Automating Bias

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The expenditures of American local governments account for over half of all domestic governmental expenditures and support a wide array of services affecting peoples' everyday lives; budgeting processes of local governments have become prime targets of reformers. By shifting greater budgetary control to elected officials and the general public, reformers hope to enhance the public accountability of governmental taxing and spending policies.

A series of technical reforms reflect this concern for improving public control of governmental budgeting decisions. Underlying and extending beyond these efforts is the development of more sophisticated computer-based information systems. One of the most technologically advanced and potentially far-reaching of these is a family of computer-based models which we have called "Fiscal Impact Budgeting Systems" (FIBS). While FIBS are largely promoted as a tool for increasing the rational control of budgetary decision making, their use is unlikely to have this effect. Ironically, FIBS are as likely to reinforce the existing biases of budgetary decision processes as they are to be an instrument for reform.

FIBS are large-scale, comprehensive computer models which forecast local government service needs, expenditure levels, and revenues for the coming fiscal year(s). Such forecasts are based on historical expenditure and revenue data; community land use, housing and demographic data; governmental characteristics; intergovernmental funding relationships; taxation rates; and projected changes in these characteristics. The models define the relationships among these elements by sets of mathematical equations and instructions. The projections from the models can be of direct relevance to governmental budgeting decisions if they are made at a level of detail which reflects the budget categories of operating departments.

Fiscal impact budgeting systems generally are comprised of leading-edge urban development, fiscal impact, and budgeting models which are linked so that the outputs of some component models are inputs to other component models. The result is a new kind of "system level" model which can serve a function much broader than, and different from, the fiscal impact and urban development models used by planners in the past. These more traditional analyses range from back-of-the-envelope methods for estimating the costs and revenues of a projected population change to finely tuned and sophisticated models which project the costs and revenues of new land uses. Such methods are components of many FIBS but fall short of a complete system. Likewise, urban development models, which have been analytical tools of planners, are often components of FIBS but fall short of a complete system. Urban development models range from both regional and subregional population and employment allocation models to functional models of transportation, air quality, water, and sewer services. These models sometimes give attention to cost and revenue impacts, but seldom have been linked to budgetary processes. It is more useful to view fiscal impact budgeting systems as an outgrowth of large-scale corporate planning models in the private sector than as natural extensions of traditional fiscal impact analyses.

Diffusion of Fiscal Impact Budgeting Systems

Fiscal impact budgeting systems are important because they might shortly be widely diffused among local governments. Urban fiscal problems have created a receptivity to management reforms like FIBS which promise to improve the productivity of local governments. These fiscal problems refer to the general inability of local governments to respond to their financial predicament. Local government officials are faced with public pressure to reduce taxes and with rising costs and heightened demands for government services. This fiscal crisis is magnified in many metropolitan areas by continuing disparities in the distribution of resources and needs. The suburbs have the greatest ability to pay, while central cities have the greatest need for governmental services. Typically, local governments are too weak politically to cut taxes and spending sharply, to increase taxes sufficiently to meet escalating costs and demands, or to redistribute resources.

The growth of state and federal aid to local governments and the shifting of more functions to counties, metropolitan-wide jurisdictions, and special districts are feasible approaches to increasing local revenues and lessening fiscal disparities. However, intergovernmental aid

0147-2011/80/0115-0009$02.50/1

has reached politically unpopular levels, and metropolitan consolidation efforts have met continuing and increasing resistance. Consequently, local governments are pushed towards politically more popular options for alleviating their financial problems and managing conflicting demands. One option has been to increase the municipal debt, passing the political buck to future generations. This option is closed to local governments with strict legal limits on indebtedness. Furthermore, overindebtedness has contributed to the near financial collapse of more cities than New York and Cleveland. A more prevalent option has been a search for ways to enhance productivity by improving the quality of local government taxing and spending decisions.

The widespread diffusion of management science models has created a receptive intellectual climate which is likely to facilitate the adoption of FIBS. Although few cities and counties had adopted computer models by the mid-1970s, the use of various models by local governments has at least tripled from 1975 to the present. The most widely adopted models have been and will be in the budget and management area. Twenty-five percent of U.S. cities over 50,000 and 11 percent of counties over 100,000 had an expenditure forecasting model in 1975. Twenty percent of the cities and 14 percent of the counties over 100,000 had a revenue forecasting model. By now, each of these kinds of models is likely to have been adopted by a full third of U.S. cities and counties. Moreover, a small but growing proportion of local governments have adopted FIBS. With some exceptions, these local governments tend to be increasing in population, located in the sunbelt, relatively professional, and relatively affluent. FIBS have been adopted initially as a planning tool for forecasting the consequences of urban development and implementing selective growth management policies. Yet in some local governments, the models are already being used as a management as well as a planning tool. The models are potentially as useful to developed, and even decaying, cities as to the developing cities. They can be used to forecast the fiscal impacts of changing federal and state funding levels, population decline, redevelopment projects, or tax reductions. The market for FIBS is vast.

Given this market, there are an adequate number of models and suppliers to support and promote the widespread diffusion of FIBS. There are about ten versions of FIBS within the U.S. today which can be relatively easily transferred. The most generalized software packages for fiscal impact budgeting are the Municipal Impact Evaluation System (MUNIES), the Fiscal Impact Analysis System (FIAS), the Local Government Fiscal Impact Model (FIM), and the Fiscal Impact System for Communities (FISCOM). These packages have strong institutional bases for marketing, are similar in their overall purpose, and are competing models in the local government marketplace. The relatively low cost of acquiring FIBS by local governments facilitates their widespread adoption. Costs range from a few thousand dollars for the purchase of a user's manual to about fifty thousand dollars for installation of the largest model.

FIBS in Theory and Practice

FIBS are a classic management science response to a classic policy problem—developing more rational control by elected officials and the general public over decisions that affect the fiscal position of government. FIBS are expected to do this through improvements in information processing, content, and flows.

FIBS are expected to greatly facilitate the work of budget and management analysts in making service, revenue, and expenditure projections for the coming fiscal year(s). By utilizing the recordkeeping, calculating/printing, record-restructuring and sophisticated analytical capabilities of the computer, FIBS are designed to reduce the workload of menial and exacting tasks involved with budget decisions. The time of budget and management analysts can be more appropriately focused on reviewing such decisions as the reasonableness of budgeting assumptions rather than the accuracy of routine calculations. In this way, budget and management analysts will be able to provide more timely and adequate support to top management and elected officials.

The main impact of FIBS is expected improvement in the content of information available to central management, elected officials, and the general public. FIBS are expected to insure more accurate information, permit analysts to explore a wider range of alternative policy decisions, and free budgetary decisions from traditional incrementalist budgeting assumptions which artificially constrain policy alternatives. By providing more and better information to elected officials and the public, FIBS might then enhance the rationality of public control over budgetary decisions.

FIBS are expected to alter the character of information flows. FIBS might accomplish this, first, by presenting forecasts of the service, revenue, and expenditure implications of alternative policy decisions in a simple format (e.g., comparable to local government budget documents) that is directly relevant to lay officials. Second, FIBS are expected to change information flows by presenting elected officials with information which is less filtered and distorted than that available through the more traditional decentralized and fragmented budgetary process. Third, FIBS are expected to have a major educational role by informing elected officials and the public not only of the fiscal impacts of decisions but also of the major assumptions underlying these fiscal projections.

Whether these expectations are realized in practice is problematic. Some research indicates that many local governments have failed to achieve the expected benefits of computer-based information systems due to the manner in which their systems have been implemented at the local level. Other research suggests that decision makers sel-

dom make particularly effective use of information, even when available.

The potential of FIBS to increase the control of elected officials and the general public over budgetary decisions might be realized by the following improvements: (1) facilitating the work of management and budget analysts, (2) improving the accuracy of information, (3) enabling officials to explore a wider array of policy alternatives, (4) freeing officials from traditional incremental budgeting practices, (5) simplifying decisions by reducing complexity through the modeling process, (6) centralizing information flows, and (7) educating elected officials and the public. Do the experiences of local governments support these expectations? And even if these expectations are fulfilled, will local government decision makers utilize this information to enhance rational public control over budgetary decisions?

There is little doubt that computers increase the speed, ease, and accuracy of information-processing tasks. Interviews with local government management and budget analysts reinforce this benefit in the case of FIBS. In fact, officials in one of the earliest cities to adopt a FIBS claim these technical benefits to be the only benefits of FIBS. According to one of their top budget officials, their use of a FIBS model has simply increased the speed, ease, and timeliness of calculations and bookkeeping procedures that were done manually prior to their adoption of a FIBS. In response to inquiries from cities considering adoption of their model, they have recommended against adoption unless the jurisdiction is of sufficient size to justify the costs of the model simply as a high speed calculator. While officials of other cities often attribute more benefits to FIBS, most officials agree that FIBS do facilitate the work of budget and management analysts in preparing service, revenue, and expenditure forecasts as compared to manual procedures done with the aid of a hand calculator.

FIBS might be justified if they simply provided more accurate revenue and expenditure forecasts than currently available. Such accuracy would not only facilitate more rational decisions but also improve financial management by permitting less conservative estimates of revenues and more liberal expenditures, given that uncertainty leads most budget makers to be on the safe side (underestimating revenues and therefore budgeting lower expenditures than might be made with more accurate estimates). However, the accuracy of FIBS forecasts are largely unknown and the reliance on these estimates, even if accurate, might increase the vulnerability of local governments to unpredictable revenue and expenditure fluctuations.

The questionable accuracy of FIBS derives from three considerations. First, the validation of these models is based normally on studies conducted in sites where these models were developed. The transfer of these models to other governments raises questions of their generality. Second, the accuracy of the forecasts is dependent on the quality of assumptions and input data developed at the local site. For example, historical budgetary data is often used for projections although budgeted allocations are likely to differ significantly from actual revenues and expenditures given the generally wide latitude of urban administrators in executing local budgets. Third, many of these models are anchored in data several years old. Most models are heavily dependent on U.S. census data. One of the most sophisticated FIBS takes census data from 1970 to project 1971 estimates. These 1971 estimates are then used to project 1972 estimates and so on until projections are made for the upcoming fiscal year. By making estimates on the basis of estimates in combination with local guesstimates, the models task the confidence of even the most loyal modeler.

Increased vulnerability of organizations to unpredictable revenue and expenditure fluctuations might well result from the perceived accuracy of forecasting tools such as FIBS. That is, as budget makers become more confident of revenue and expenditure forecasts, they are likely to match more closely budgeted expenditures with anticipated revenues. They will be less likely to estimate revenues conservatively and therefore be less likely to budget expenditures conservatively. Yet natural disasters, excessive snowfalls, radical fluctuations in the municipal bond markets, public employee strikes, and so forth cannot be anticipated. Such unpredictable fluctuations might well create short-term fiscal crises for governments which have moved away from more traditional and conservative financial management strategies.

Governmental budgets are traditionally based on a very limited search of alternative taxing, spending, and (re)development policies. This is a function of both the incremental nature of budgetary decision making and the complexity of evaluating the budgetary implications of alternative decisions. Complexity leads the rational decision maker to a limited search for a satisfactory alternative. Fiscal impact budgeting systems are thought to provide the technical capability for participants in the budgeting process to evaluate the budgetary impacts of a broader array of alternative taxing, spending, and (re)development decisions. A major benefit of FIBS derives from their use as high-speed calculators and bookkeepers. The consequences of slight variations in model assumptions can be rapidly computed with most computerized FIBS—an impossible bookkeeping task without FIBS.

In practice, however, local government officials place severe restrictions on the number of alternative scenarios which are evaluated with a FIBS. One southwestern city utilized a FIBS model to compare only two policy alternatives, a managed growth plan versus the continuation of current growth trends. In an effort to simplify decision making and to manage the complexity of using the model itself, officials are reluctant to use FIBS in the very way they might be most beneficial. In addition, FIBS might actually narrow the array of alternatives considered by portraying the budget as externally determined by changing environmental conditions. Rather than FIBS answering many "what if" questions of decision makers, FIBS

forecasts sometimes evolve into self-fulfilling prophecies, for they prescribe the "rational" budgetary response to a changing urban environment.

The traditional means for simplifying the budgetary decision-making process is reliance on incremental decision making. Decision makers focus their attention on deviations from last year's budget requests and assume that past decisions remain acceptable. Incrementalism is commonly criticized as theoretically irrational even if practically rational given the nearly impossible task of reconsidering all controllable budget items each fiscal year. FIBS may offer an alternative means for simplifying budgetary decisions by prescribing service and expenditure needs on the basis of environmental data and, therefore, allow more radical departures from incremental decision rules than possible in the past. A major problem with this argument is the dependence of most FIBS on historical service, revenue, and expenditure data to derive estimates of model parameters (such as the number of patrol officers required per capita) and make forecasts. That is, FIBS are based on incrementalist assumptions regarding the acceptability of past decisions. Use of FIBS is likely to reinforce decisions which are consistent with decisions based on traditional incremental decision making rules.

A major impetus for the development of management science models generally and FIBS specifically is the complexity of problems confronting decision makers. By consciously ignoring some phenomena and emphasizing others, models aim to reduce the complexity of the real world to a manageable level. FIBS introduce a wide array of simplifying assumptions and provide budgetary forecasts in formats no more complicated than the budgets of local governments. Yet FIBS introduce a new complexity to the budgeting process. One virtue of computer models is that a large number of parameters, variables, and interrelationships can be incorporated. As a consequence, most FIBS are incomprehensible, or at least extremely complex, to most users. Very few people understand the underlying structure and logic of FIBS. The developers of FIBS do not have a clear understanding of their competitors' models. Their size, complexity, and proprietary status combine to make FIBS too complex for local government decision makers to understand. As a consequence, FIBS place a new demand on decision makers who seldom trust and use techniques which are not understood.

Budgeting models could alter information flows such that top elected officials have better information to control budgetary decisions. Traditionally, major budgetary decisions are fragmented and decentralized among the various departments and agencies of local governments. Budgeting models could provide elected officials with independent and objective estimates of departmental and agency needs with which they can counter budget requests.

FIBS supposedly provide objective information. Governmental budgets are traditionally more dependent on internal decision criteria than are the budgets of organizations in a market environment which have more clear and concrete environmental information. Fiscal impact budgeting systems are designed to assess the taxing and spending implications of environmental information which is widely available to local governments. Some hope (while others fear) that local government budgeting decisions may become less dependent on internal decision criteria such as the forcefulness of a department head or the weight of an interested group. By linking revenue-expenditure forecasts to objective and quantitative environmental data, these forecasts might be less subject to manipulation by departments and agencies seeking to maintain and enhance their resources during the annual budget cycle.

The "objectivity" of FIBS model outputs is at best unclear and at worst a fiction. FIBS are likely to introduce systematic biases into revenue-expenditure forecasts which are invisible to local government decision makers due to the complexity of the models. For example, FIBS models often have a pro-growth bias because users normally "overweigh" the short-term revenue gains and "underweigh" the long-term carrying costs of population growth.

Implementation of FIBS requires that local government officials make many assumptions and estimates of such factors as the number of patrol officers required per capita, the rate of inflation, and the revenue capacity of single family housing. Most FIBS models require literally hundreds of such simplifying assumptions on the part of the adopter. These assumptions generally are not made by the top elected officials. Rather, as in the past, such technical decisions are passed down to the department and agency levels, although central management staff often coordinate the completion of this process of specifying the model. In short, FIBS produce outputs which appear far more objective than they are in fact.

Similarly, the independence of information reaching elected officials is more apparent than real, given the manner in which FIBS are implemented. The high degree of departmental involvement in developing the initial service, revenue, and expenditure assumptions provides the departments with ample opportunities to inject their traditional biases into the final model outputs. The mystique and authority surrounding computer models might even enhance the credibility attached to these outputs. FIBS are more likely to decrease rather than increase the influence of elected officials over budgetary decisions by giving more credibility to departmental opinions.

FIBS might serve an educational function by making the assumptions underlying budget forecasts more explicit, increasing the sensitivity of officials to the fiscal impacts of their choices, learning-by-modeling, and providing a new tool for public oversight of governmental decisions. The experience of cities now using FIBS suggests these impacts are quite limited and entail some dysfunctional side effects.

FIBS are expected to make revenue-expenditure assumptions explicit and therefore open to debate. Unfortunately, there are two major problems in accomplishing this outcome. The first is that the proprietary nature and complexity of some FIBS prevent an explicit consideration of a number of model assumptions. Even if local governments had the inhouse capability to evaluate models by means of structural and sensitivity analyses, the size and complexity of the models would make such exercises extremely difficult and costly. Secondly, assumptions and biases which might enter during the implementation phase within a particular local government might be documented and in that sense made explicit. Given that literally hundreds of these assumptions are made through a normally decentralized process, few if any individuals could carefully evaluate the reasonableness of a large proportion of these assumptions. Even fewer people would comprehend the cumulative and interactive effects of the complete set of assumptions.

Budgeting models are expected to make the fiscal consequences of local government decisions more visible and hence more accountable to public scrutiny. This is the most commonly expected educational impact of using a FIBS. However, this impact might well be the most inherent bias attached to FIBS use. For example, the very use of a fiscal impact budgeting system will tend to focus attention on the fiscal impacts of decisions and deflect attention from social and environmental impacts. Increased public sensitivity to fiscal impacts might well decrease public sensitivity to social and environmental impacts. Few fiscal impact budgeting models incorporate social or environmental costs of benefits into their framework.

The process of modeling might be an educational process for elected officials. Research on the use of computer models, especially urban development models, suggests that the modeling process has an educational benefit. However, Martin Greenberger, Matthew Crenson, and Brian Crissey suggest that one of the primary functions of modeling is the education of the modeler, not the model user. Modeling develops a small group of experts informed by the modeling effort. Unfortunately, this small group of experts is not composed of elected officials—the users of FIBS. The education of budget and management analysts and department staff seldom enhances public control, rather it increases the influence of the technical experts.

Modeling is sometimes expected to serve an even broader community educational function. A model might serve to crystallize debate, clarify conflicts, and sharpen the precision of public discussions. The use of multiple models, adversary modeling, and counter modeling could become an extremely valuable community teaching aid. We are aware of only one city in which such a process was approximated. In this case, counter modeling developed only after years of protracted community conflict over growth policy. Both pro- and anti-growth advocates were eventually armed with their own models. Given that FIBS are likely to be used on a frequent basis for normally routine budgetary decisions, their use is unlikely to provide the time or provoke the intensity of opinions which spurred such counter-modeling efforts. In some documented cases of counter modeling, the efforts were often instrumental in blocking or delaying decisions, and tended to deflect debate from substantive issues to the entrails of the opposing models. It is doubtful that FIBS will serve as a tool for increasing public oversight.

Most of the expected improvements attributed to FIBS have not been realized by local governments which have implemented them. Even if these improvements were realized, would these models be utilized in ways which would enhance the rational control of budgetary decisions? Here again, our case studies and the computing literature suggest that FIBS are more likely to be used to reinforce existing biases than as a rational tool for decision making.

Computer-based information is often used selectively. The experience of one northern city in which a major FIBS was developed is illustrative of a general tendency. During the development and implementation phase of the model, its use was supported by elected officials with a pro-growth orientation. After the general election, not only did the pro-growth elected officials disappear, but also the model which was perceived as supportive of a pro-growth policy.

Models are commonly employed to serve political functions contrary to the rationality motives used to justify their adoption. These political functions of models include their use to block or delay rather than to solve a particular decision problem. Models also serve as a symbolic response to problems. Modeling problem solutions might be the contemporary equivalent of "referring it to a committee." Models are often used intentionally to shift the relative priority of different interests in the decision-making process by altering the budgetary process and outcomes.

Embedded within every fiscal impact budgeting system are explicit and implicit assumptions and theories which can systematically influence the model outputs in ways which advantage certain groups or interests within the local community. Models are seldom neutral, unbiased reflections of existing scientific theories used to raise the factual basis of debates among opposing interests. Rather, models are most often developed in ways which incorporate biases which purposefully favor different interests. For example, fiscal impact budgeting systems can be developed such that they have a pro-growth bias by overweighing the short-term revenue gains and underweighing the long-term carrying costs of population growth. In addition, models are embedded with various normative assumptions and biases that exist less by design than by the numerous technical choices made by the model designers.

Use of a fiscal impact budgeting system for selective growth management is likely to bias decisions in favor of fiscal conservatism instead of other ends like maximizing

urban amenities, redistributing wealth, or increasing the quality of social services. Not only does the use of a fiscal impact budgeting system suggest that fiscal impacts are considered important criteria to the decision makers, but also that decision makers will be more likely to take fiscal impacts into account because the model makes such information available and lessens the importance of internal decision criteria.

The political use of fiscal impact budgeting systems can influence the outcomes of governmental decisions. Models can be used as a tool to gain credibility, publicity, and legitimacy in order to persuade others to support a given policy. For example, FIBS have been used to exacerbate urban fiscal problems rather than aid in their solution. This results from their use by the growing and affluent jurisdictions to show that low income housing is a fiscal drain on the community. Thus, FIBS are used by those jurisdictions least affected by the urban fiscal crisis to perpetuate exclusionary policies which have fueled the crisis.

Reforming FIBS Use

Governmental structures and processes are not politically neutral—they tend to favor some interests over others. Recent research suggests that computers tend to extend and reinforce the prevailing biases of governmental structures and processes. Those who control local government decisions have adapted computer technology to serve existing structures of influence and control by determining the kinds of applications adopted and selectively utilizing available computer-based information.

Ironically, fiscal impact budgeting systems have been promoted as a tool for reforming the budgetary processes of local governments. Rather than being a tool for reform, FIBS, like many other computer applications, tend to automate the existing biases of the budgetary process. FIBS are unlikely to increase rational public control of budgetary decisions; they are likely to perpetuate many traditional biases generated by incrementalist assumptions and decentralized control over budgetary decisions. FIBS might well exaggerate these biases due to the complexity and mystique of computer-based models.

The appropriate course for local government officials is not clear. On the one hand, the urban fiscal crisis has increased demands for better financial planning and management. There are few tools other than FIBS which provide local governments the potential for generating service, revenue, and expenditure forecasts. FIBS do facilitate the work of budget and management analysts in preparing these forecasts. On the other hand, FIBS are likely to accentuate existing biases and introduce new biases into the budgetary process. Biased generation of service, revenue, and expenditure forecasts may be worse than none, especially if the adopters of FIBS fail to recognize the limits of computer-based models for promoting more rational public control over budgetary decisions.

For FIBS to reform the budgetary decision-making process, the processes by which models are adopted, implemented, and used by local governments must be reformed. At minimum, top elected officials must be intimately involved with the selection and implementation of these models. Their involvement in model selection must be sufficient to provide the elected officials with understanding of the basic differences among competing models. This includes understanding the assumptions and kinds of outputs produced by the models as well as the theory embedded in their functional operation. Moreover, elected officials must be sufficiently involved in model implementation to insure that the models embody their values and decision premises rather than, as is so frequently the case, only those of the planners and analysts who operate the models. Second, in addition, elected officials and the public must have access to experts who can interpret the outputs of models in lay terms. The direct outputs of models frequently are too complex and technical for elected officials and the public to comprehend without data reduction, simplification, interpretation, and context setting. Third, adversary modeling should be a standard rather than exceptional procedure in model use. The great advantage of computer models is that they can be used to try out many alternatives. Adversary modeling is more likely to insure that a range of alternatives are considered and that the alternatives are vigorously analyzed and evaluated. Moreover, it is likely to insure that alternatives which various groups in the community consider important are included in the decision process. Finally, it is critical that all of these reforms be implemented in concert, since no single reform is sufficient to counterbalance the automation of bias common to FIBS and other computer models. □

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