an era of desktop forecasting software that imports Excel spreadsheets, even small or medium sized communities could begin to utilize simple or moderately complex time series models with fairly little effort (Cirincione, Guerrieri & Van de Sande, 1999; Wong, 1995). The use of BusinessPro or ForecastPro would be relatively straightforward to learn and use in improving forecasting accuracy.

Using multiple regression for projecting income tax and Undivided Local Government Funds and Undivided Local Government Funds is the most complex of the methods used by Canton. The use of statistical software such as SPSS can help the forecaster avoid many of the complex calculations involved in multiple regression. An understanding of statistics is important to this analysis. The forecaster must understand tests of significance, coefficients of determination, and other types of statistical information and how to apply them to analysis of revenues. If a local government has staff trained in statistics, the quantity and quality of data necessary, and computer software such as SPSS, it can use multiple regression to forecast revenues. More advanced econometric models may yield more accurate results, but they can be cumbersome and require advanced training in economics, mathematics and statistics. The resources required for econometric analysis are not easily acquired

by small to medium sized local and municipal governments and are usually reserved for large cities, the states and the federal government.

The other methods employed in Canton's analysis were both time series and simple deterministic models. Calculating moving averages is relatively simple for an analyst with rudimentary skills in spreadsheet software such as Excel. Time series analysis requires some understanding of basic statistics, but is relatively simple to perform using spreadsheets. It can be performed with a calculator and a piece of paper. Given enough historical data, any analyst should be able to perform time series analysis with nominal practice time.

The use of multiple regression by Canton to forecast income tax data provides the most accurate results. The average deviation from actual results was 0.5%. This high degree of accuracy makes multiple regression a useful tool for projecting income tax revenues, provided that the independent variables are chosen carefully. If local governments have the resources to use multiple regression, they can use this advanced technique to forecast economically sensitive revenue sources like income tax. However, regression gives equal weight to all data points in making forecasts. Prior research (Wheelwright & Makridakis, 1987) suggests that techniques such as exponential smoothing or Box-Jenkins, which puts greater weight on time periods closest to the forecast, are more likely to be accurate (Giannakis & Frank, 1993).

In the case of Canton, the use of time series analysis does not provide as high a degree of accuracy as multiple regression. The average deviation from actual results ranged from one to five percent, depending on the revenue source. However, if the historical data were more reliable, the time series projections may have yielded better results. The ease of use for time series models makes them attractive to governments with limited resources. They also provide a more rational basis for projections than the purely qualitative approaches often used by local governments. Volatile data can be refined using exponential smoothing and moving averages. Refinement of the data as well as a detailed understanding of the revenue sources can make time series analysis a fairly accurate and simple method of projecting revenues.

The city of Canton uses a variety of methods such as multiple regression and time series analysis, depending on both the revenue source and the quality, quantity, and mix of the data available. This has some unique advantages over a strict adherence to a single approach.

The relative strengths of particular approaches can be maximized through application to specific revenue sources that are best suited to those methods. One of the weaknesses of a time series approach, for example, is that variable data, such as one-time fluctuations caused by unusual circumstances, can skew historical data, or make future projections inaccurate. By applying judgment to the quantitative data, some of the inaccuracies can be avoided. In the case of the City of Canton, the quality, quantity and mix of the data did not allow purely causal approaches for most of the sources of revenue, so blended time series and judgment approaches were necessary. Most local governments have neither the data nor the expertise to perform wholly causal analysis, and blended approaches may allow for the use of rational techniques such as time series, while keeping the advantages of expert knowledge.

Multiple regression, the method used for projecting income tax and Undivided Local Government Funds, is the most complex of the methods used. The use of statistical software such as SPSS can aid in avoiding many of the complex calculations involved in multiple regression. An understanding of statistics is fundamental to using SPSS. The forecaster must understand tests of statistical significance, coefficients of determination and other types of statistical information and how to apply them to the analysis of revenue. If a local government has staff trained in statistics, the quantity and quality of data necessary and computer software such as Excel and SPSS, it can use multiple regression to forecast revenues. More advanced econometric models may yield more accurate results, but they can be cumbersome and require advanced training in economics, mathematics, and statistics. The resources required for econometric analysis are not easily acquired by small-to-medium sized local governments and are usually reserved for large cities, the states and the federal government.

The other methods that can be used are time series and simple deterministic models. Calculating moving averages is relatively simple for an analyst with rudimentary skills in spreadsheet software such as Excel. Time series analysis requires some understanding of basic statistics, but is relatively simple to perform using spreadsheets. It can be accomplished with a calculator and a piece of paper. Given enough historical data, any analyst should be able to perform time series analysis.

SUMMARY AND CONCLUSION

This article explored revenue forecasting approaches and forecasting accuracy in two Ohio local governments. There is a significant difference between the forecast methods used in Summit County and the City of Canton. Summit County uses human judgment applied to all revenue, while the City of Canton uses a variety of models depending on the sort of revenue being forecasted. As mentioned previously, more complex and sophisticated models do not necessarily lead to more accurate forecasts, but there is indication that more formal approaches do seem to make a difference.

The study provides some insight into how the use of informal human judgment forecasting approaches in Summit County affected forecasting accuracy. Summit County's approach resulted in forecast variances of 1.22 to 18.31 percent of aggregated revenues. The range of forecast variance in aggregated revenues using human judgment is near but most often outside that considered reasonable, e.g., +/- 5% (Frank, 1988; MacManus & Groethe, 1989). Further, the study provides insight into how the use of simple, formal forecasting approaches in the City of Canton resulted in aggregate revenue variances from 1.09 percent to 9.71 percent, much tighter and more accurate forecasting.

On the other hand, for all four years, Summit County's actual Sales Tax and Other Tax revenues did not exceed the estimated revenues by more than 10 percent. All other categories, however, substantially varied using the human judgment forecasting approach. Although forecasting variance should preferably be as low as possible, it can be considered relatively accurate considering that the revenue forecast is based on an informal human judgment approach. It is also important to point out that while on the aggregate level Summit County forecasts appear to be reasonable, when viewed on a revenue source by source basis, the forecasts vary from a negative 81 to a positive 233 percent.

Two conclusions can be drawn from this study. The first is related to the differences between the accuracy of the informal, human judgment forecasting approach used in Summit County government and the formal forecasting approaches used in Canton's city government in Ohio. Formal forecasting is more accurate than informal. Further, the research finds that forecast accuracy varies by level of revenue aggregation. For example, when revenue sources are disaggregated and weighted, the Summit forecasts vary radically. Additionally, depending on the revenue

source, simple formal methods may be more appropriate than complex. Since the level of aggregation of the revenue source has an impact on forecast accuracy, it may be necessary to forecast individual sources and weight them proportionally in order to maximize overall accuracy. The case findings support Bretschneider, Bunch and Gore (1992) in that sales and other taxes were most important to Summit County and the county has had little difficulty in accurately forecasting tax revenues. The findings also support McCullough and Frank's research that quantitative/formal forecasts tend to be more accurate than judgmental.

The second conclusion is that Ohio local governments undergoing fiscal stress still tend to focus more on cutting expenditures and less on improving revenue forecasting which could yield more accurate revenue forecasting capability. Losing sight of the benefits of formal forecasting has major policy implications in Ohio. On the policy level, steps should be taken to encourage more formal training in more formal forecasting methods. Research including the findings of this case study has established that quantitative forecasts tend to be more accurate than judgmental. The City of Canton is rapidly moving in that direction.

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