

Application of an Alternative Methodological Approach for Budget Generators for Research

Stephen P. Slinsky and Kelly H. Tiller

Abstract

While several budget generators are available to aid in development of field-level operations information and associated costs, many are based on methodologies that limit research value. Several of these limitations are identified, an alternative methodological approach will be introduced, and the versatility of ABS as a research tool is described.

Historically, enterprise and rotational budgets have been used in farm production and economic planning and research. Complete planting flexibility, global market competition, and the introduction of a host of new biotechnologies and production methods are accentuating the potential research value of budgets. Many large-scale agricultural production and natural resource research efforts have been supported by very detailed accounts of field-level operations and associated costs (De La Torre Ugarte, Slinsky, and Ray; De La Torre Ugarte, Tiller, and Ray; De La Torre Ugarte et al. 1996a and 1996b; Slinsky et al.). In addition to research use, these same changes and trends in U.S. agriculture make budgets increasingly more important to farmers as they identify their comparative advantages and refine their operation.

Numerous budget generators are available to assist in obtaining information on field-level operations and associated costs. However, many traditional budget generators have limitations for contributing to large-scale economic research. Several of these limitations are identified in this paper, and an alternative methodological approach will be introduced, highlighting benefits of such an alternative budget-generation methodology for large-scale research purposes. An application of this methodology, the APAC Budgeting System (ABS), is presented.

Context and Background

A budget generator is basically a fancy calculator that uses a series of algorithms to estimate machinery costs or net farm income. However, these fancy calculators serve a number of needs for researchers and other users such as farmers and extension personnel. Most budget generators available, such as CARE (Christensen et al.), OKBuds (Doye), BUDPRO (Bever), and the University of Arizona budget generator (Tronstad), are used for estimating and reporting typical or recommended practices and their associated costs to producers. More complex budget generators, such as Planetor (Hawkins et al.) and Machsel (Kletke and Sestak), combine environmental or economic models with financial algorithms to assist in decision making.

Researchers use budget generators to develop budgetary information for research because there are limits to the expertise and resources available to individuals while no limit seems to exist for human error. It is for the very same reasons that some traditional

budget generators have limited research value. An ideal budget generator for research purposes would be capable of developing budgets that are accurate and consistent, and flexible enough to support the various data needs of diverse research efforts.

Changes in technologies, prices, and cultural practices necessitate that budgets used for reporting purposes be regularly updated. Therefore, operating the ideal budget generator must be easy, yet able to provide all the relevant information in a presentable format.

Limitations of Budget Generators

Currently available budget generators have been designed with a relatively narrow set of objectives in mind and have been tailored to perform specific tasks. As a result, limitations exist that prohibit budget generators from simultaneously fulfilling the needs of researchers, farmers, and Extension personnel.

Some budget generators require users to provide a significant amount of site-specific technical and/or cost information (e.g., Planetor and Machsel). While providing an accurate depiction of a specific farm's costs and returns, collecting and entering this site-specific technical and cost information for multi-region or multi-firm analyses requires significant resources and expertise, may compromise consistency, makes updating budgetary information more difficult, and makes budgets more susceptible to human error. Since not all users or potential users of these budgeting systems have access to

such information, these requirements serve as a barrier to the effective use of budgeting tools in farm management and applied research.

In addition, accuracy could be compromised if the methodological approach for collecting and entering information is ad hoc. Budgetary information used for research must be developed using a methodology which assures consistency among crops, production regions, production practices, rotations, and even soils in some cases. The nature of the site-specific technical and cost information required for budget generation makes consistency among machinery and other input prices across budgets difficult to achieve. Site-specific data require significant resources to collect and verify. Rapid changes in cultural input technologies, regulations, and prices necessitate frequent updating of input data to retain research value. In addition, more user interaction makes budgets more susceptible to human input errors.

Large-scale research efforts often begin with the development of enterprise and rotational budgetary data. However, the actual development of budgetary data is only the first hurdle that must be overcome. Information developed by some traditional models only include general balance sheet information (e.g., OKBuds, BUDPRO, and the University of Arizona budget generator), and this information is not sufficient to fulfill research needs when research efforts also require itemized budget information or operation schedule information.

There may be as many different data formats required by models and simulators as there are models and simulators. Even if some traditional budget generators are able to meet the data requirements of a complex model or simulator (e.g., Planetor and CARE), the resources required to incorporate this data into models or simulators might be

prohibitive. In addition, the more users are required to handle data the more susceptible the results are to human error.

An Alternative Methodology for Budget Generation

An alternative methodology for budget generation was developed by the Agricultural Policy Analysis Center (APAC) at The University of Tennessee, Knoxville. The alternative methodology utilizes a series of internalized databases. Budgetary information is generated by applying established efficiency and cost equations to these internalized databases through multi-platform computer code. This methodology minimizes user resources required and allows for data to be readily updated. Several other budget generators also utilize a database approach, including Planetor and CARE. The unique contributions of this alternative methodology is that it also allows users to specify the format of the output, increasing compatibility with various research applications.

Ideally, a budget generator would incorporate internalized machinery and input databases containing machinery costs and efficiencies, input and commodity prices, chemical use restrictions, and previously-defined field operations, which would be used for budget creation. Data contained in each database would be obtained from published sources so that data could be easily verified and updated. With such databases internalized, the database methodology would facilitate the modification of data and

equations so that the effects of certain changes in prices or efficiencies can be analyzed and data can be updated.

ABS: An Application of a Database-Supported Budget Generator

Using the alternative methodology, a multi-purpose budgeting system was developed to meet the rigorous demands of research while also remaining flexible enough for firm-level usage. The APAC Budgeting System (ABS) was designed to provide researchers, extension personnel, and farmers with a reliable and user-friendly method of developing rotational and enterprise budgetary data. ABS is comprised of sets of multi-platform computer codes, which drive data manipulation to produce budget information. A series of internalized machinery and input databases support this process.

Database Relationships Within ABS

Budget creation within ABS requires a user to identify and make modifications to a default set of field-level activities (e.g., operation schedule) for a particular region, crop, and type of production system. Standardized machinery and labor efficiency equations, which are obtained from the American Society of Agricultural Engineers (ASAE) Standards, are applied to the field-level activities, and data supplied from internalized databases are applied to the appropriate machinery and input items.

ABS's chemical database includes national prices for more than 400 chemicals. These prices (\$/LB A.I.) were obtained from annual *AGCHEMPRICE* publications, which are developed by DPRA Incorporated. DPRA Incorporated estimates average retail prices for chemicals by surveying retailers across the nation. In addition to price information, the chemical database includes formulation information and crop restrictions. Chemical formulation data (LB A.I./unit) are included so that a user would not be limited to reporting chemical usage in a specific unit of measure. Crop restrictions are placed on certain chemicals, especially herbicides, to avoid damage to susceptible crops. ABS uses this information to alert users when an unregistered chemical is specified for use in the field operations. This feature is especially useful when generating rotations.

The fertilizer database included in ABS contains price and formulation data for more than 80 fertilizers. Fertilizer prices, reported by multi-state USDA Fertilizer Regions, are obtained from annual summary of a National Agricultural Statistics Service (NASS) publication, *AgPrices*. Fertilizer formulation data are used to calculate the price of fertilizer mixtures using regional elemental prices.

The crops database contains crop price information while another internal database contains seed prices and other miscellaneous inputs. Prices received for 190 crops and prices for 40 types of seed are obtained at the national level from annual summaries of *AgPrices*. The crops database also has crop-price indices that adjust the national prices to regional levels.

Machinery costs and efficiencies for 290 pieces of machinery are included in the machinery database. This data are provided and collected by the Economic Research Service (ERS) at the state level.

The database of operation schedules provides users with default cultural practices for major crops and rotations, which account for operational and geographical variances occurring in almost all of the Agricultural Statistics Districts (ASD). This database minimizes resources required of users by allowing users to (1) make changes in default cultural practices to account for geographic or production differences, (2) develop budgets for new crops or alternative production practices from default cultural practices, (3) and sequentially combine cultural practices from several enterprises to form a rotation. The cultural practice information used to develop default enterprise and rotation cultural practices was obtained from Extension Service publications and through personal communications. While the data contained in this database are reported at the ASD-level, the Extension Service publications only report cultural practices at the state or sub-state level. This information is continually revised and updated.

ABS Output

ABS is designed to facilitate the process of building large-scale models by making available multiple formats for outputting budgetary information. Budgetary output may be accessed as either a Hyper Text Markup Language (HTML) file, which allows access of ABS budgets on the World Wide Web, or a user-defined text format file. The user-

defined text file allows users to choose which information is reported and how the database is formatted. Since the format of output databases can be customized, ABS is able to support the budgetary data requirements of most models with relative ease.

The default format for output generated for each budget is an HTML file. Each HTML file contains a cost summary sheet, detailed schedule of operations, labor schedule, and machinery cost table, with all expenditures calculated at a per acre basis. The cost summary sheet lists per-acre revenue and costs of producing crops and rotations. Total production costs estimated include variable expenses and fixed expenses. Variable expenses are estimated for inputs, (e.g., seed, fertilizer and lime, herbicides, insecticides, and irrigation) machinery, labor, and services (e.g., interest of operating capital, and custom operations). The only fixed expenses considered are those associated with machinery. The operation schedule allows users to readily identify specific field activities defined by the implement used on a particular day. Associated machine and labor times are included in the operation schedule, as well as quantities of inputs applied (e.g., fertilizers, chemicals, seed, etc.). The machinery cost table reports variable and fixed costs for each machine, and the labor schedule defines labor requirements by month, quarter, and year.

HTML files for default budgets are accessible in a user-friendly format via the World Wide Web at <http://apacweb.ag.utk.edu/ABSWeb>. Although the system does not yet allow users to change budgets to meet their personal needs, default budgets can be accessed by crop for most of the 305 Agricultural Statistics Districts (ASD). These budgets contain information typical of the particular ASD.

Example Uses of ABS for Research

ABS has been used to support several large-scale research projects since its development. For example, budgetary data generated by ABS was used to support economic and environmental analyses of sustainable agriculture conducted at the national (De La Torre Ugarte et al. 1996b), regional (De La Torre Ugarte et al., 1996a), and firm-level (Slinsky et al.) using the Policy Analysis System, POLYSYS (Ray et al.), and the Environment/Productivity Impact Calculator, EPIC (Williams et al.), model. POLYSYS and EPIC required operation schedule and budgetary data from almost 10,000 enterprise and rotation budgets to complete these projects. The procedure required to insert this data directly into these models was automated using short external sub-routines.

Researchers have also used ABS to generate budgetary data to support economic analyses of field research. For example, modified default budgets were used to estimate and report the production cost and revenue difference observed for test plots testing the marginal returns of nitrogen applied to no-till corn (Larson et al.). ABS was able to greatly reduce the time required to generate the budgetary data used in the analysis and publication-quality budgets included in the reports.

Concluding Remarks and Plans for the Future

Building from the methodologies of available budget generators, this methodology combines the database approach with multiple, user-defined output options for

developing and reporting budgetary data. An application of this alternative methodology, ABS, allows a single budget generator to service multiple users and multiple needs accurately and consistently.

APAC is well on the way to making available the next generation of ABS. Structured for both research and site-specific use, provisions are being made to allow users full access to ABS via the Internet. The new version of ABS will be called ABSWeb.

Upon logging on to the ABSWeb website, casual users will be able to look at default budgets and modify the default budgets (e.g., operation schedules, the cost of machinery and other inputs) to more accurately estimate site-specific production cost and return estimates. The default enterprise and rotation budgets, which attempt to account for operational and geographical variances occurring for major crops, will be used to (1) make changes in the existing budget, (2) develop additional budgets, (3) or sequentially combine input data from several enterprises to form a rotation. The resulting output for each budget will contain the same type of data as are contained in the default budgets. Any modifications made to default budgets by casual users will not become a permanent change to ABSWeb base budgets.

Researchers, Extension personnel, and individuals who wish to use ABS more extensively will have the ability to register and utilize ABSWeb as a project manager (PM). PMs will have the ability to modify databases and select default budgets to utilize and modify. Selected budgets and modified databases will be stored in an assigned project directory. From this project directory, PMs will be able to rerun single budgets or batches of budgets. PMs will also have the ability to choose the format in which

budgetary data are reported. Project directories, secured by user passwords, will store generated data for a user-specified duration before being removed.

Resources

Beyers, S. Personal Communications. Professor & Extension Economist, Agricultural Economics, Texas A&M University. January 5, 1999.

Christensen, D., A. Hinkston, T. Kuntz, D. Langemeier, D. Lawrence, R. Neis, and F. Swartz. "CARE: Cost and Returns Estimator: User's Guide." United States Department of Agriculture, Soil Conservation Service. Version 2.2. February, 1994.

De La Torre Ugarte, D.G., S.P. Slinsky, and D.E. Ray. "The Economic Impacts of Biomass Crop Production on the U.S. Agriculture Sector." Preliminary report prepared for the Office of Alternative Uses, Economic Research Service, U.S. Department of Agriculture. June 1998a.

De La Torre Ugarte, D.G., K.H. Tiller and S.P. Slinsky. "Sustainable Agriculture: Implications for the Agricultural Input Sector." Paper presented at the Southern Agricultural Economics Association Annual Meeting, Little Rock, Arkansas. February 1998b.

De La Torre Ugarte, D.G., S.P. Slinsky, J.A. Hamrick, D.E. Ray, and R.L. White. "Economic and Environmental Impacts of Movement Toward a More Sustainable

- Agriculture on the Southeastern United States, Final Report.” Agricultural Policy Analysis Center, The University of Tennessee, Knoxville. June 1996a.
- De La Torre Ugarte, D.G., S.P. Slinsky, J. Hamrick, D.E. Ray, R.L. White, and R.M. Pendergrass. “Economic and Environmental Impacts of Movement Towards a More Sustainable Agriculture on the United States.” Agricultural Policy Analysis Center, The University of Tennessee. April, 1996b.
- Doye, D. Personal Communications. Professor, Agricultural Economics, Oklahoma State University. January 5, 1999.
- Hawkins, R., R. Craven, K. Klair, R. Loppnow, D. Nordquist, W. Richardson, and J. Whitney. “Planetor User’s Manual.” Center for Farm Financial Management, Department of Agricultural and Applied Economics, Minnesota Extension Service, University of Minnesota. 1995.
- Slinsky, S.P., R.L. White, J. Hamrick, R.M. Pendergrass, and D.E. Ray. “Farm-Level Impacts of Sustainable Agriculture on the Southeastern United States: Final Report.” Agricultural Policy Analysis Center, The University of Tennessee. December, 1995.
- Kletke, D. and R. Sestak. “The Operation and Use of MACHSEL: A Farm Machinery Selection Template.” Oklahoma State University. Computer Software Series CSS-53. September, 1991.
- Larson, J.A., R.K. Roberts, D.D. Tyler, B.N. Duck, and S.P. Slinsky. “Nitrogen-Fixing Winter Cover Crops and Production Risk: A Case Study for No-Tillage Corn.” *Journal of Agricultural and Applied Economics*. 30(1):163–74. 1998.

Ray, D.E., D.G. De La Torre Ugarte, M.R. Dicks, and K.H. Tiller. "The POLYSYS Modeling Framework: A Documentation." Unpublished manuscript. Agricultural Policy Analysis Center, The University of Tennessee, Knoxville. July 1998.

Tronstad, R. Personal Communications. Extension Economist, Agricultural and Resource Economics, University of Arizona. January 4, 1999.

Williams, J.R., P.T. Dyke, W.W. Fuchs, V.W. Benson, O.W. Rice, and E.D. Taylor. "EPIC-Erosion/Productivity Impact Calculator: User's Manual." United States Department of Agriculture, Agricultural Research Service. Technical Bulletin No. 1768. September 1990.