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ABSTRACT

This paper discusses the development and use of a budgeting case study and an object-oriented modeling tool to introduce the concept of uncertainty and risk in financial analysis to students in upper-division accounting information systems classes. The emphasis is on teaching the concepts involving probabilistic budgeted financial statements using an object-oriented, discrete event, Monte Carlo simulation model of a simplified business environment. Teaching materials have been developed and tested in an advanced AIS course typically taught to senior or graduate-level students. Assignments are designed to assist students in understanding probabilistic models of business planning, and specifically, in development of budgeted financial statements, to create a stronger understanding of the interrelation of business processes and to expose students to business modeling via simulations.

Keywords
Accounting information systems, simulations. budgeting

A teaching note and electronic files are available for use with this case. If you are member of the AIS Educator Association, please go to http://www.aiseducators.com and follow the links for the AIS Educator Journal. If you are not a member of the Association, please contact the author directly at the address provided above to obtain these materials. Please provide a means for verifying your credentials as a faculty member so that we may protect the integrity of the solutions materials.

INTRODUCTION

Financial accounting stresses historic measures. Therefore, accounting students tend to think strictly in point estimate terms. However, budgeting activity is, by its very nature, stochastic. Therefore, the purpose of this paper is to introduce a teaching aid to incorporate uncertainty into teaching the budgeting process using Monte Carlo simulation software. The advent of robust business intelligence systems in business provides the rich source of data required to make budgeting simulation models practical.

Development of operational budgets and the resulting budgeted financial statements (or pro forma financial statements) is an important skill for an accountant to master (Hansen et al. 2009, 250). Traditional accounting textbooks stress the use of deterministic models for developing budgeted financial statements (op. cit., 253). While this is not a realistic approach to predicting future events, it can be a useful way for students to begin to learn the complex interrelationships among the various components and subsystems of an organization and to experience the complexities of developing planning scenarios and dealing with the assumptions that must be made. In addition, since the traditional financial reporting functions of producing historical financial statements are based on known, deterministic data, students should be familiar with performing this type of static analysis.

While past events are known with certainty, future financial measures can only be estimated with some level of uncertainty or risk. Modeling approaches that do not incorporate uncertainty are of limited usefulness because they assume future financial results can be predicted with certainty. (Hall and Kolkmann 1976, 45). For example, if you are developing budgeted financial statements, the traditional approach is to start with a fixed estimate of sales (Hansen et al. 2009, 254) and then use the sales forecast to derive all of the other pertinent information such as scheduled production, desired inventory levels, payments of accounts payable, collection of accounts receivable, cash balances, etc. Some of the parameters used in developing a financial model are discretionary decision variables; for example, inventory reorder points, order quantities, desired cash levels, timing of payments of accounts payable, etc. However, most of the financial model parameters are probabilistic in nature, thus rendering budgeting a stochastic, rather than deterministic, process. For example, the normal budgeting starting point of predicting sales can be highly volatile, and this volatility is compounded by other probabilistic estimates made throughout the budgeting process. Students tend to trivialize the issue of uncertainty, thus failing to recognize the planning risks involved in using the results of the static budgeting process.

Incorporation of uncertainty is achieved by generating probability functions for accounts contained in a hypothetical company's budgeted financial statements. The case highlights for students the interconnected systems nature of the budgeting process, the importance of reporting measures of budget risk, and traditional budget category point estimates. A realistic budget model for the firm is developed. The model is built using GoldSim simulation software for performing Monte Carlo simulation. The simulation produces budget point estimates and a distribution around those estimates. There is a series of exercises based on this model. These exercises introduce students to sensitivity analysis as well as asking them to extend the model to include additional or optional business processes. The case has been used successfully in senior/graduate AIS classes. Three assignments and teaching notes, in addition to the simulation model, are made available on the AIS Educators website: http://www.aiseducators.com.

Classroom Importance

Traditionally, it has been difficult in a classroom situation to do more than discuss the variability of the budgeted predictions and the risks associated with them. Even for businesses, the probabilistic nature of budgets has traditionally been a concern that was known but not handled analytically. This primarily has been an issue of the available tools and data needed to model the business processes involved.

While simulation modeling tools have improved significantly over time, data availability issues persisted until recently as a "fundamental problem" in simulation model building and validation (Pace 2004, 167). The current prevalence of business intelligence systems is making a significant impact on data availability. Even smaller organizations are increasingly able to use business intelligence tools to compile data into valuable information (Totty 2007). Among the findings of a recent *MIT Sloan Management Review* survey of global executives is evidence of a strong positive link between the degree of sophistication of organizations' analytics and their competitive performance in their industry (Hopkins et al. 2010, 24). The same survey also indicated that global executives believe that simulation will become increasingly valuable to organizations in the next two years (op. cit., 30). Clearly, the current modeling tools and increasing data availability via business intelligence now provide businesses a cost-effective opportunity to model business processes using probability distributions. Introducing students to this environment will give them valuable knowledge that can be applied in their professional careers.

Risk management is an issue that has become of paramount importance in the business world. In addition to incorporating uncertainty into the budgeting process, use of the GoldSim model developed here allows the instructor to ground discussions of risk in a data-rich example wherein sensitivity to uncertainty and the impact of alternative probability distributions can be explored. The model also can be used to perform financial statement analysis on the budgeted financial statements, highlighting the volatility and risks inherent in financial ratios and relationships.

In summary, the learning objectives of this case study are that students will be able to do the following:

- Understand the differences between deterministic and stochastic (probabilistic) estimation
- Understand how risks enter into the budgeting process
- Appreciate the importance of assessing budget risk
- Understand how to model interconnected business processes
- Learn to use Monte Carlo simulation for modeling the budgeting process
- Perform sensitivity analysis on an interactive simulation model

THE BUDGETING CASE

The case study uses a sample merchandising business with two distribution channels, retail and wholesale sales. Goods are distributed for both channels out of a main distribution center. Accounting, sales, purchasing, and warehousing are centralized for the organization. Wholesale sales are paid in cash immediately, while retail sales are either paid in cash or billed on account based on a probability distribution. Similarly, inventory is maintained separately for the wholesale and retail sales. Merchandising business transactions addressed in the simulation

include ordering of goods for resale, wholesale sales, retail sales, distribution of goods to retail outlets, payment of accounts payable, receipt of accounts receivable and investment activities.

These relationships are presented in Figure 1 and used in assignments two and three. Using the given financial statement output (Financial_Statements.xlsx) and lecture notes (Probabilistic_Budgeting_Lecture.pptx), students are asked to forecast the company's budgeted financial statements based on assumptions and models created in the simulation. By running the simulation multiple times, the students can see outcomes based on varying assumptions and parameters.

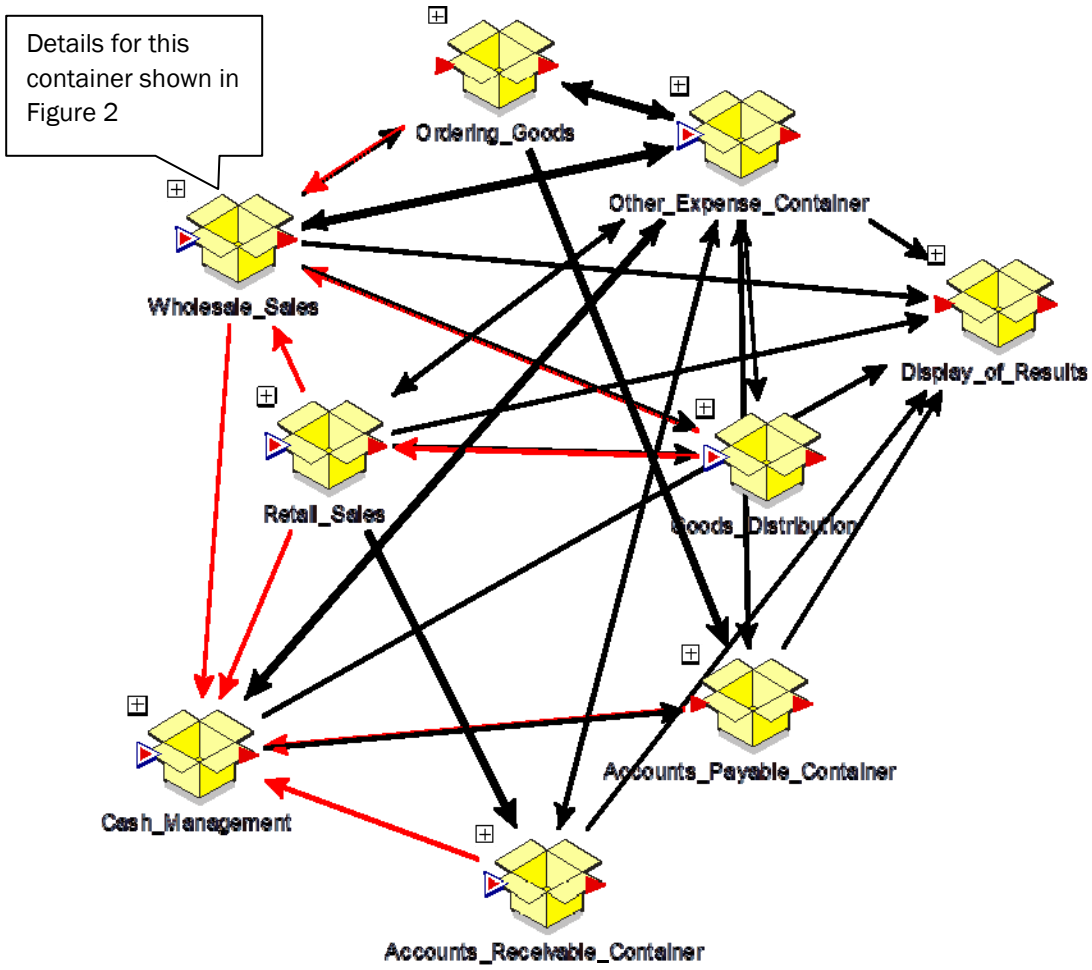


Figure 1
Overview of Simulation Model

The Simulation

A simplified Monte Carlo discrete event simulation of the sample business has been developed for use in the classroom. The simulation uses an object-oriented language, primarily involving point-and-click and drag-and-drop actions to build models. We have found that senior-level accounting students and MBA students can use the system without much instruction.

The simulation uses GoldSim, a system available free of charge for academic use (see goldsim.com). Each student can request a student version of the software, and additional copies are available to the faculty member for installation in an on-campus computer lab. The information technology background we advise for students performing the first two simulation assignments is an introductory MIS class required at most business schools. A basic understanding of object-oriented concepts such as properties and methods is helpful for completing the third assignment. If the assignments are completed in groups, those with better technology backgrounds can assist others.

GoldSim is an object-oriented simulation language that is easy for a beginner to use but can produce extremely complex models. The software contains tutorials to help the students, and the lecture notes (Probabilistic_Budgeting_Lecture.pptx) contain additional guidance. The model we present uses five primary classes of objects: inputs, stocks, functions, events and results. The inputs can be deterministic or stochastic (e.g., Wholesale_Sales in Figure 2). The stocks are containers that hold values such as account balances and inventories (e.g., Goods_Inventory in Figure 2). The functions vary from simplistic (add two numbers together) to complex mathematical calculations (e.g., Wholesale_Inventory_Cost in Figure 2). The events trigger actions within the system (e.g., Wholesale_Event in Figure 2). The results are primarily used to display the data and probability distributions produced by running the simulation (e.g., Goods_Inventory_Results in Figure 2). We purposely keep the complexity of the model at a level that can be understood by the students. However, if desired, the students can introduce additional intricacy once they become comfortable with the original model.

The Model

Following is a brief description of the model and some of the assignments that we have used in teaching the simulation material. Figure 1 shows the model overview.

While the model first appears intimidating, it corresponds closely to the business cycles discussed in accounting information systems or other business process courses. Each container is a collection of objects that model the logic for that function (cycle) of the business. The lines connecting the containers represent what are termed influences between the containers. This includes data values (thin black lines), transactions (red lines) and multiple types (thick black lines). As you can see, the model contains most of the major functions of the case study business.

The objective of this paper is not to present a complete explanation of the model, but to introduce the concepts involved and entice you to adopt this approach for your class. The model details are provided as part of the available teaching materials, both in videos and a PowerPoint presentation. However, we will explain some aspects to enhance the reader's understanding of the richness of the model and some of the instructional possibilities. Figure 2 displays contents of the wholesale sales container. The intent is not to explain the wholesale sales container detail, but rather to show the richness of the model and to highlight how probability is built into the model. In the center of the module is the demand distribution (symbol 

) for wholesale sales (Wholesale_Demand) as an input object. This is an example of a stochastic component introduced into the model.

Note that from the model overview in Figure 1, we drilled down to the details of the Wholesale Sales Module in Figure 2. Figure 3 is a drill-down of the Wholesale Sales Demand function in Figure 2 and shows the demand distribution used to represent wholesale sales. For

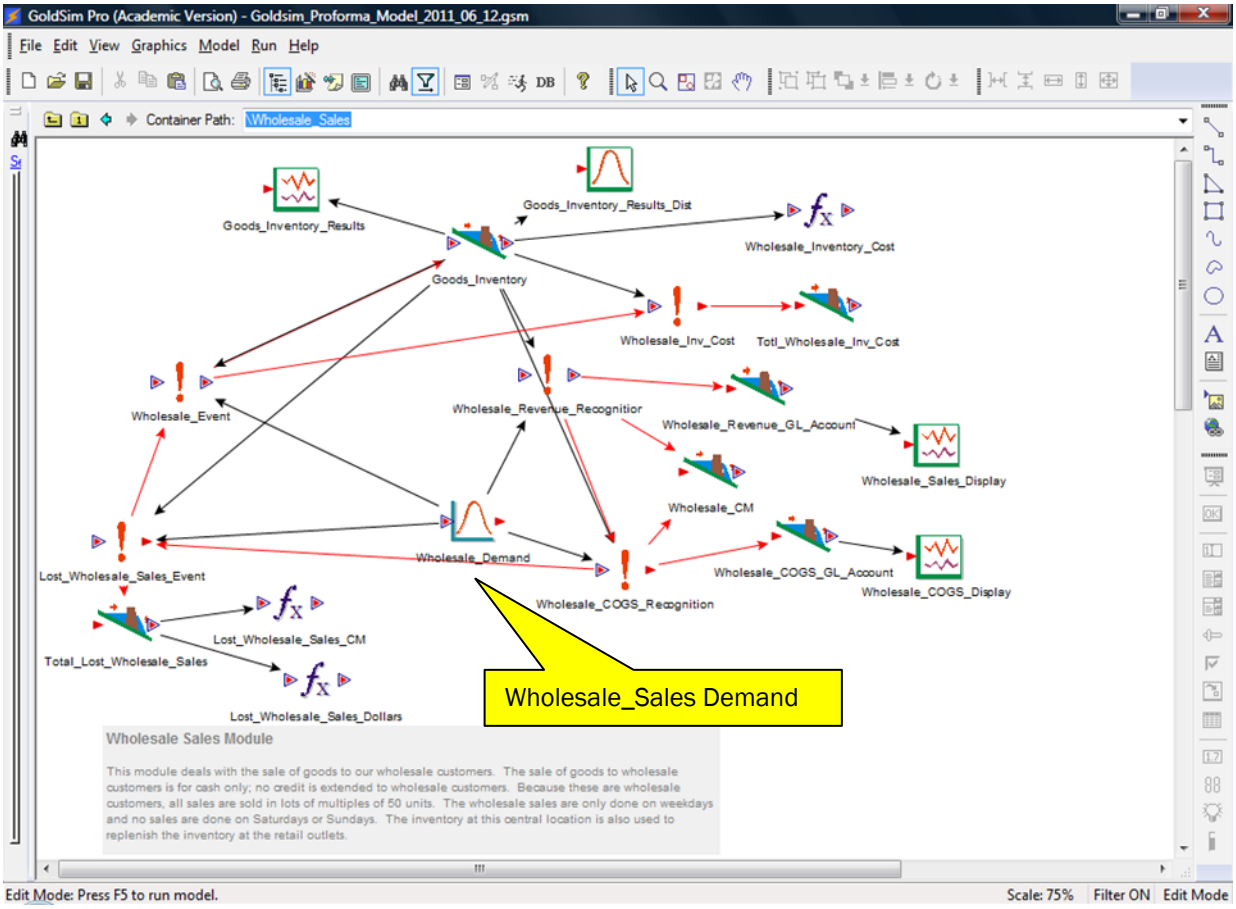


Figure 2
Wholesale Sales Module

this instance, we selected a discrete probability distribution. This is just one of the many possible probability distributions that can be used. There are additional stochastic components in the other process containers (e.g., Retail_Sales) and many more could be introduced to present more realism. However, as stated before, this is a teaching tool, and we want to keep the model simple enough for students who are not familiar with the concepts. Despite its simplicity, the model illustrates different ways in which business processes can be constructed. For example, the algorithm for ordering wholesale inventory is different from the algorithm for ordering retail inventory.

It is advisable that students have taken an introductory statistics class before engaging in the simulation, but most accounting students will have taken such a course before taking advanced accounting classes. Nevertheless, students need only a "cookbook" knowledge of statistics to complete the assignments and grasp the importance of stochastic models. A basic overview/review of probability concepts used in the simulation is available to students in the supplementary materials.

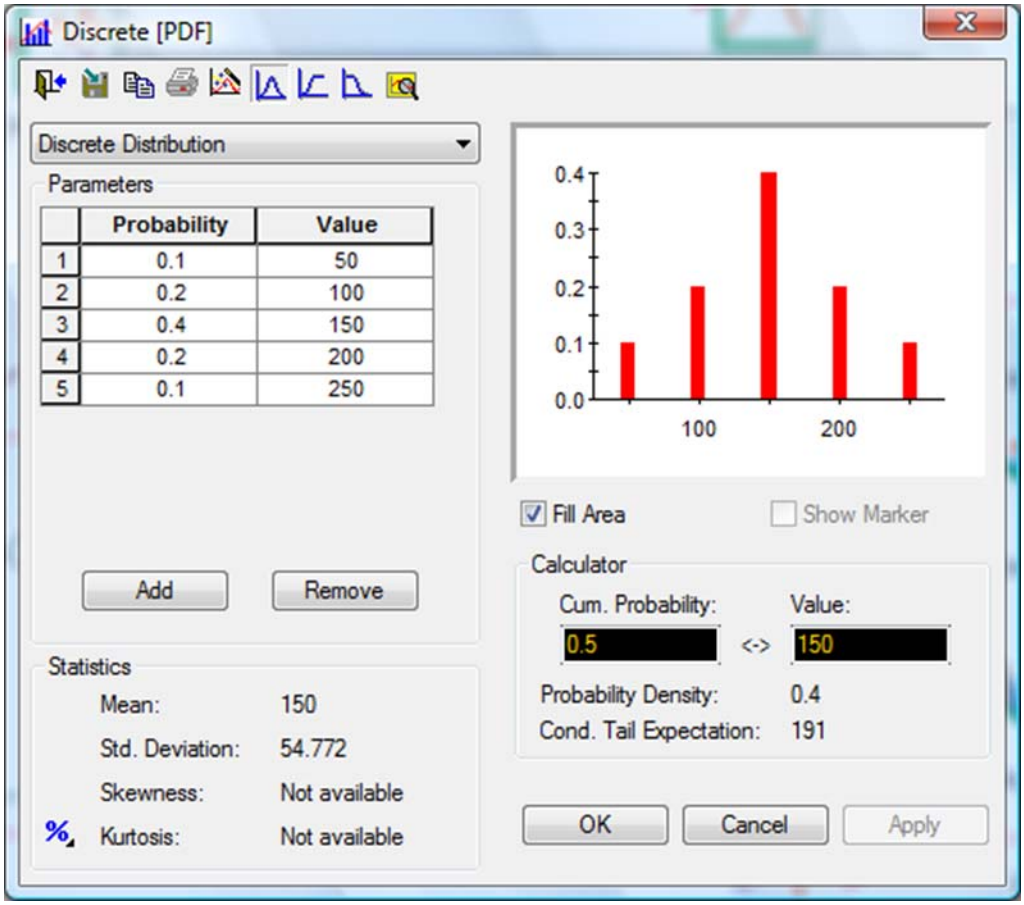


Figure 3
Wholesale Sales Demand Distribution

Each object in the model has parameters that dictate the behavior of the object. For example, Figure 4 shows the drill-down details of the Goods_Inventory object (symbol) in Figure 2. This is a stock object in which the balance represents the goods in the central warehouse. Note that the primary information involves the inflows (Additions) and the outflows (Withdrawals) of the stock object.

The actual amount of wholesale sales is not strictly determined by the demand function, but is also dependent on the goods available in inventory. This analysis is handled in the discrete change event, Lost_Wholesale_Sales_Event (symbol). If there is not adequate inventory, then the amount of lost sales is accumulated in Total_Lost_Sales stock object (in units) and the function Lost_Wholesale_Sales_Dollars (symbol) converts the units to dollars based on the wholesale price.

The results are shown in two different forms. One form is a probability distribution of the results (symbol). Figure 5 shows the probability distribution of the goods inventory.

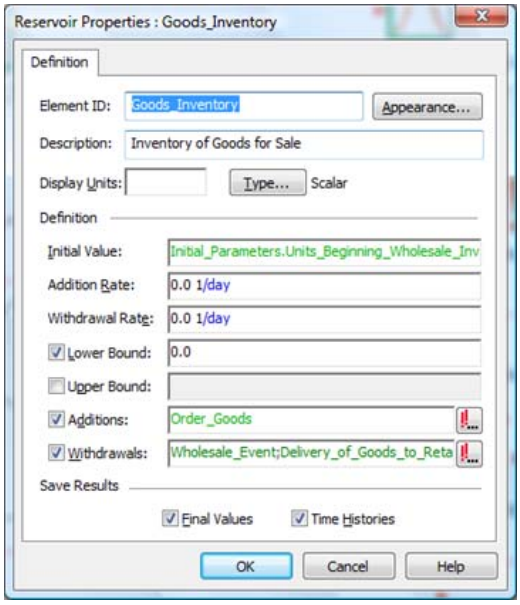


Figure 4
Characteristics of Goods_Inventory Stock Object

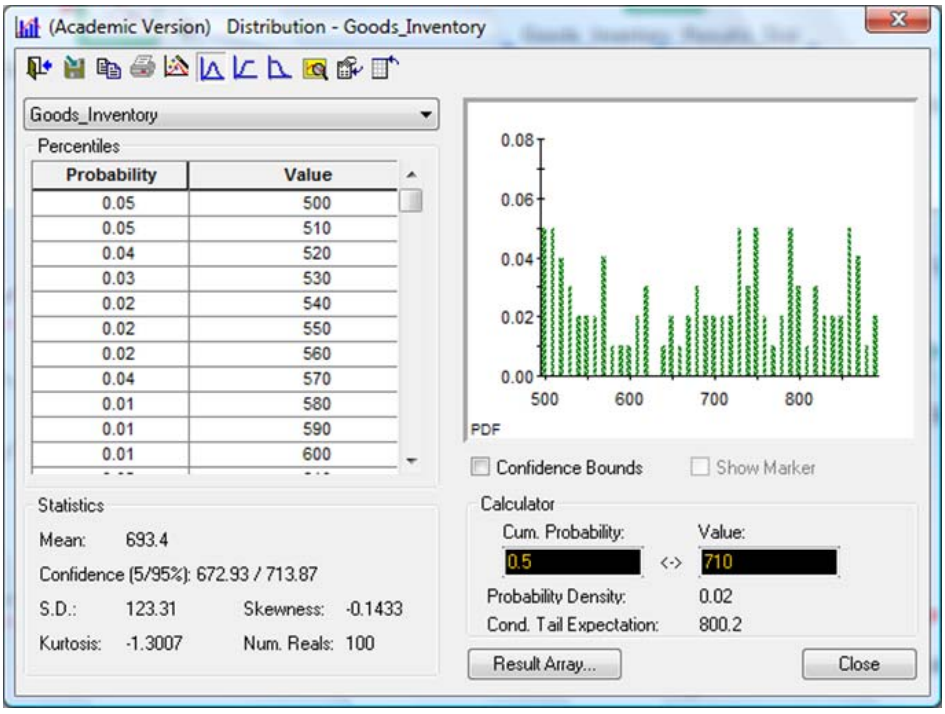


Figure 5
Probability Distribution of Goods Inventory

The other form of results used here is results over time (symbol ). Figure 6 illustrates the format of that output. This display shows the value of each realization (i.e., iteration) in green, the mean value of the realizations for each day is represented by red and the median values are in blue. There is the option to display this information in table form also (see Figure 7).

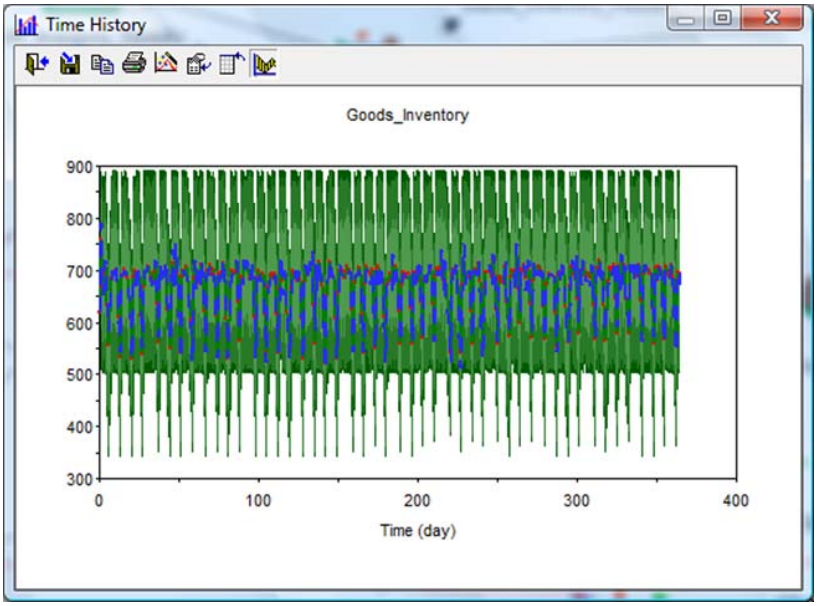
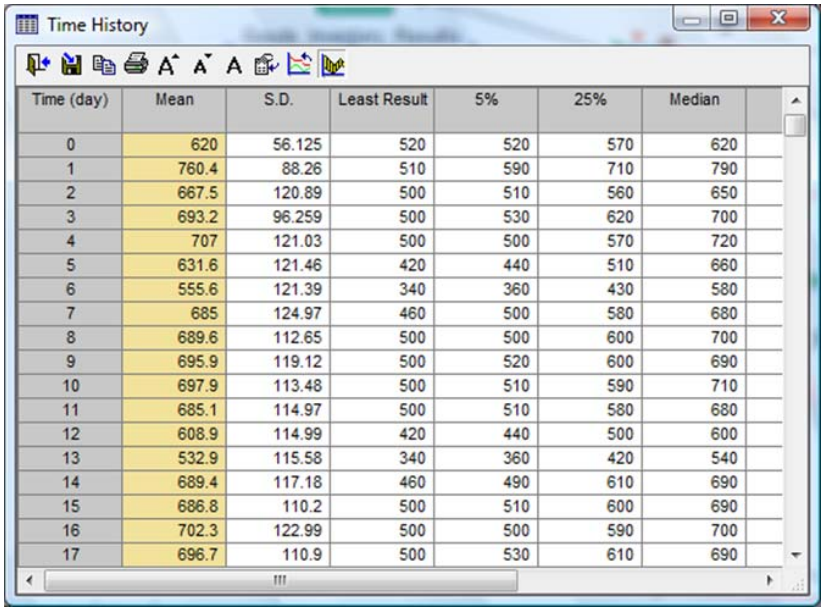


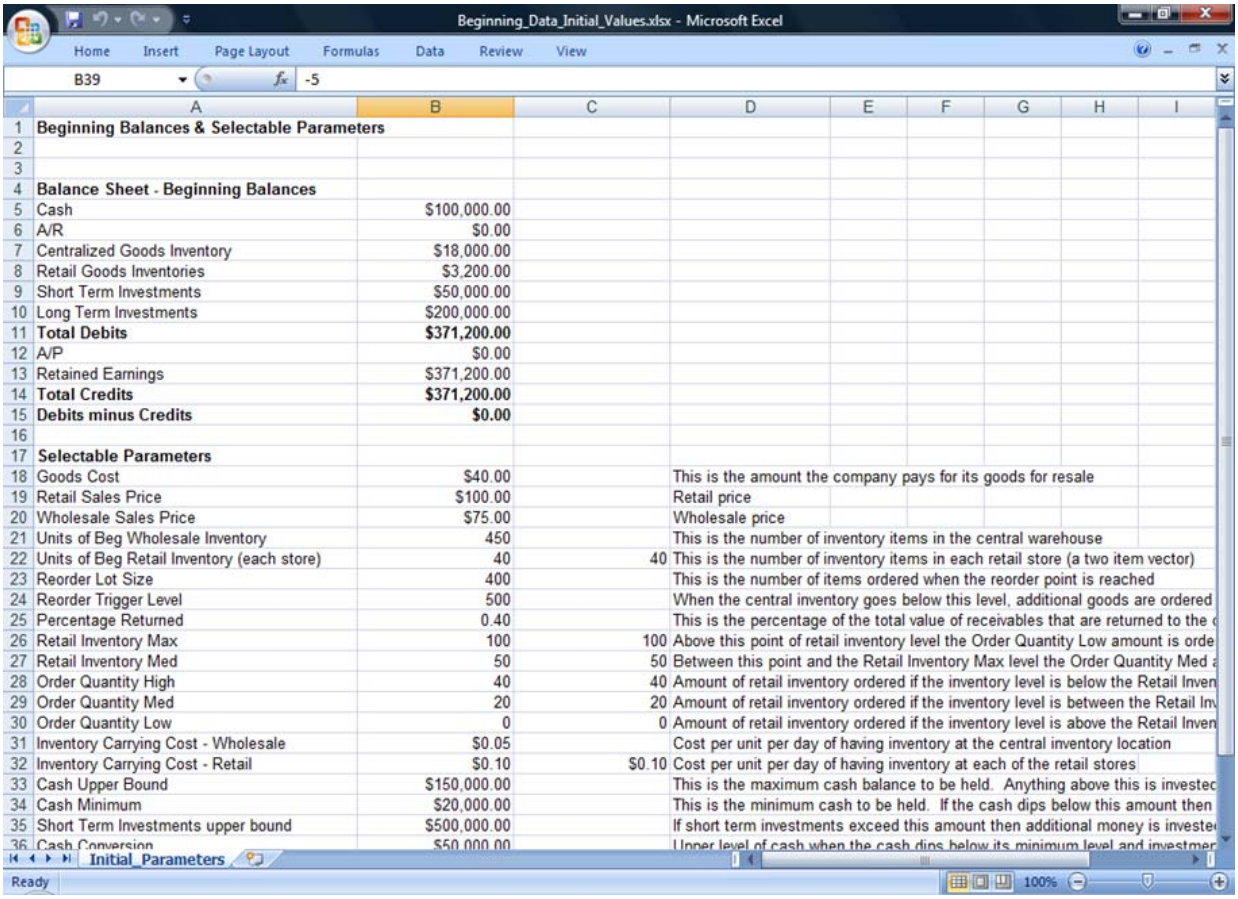
Figure 6
Inventory Levels Over Time



Time (day)	Mean	S.D.	Least Result	5%	25%	Median
0	620	56.125	520	520	570	620
1	760.4	88.26	510	590	710	790
2	667.5	120.89	500	510	560	650
3	693.2	96.259	500	530	620	700
4	707	121.03	500	500	570	720
5	631.6	121.46	420	440	510	660
6	555.6	121.39	340	360	430	580
7	685	124.97	460	500	580	680
8	689.6	112.65	500	500	600	700
9	695.9	119.12	500	520	600	690
10	697.9	113.48	500	510	590	710
11	685.1	114.97	500	510	580	680
12	608.9	114.99	420	440	500	600
13	532.9	115.58	340	360	420	540
14	689.4	117.18	460	490	610	690
15	686.8	110.2	500	510	600	690
16	702.3	122.99	500	500	590	700
17	696.7	110.9	500	530	610	690

Figure 7
Table of Inventory Levels Over Time

In order to enhance student understandability of the model, a large majority of the static parameters of the model are contained in an Excel spreadsheet that is used as input into the model. Figure 8 shows some of this initial data. Using a spreadsheet to consolidate the data makes changing parameters a straightforward task in which all data are in one place.



	A	B	C	D
1	**Beginning Balances & Selectable Parameters**			
2				
3				
4	**Balance Sheet - Beginning Balances**			
5	Cash	$100,000.00		
6	A/R	$0.00		
7	Centralized Goods Inventory	$18,000.00		
8	Retail Goods Inventories	$3,200.00		
9	Short Term Investments	$50,000.00		
10	Long Term Investments	$200,000.00		
11	**Total Debits**	**$371,200.00**		
12	A/P	$0.00		
13	Retained Earnings	$371,200.00		
14	**Total Credits**	**$371,200.00**		
15	**Debits minus Credits**	**$0.00**		
16				
17	**Selectable Parameters**			
18	Goods Cost	$40.00		This is the amount the company pays for its goods for resale
19	Retail Sales Price	$100.00		Retail price
20	Wholesale Sales Price	$75.00		Wholesale price
21	Units of Beg Wholesale Inventory	450		This is the number of inventory items in the central warehouse
22	Units of Beg Retail Inventory (each store)	40	40	This is the number of inventory items in each retail store (a two item vector)
23	Reorder Lot Size	400		This is the number of items ordered when the reorder point is reached
24	Reorder Trigger Level	500		When the central inventory goes below this level, additional goods are ordered
25	Percentage Returned	0.40		This is the percentage of the total value of receivables that are returned to the
26	Retail Inventory Max	100	100	Above this point of retail inventory level the Order Quantity Low amount is orde
27	Retail Inventory Med	50	50	Between this point and the Retail Inventory Max level the Order Quantity Med
28	Order Quantity High	40	40	Amount of retail inventory ordered if the inventory level is below the Retail Inven
29	Order Quantity Med	20	20	Amount of retail inventory ordered if the inventory level is between the Retail In
30	Order Quantity Low	0	0	Amount of retail inventory ordered if the inventory level is above the Retail Inven
31	Inventory Carrying Cost - Wholesale	$0.05		Cost per unit per day of having inventory at the central inventory location
32	Inventory Carrying Cost - Retail	$0.10	$0.10	Cost per unit per day of having inventory at each of the retail stores
33	Cash Upper Bound	$150,000.00		This is the maximum cash balance to be held. Anything above this is investec
34	Cash Minimum	$20,000.00		This is the minimum cash to be held. If the cash dips below this amount then
35	Short Term Investments upper bound	$500,000.00		If short term investments exceed this amount then additional money is investe
36	Cash Conversion	$50,000.00		Upper level of cash when the cash dips below its minimum level and investmer

Figure 8
Beginning Balances and Selectable Model Parameters

The results of the simulation are presented in two formats. First, a container (Display_of_Results) in the model has each of the financial statement accounts displayed as a probability distribution. In addition, all of the numeric results are written to a spreadsheet that shows separate results for each realization of the simulation. Figure 9 shows the probability distribution for the cash account.

Figure 10 shows part of the spreadsheet that is written to Excel by GoldSim. The spreadsheet shows the balance sheets and income statements (by realization) in one tab, the related cash flows in another tab and a series of reconciliation calculations in the final tab. These data are also available in the various modules of the model. Placing all data into a single spreadsheet allows the students access to the results in a single source.

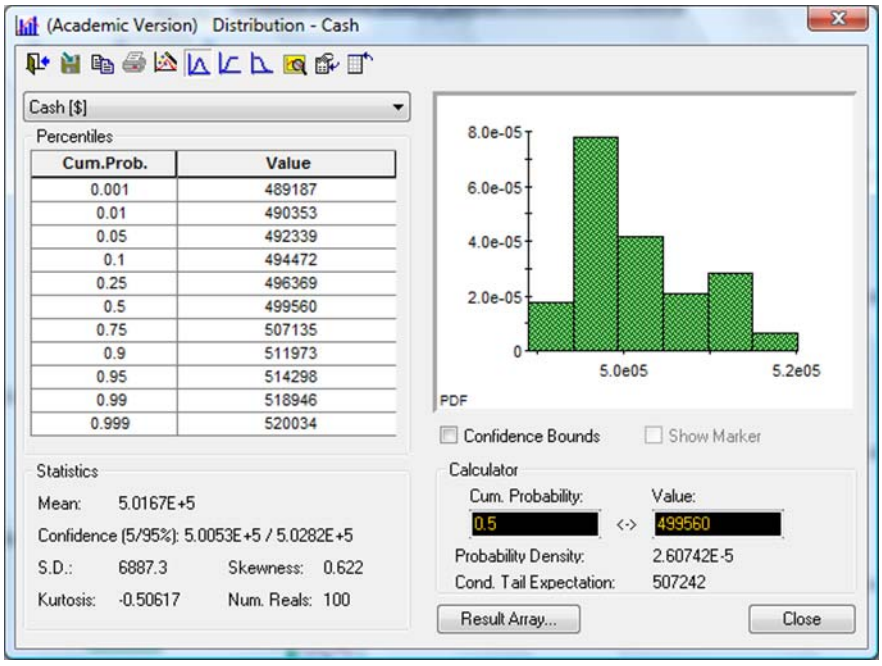


Figure 9
Probability Distribution of Cash

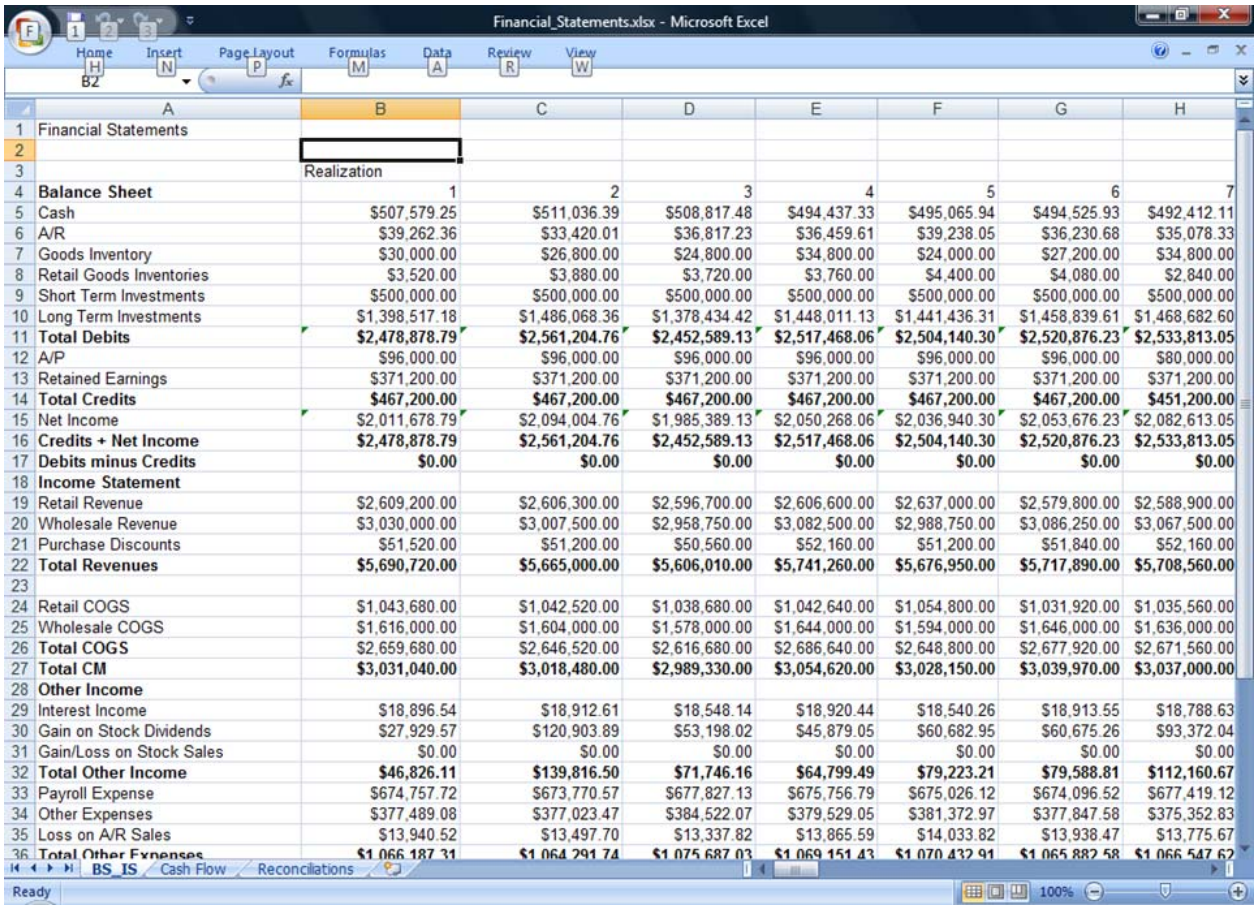
Sensitivity Analysis

At the business level, students can perform a broad series of sensitivity tests of the various model parameters. This is an important aspect of business modeling and may, in fact, be the intended result of the modeling process. For the students, there is no need for a deep technical understanding of the model in performing this type of sensitivity analysis. Instead, the students need to grasp the business processes in the model and the scope of the parameters involved. This is a good starting point for teaching simulation. A PowerPoint presentation (Probabilistic_Budgeting_Lecture.pptx) covering simulation basics, sensitivity analysis, and how to use the simulation to complete the first assignment is available as a supplement to this paper. There also are three videos in the supplementary materials explaining to students how to use the GoldSim software to complete the assignments.

Sensitivity analysis can be focused on different aspects of the business. For example, by changing the cost of the product and the retail and wholesale selling prices, the profitability of the two distribution channels can be compared under differing circumstances. Making changes to the reorder points and the quantity ordered for both retail and wholesale inventories can help determine the optimal inventory management policy. Changing the demand by using a demand offset value or a seasonality factor can also be used in cash flow analysis and other aspects of the business. These are just a few of the possible variations that can be used when testing sensitivity of the model.

Suggested Assignments

The materials available to faculty include three assignments. These assignments have been classroom-tested with senior level accounting majors. The first assignment uses the GoldSim sample simulation (Jason buying a bicycle) and has the students first do sensitivity analysis



	A	B	C	D	E	F	G	H
1	Financial Statements							
2								
3		Realization						
4	**Balance Sheet**	1	2	3	4	5	6	7
5	Cash	$507,579.25	$511,036.39	$508,817.48	$494,437.33	$495,065.94	$494,525.93	$492,412.11
6	A/R	$39,262.36	$33,420.01	$36,817.23	$36,459.61	$39,238.05	$36,230.68	$35,078.33
7	Goods Inventory	$30,000.00	$26,800.00	$24,800.00	$34,800.00	$24,000.00	$27,200.00	$34,800.00
8	Retail Goods Inventories	$3,520.00	$3,880.00	$3,720.00	$3,760.00	$4,400.00	$4,080.00	$2,840.00
9	Short Term Investments	$500,000.00	$500,000.00	$500,000.00	$500,000.00	$500,000.00	$500,000.00	$500,000.00
10	Long Term Investments	$1,398,517.18	$1,486,068.36	$1,378,434.42	$1,448,011.13	$1,441,436.31	$1,458,839.61	$1,468,682.60
11	**Total Debits**	**$2,478,878.79**	**$2,561,204.76**	**$2,452,589.13**	**$2,517,468.06**	**$2,504,140.30**	**$2,520,876.23**	**$2,533,813.05**
12	A/P	$96,000.00	$96,000.00	$96,000.00	$96,000.00	$96,000.00	$96,000.00	$80,000.00
13	Retained Earnings	$371,200.00	$371,200.00	$371,200.00	$371,200.00	$371,200.00	$371,200.00	$371,200.00
14	**Total Credits**	**$467,200.00**	**$467,200.00**	**$467,200.00**	**$467,200.00**	**$467,200.00**	**$467,200.00**	**$451,200.00**
15	Net Income	$2,011,678.79	$2,094,004.76	$1,985,389.13	$2,050,268.06	$2,036,940.30	$2,053,676.23	$2,082,613.05
16	**Credits + Net Income**	**$2,478,878.79**	**$2,561,204.76**	**$2,452,589.13**	**$2,517,468.06**	**$2,504,140.30**	**$2,520,876.23**	**$2,533,813.05**
17	**Debits minus Credits**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
18	**Income Statement**							
19	Retail Revenue	$2,609,200.00	$2,606,300.00	$2,596,700.00	$2,606,600.00	$2,637,000.00	$2,579,800.00	$2,588,900.00
20	Wholesale Revenue	$3,030,000.00	$3,007,500.00	$2,958,750.00	$3,082,500.00	$2,988,750.00	$3,086,250.00	$3,067,500.00
21	Purchase Discounts	$51,520.00	$51,200.00	$50,560.00	$52,160.00	$51,200.00	$51,840.00	$52,160.00
22	**Total Revenues**	**$5,690,720.00**	**$5,665,000.00**	**$5,606,010.00**	**$5,741,260.00**	**$5,676,950.00**	**$5,717,890.00**	**$5,708,560.00**
23								
24	Retail COGS	$1,043,680.00	$1,042,520.00	$1,038,680.00	$1,042,640.00	$1,054,800.00	$1,031,920.00	$1,035,560.00
25	Wholesale COGS	$1,616,000.00	$1,604,000.00	$1,578,000.00	$1,644,000.00	$1,594,000.00	$1,646,000.00	$1,636,000.00
26	**Total COGS**	$2,659,680.00	$2,646,520.00	$2,616,680.00	$2,686,640.00	$2,648,800.00	$2,677,920.00	$2,671,560.00
27	**Total CM**	**$3,031,040.00**	**$3,018,480.00**	**$2,989,330.00**	**$3,054,620.00**	**$3,028,150.00**	**$3,039,970.00**	**$3,037,000.00**
28	**Other Income**							
29	Interest Income	$18,896.54	$18,912.61	$18,548.14	$18,920.44	$18,540.26	$18,913.55	$18,788.63
30	Gain on Stock Dividends	$27,929.57	$120,903.89	$53,198.02	$45,879.05	$60,682.95	$60,675.26	$93,372.04
31	Gain/Loss on Stock Sales	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
32	**Total Other Income**	**$46,826.11**	**$139,816.50**	**$71,746.16**	**$64,799.49**	**$79,223.21**	**$79,588.81**	**$112,160.67**
33	Payroll Expense	$674,757.72	$673,770.57	$677,827.13	$675,756.79	$675,026.12	$674,096.52	$677,419.12
34	Other Expenses	$377,489.08	$377,023.47	$384,522.07	$379,529.05	$381,372.97	$377,847.58	$375,352.83
35	Loss on A/R Sales	$13,940.52	$13,497.70	$13,337.82	$13,865.59	$14,033.82	$13,938.47	$13,775.67
36	**Total Other Expenses**	**$1,066,187.31**	**$1,064,291.74**	**$1,075,687.03**	**$1,069,151.43**	**$1,070,432.91**	**$1,065,882.58**	**$1,066,547.62**

Figure 10
Spreadsheet of Simulation Results

on the simulation by changing only one parameter. The assignment also includes a very minor structural addition to the model. This allows the students to become acquainted with the GoldSim modeling language and also sets the stage for other assignments.

The second assignment involves sensitivity analysis of the business simulation. The assignment progresses from very structured to unstructured questions. The questions asked are focused on interpreting the business consequences of changes in the parameters.

The final assignment deals with understanding the model, suggesting additional functionality for the model and then implementing some of the suggested additional functionality. This assignment is more technical than the other two, but it is reasonable for the average accounting student.

Besides the model and the associated assignments, available teaching materials also include a PowerPoint slide set, descriptive videos for the students, critical instructions for the faculty in both written and video form, and possible answers to the assignments. Separate videos are available for students and faculty for each assignment, explaining in depth GoldSim and the budgeting model. A detailed list of available material is provided in Appendix A.

We suggest that one week be given to complete each of the first two assignments, with an additional two weeks allotted for the third. For the first assignment, in addition to the assignment and the video accompanying the first assignment, the Probabilistic Budgeting lecture should be assigned. With the second assignment and its accompanying video, the Beginning Data initial Values, the Financial Statements, and the BI lecture should be assigned. The remaining materials should be assigned with the third assignment. We also recommend a group approach be employed whereby each group is assigned a different container for analysis.

CONCLUSION

Requiring students to develop and use stochastic budgeted financial statements will 1) expose students to stochastic models of business planning, 2) help them better understand interrelated business processes, and 3) introduce them to business model simulations. The emphasis is on teaching the concepts involving stochastic budgeted statements using an object-oriented discrete event Monte Carlo simulation model of a simplified business environment. This model and teaching tools related to the subject are made available to faculty members.

REFERENCES

Arnold, T. and J. James. 2000. Finding Firm Value without a Pro Forma Analysis. *Financial Analysts Journal* 56 (2): 77-84.

Brody, R. and R. McDonald. 2004. The Next Scandal: The Undisciplined Use of Pro Forma Financial Statements. *American Business Review* 22(1): 34-38.

Bryan, S. and S. Lilien. 2004. Managed Disclosure and Pro Forma Earnings. *The CPA Journal* 74(3): 40-45.

Cuddington, J. and I. Khindanova. 2008. Integrating Financial Statement Modeling and Sales Forecasting. *Journal of the Academy of Business Education* 9. Retrieved June 15, 2011 from http://www.abe.sju.edu/proc2008/cuddington.pdf

Elkjaer, M. 2000. Stochastic Budget Simulation. *International Journal of Project Management* 18: 139-147.

Francis, J. and D. Rowell. 1978. A Simultaneous Equation Model of the Firm for Financial Analysis and Planning. *Financial Management* 7(1): 29.

Hall, E. and R. Kolkmann. 1976. A Vote for the Probabilistic Pro Forma Income Statement. *Management Accounting* 57(7): 45.

Halsey, B. and G. Soybel. 2002. All about Pro Forma Accounting. *The CPA Journal* 72(4): 13.

Hansen, D., M. Mowen, and L. Guan. 2009. *Cost Management Accounting and Control*, 6th edition. Mason, OH: South-Western Cengage Learning.

Hayen, R. 1983. How to Design a Financial Planning Model. *Long Range Planning* 16(5): 111.

Helmkamp, J. 1973. Simulating a Stochastic Proforma Income Statement. *Managerial Planning* 21(4): 35.

Hopkins, M. S., S. LaValle, F. Balboni, N. Kruschwitz, and R. Shockley. 2010. 10 Insights: A First Look at the New Intelligent Enterprise Survey on Winning with Data & 10 Data Points: Information and Analytics at Work. *MIT Sloan Management Review* 52(1): 21-31.

Kirschner, G. and W. Scheel. 1998. The Mechanics of a Stochastic Corporate Financial Model. *Casualty Actuarial Society Proceedings* LXXXV 163: 404-454. Retrieved June 15, 2011 from http://www.casact.org/pubs/proceed/proceed98/980404.pdf

Pace, D. K. 2004. Modeling and Simulation Verification and Validation Challenges. *Johns Hopkins APL Technical Digest* 25(2): 163-172.

Schalow, D. 1994. Pro-Formas for New Business. *Journal of Business and Entrepreneurship* 6(2): 23-28.

SSARS No. 14-Compilation of Pro Forma Financial Information. 2005. *Journal of Accountancy* 200(5): 117-121.

Totty, M. 2007. Making Sense of It All: New Software Aims to Put Corporate Data into the Hands of Decision Makers -- and in a Form That's Easily Understood. *The Wall Street Journal* September 24: 8.

Appendix A: Available Materials

There are a series of materials available for both student and faculty use:

For student and faculty use
- GoldSim simulation of a business
- Spreadsheet of initial parameters
- Spreadsheet for output of pro forma financial statements
- Three sample assignments
- PowerPoint lecture slides

For student use
- Videos for student viewing

Strictly for faculty use
- Index of available materials
- Instructions for faculty
- Video for faculty use
- Answers to assignments