Developing Essential Skills For Success In The Business World: A Look At Forecasting

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Abstract

As the business environment evolves, the skills required for success in business careers are also evolving. A major purpose of the undergraduate business curriculum is to prepare students for their careers in this evolving business environment. Educators should periodically reassess the skills needed by business graduates and ensure that those skills are included in their undergraduate curricula. According to leaders in business and industry, one of the most important skills needed in today's competitive business environment is the ability to use data to make projections and forecasts about the future. Unfortunately, forecasting skills currently receive limited attention in undergraduate business curricula. This paper addresses the limited attention given to forecasting skills and presents empirical evidence on the effect of providing students with forecasting instruction. One group of students was instructed on the use of certain quantitative forecasting skills and was asked to provide a forecast using a real world data set. Their results were compared to a control group that did not receive any instruction in forecasting methods. The results show that certain forecasting skills can be effectively taught in the university classroom and students can utilize these skills to make projections and forecasts about the future.

Introduction

dustry, one important skill needed in today's competitive business environment is the ability to use data to make projections and forecasts about the future. Companies today are "reengineering" to help define their fundamental business activities and purposes. This endeavor is undertaken with the expectation to produce a better understanding of future opportunities, and the risks associated with

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those opportunities. This "reengineering" effort is also seen by managers as a way to identify the skills and abilities they and those working with them will need to navigate through the changes taking place in the business environment.

The skill set needed in today's businesses has changed relative to the past. Forecasting is an example of a skill that is viewed by business leaders with increasing importance in today's dynamic business environment. These business leaders know that as managers are more accurate in understanding what to expect in the future,

they can more effectively take advantage of opportunities as they arise. The increasing importance of future-oriented information was noted by a symposium held in October, 1996 with the major focus being the discussion of how to implement the changes suggested by the Jenkins Committee Report (1994). This report was produced by the Jenkins Committee, a committee commissioned by the AICPA to study "the relevance and usefulness" of business reporting. Noll & Weygandt (1997, p. 60) state, "The most agreed-on point among symposium participants was that nonfinancial and forward-looking information was critical to assessing opportunities and risks. . ."

The importance of forward-looking information is also recognized skill by individuals who own and/or operate small companies. A former CPA firm partner and current owner/CEO of a small manufacturing firm stated that "over time my [CPA] firm realized that it would have to shift its approach to meet the changing needs of clients, who were growing increasingly interested in looking ahead--with projections and forecasts. As more CPAs go into industry, they realize the need for such a shift. . ." (Zarowin, 1996, p. 72-73)

Due to the growing importance of futureoriented information, forecasting skills need stronger emphasis as part of the skill set taught to those preparing themselves for business careers. A significant part of the mission of most (if not all) business schools is to educate and prepare students for their future responsibilities. Thus, as forecasting becomes a more valued skill in the market place, more time and effort should be devoted to helping business students develop these skills in the university setting.

Forecasting Skills

Forecasting skills can be divided into two categories: quantitative skills and qualitative skills. The spectrum of quantitative skills is broad, ranging from basics such as creating

graphs and using electronic spreadsheets to complex skills such as understanding how to interpret the autocorrelation structure of a specific time-series data set in order to determine the best structure for the forecasting model. The quantitative skill set also includes the knowledge of and ability to use computer-supported (statistically-based) forecasting methods. These methods include moving average, exponential smoothing, random walk, multiple regression, time-series, ARIMA, etc. Additionally, as computer hardware and software capabilities become more powerful and more accessible, even the more computationally intensive methods are becoming accessible on a personal computer. These possibilities are bringing powerful tools to bear on forecasting problems and individuals knowledgeable in these skills are needed in today's businesses.

Qualitative forecasting skills relate to knowledge of the specific context in which forecasts are made. Knowledge of qualitative factors represents detailed, specific knowledge (institutional knowledge) that is unique to the industry, market and/or environment in which forecasts are produced and used. For example, in seeking to forecast sales or earnings of a pharmaceutical company, it is important to consider the status of products in the FDA approval process because of the potential impact of approval on sales and/or earnings. This characteristic is unique to this industry and those unfamiliar with the industry may not realize the importance of this factor. Another example of a qualitative forecasting skill is the interpretation and quantification of nonnumerical data (e.g. how the retirement of a CEO will affect earnings per share). A third example of a qualitative forecasting skill is choosing events or measurements that are causally related to the quantity to be forecasted. Developing these qualitative skills is critical to generating an effective forecasting model.

In addition to the different types of forecasting skills, data used in generating forecasts can also be categorized as quantitative and qualita-

Quantitative data are measures of constructs that are stated in numerical terms. An example from accounting is net income or earnings per share for a specific period. This type of data is usually available for most, if not all entities. Johnson (1988) provides an example of quantitative data in the context of physicians selecting medical students for prestigious internships and residencies. In his example, the quantitative data is the grade transcript, something that is available for each medical student being evaluated. Quantitative data tend to be voluminous and often require computing tools (e.g. electronic spreadsheets, regression models) to effectively identify patterns, trends and relationships in the data.

Comparatively, qualitative data are often not available for each period and/or each entity being studied and may even be unique to individual observations. An example of qualitative data from Johnson's study is whether or not a medical student was chosen for an internship at a wellknown hospital. Because these positions are few in number and limited to particular hospitals, it is impossible to consider this specific datum for each and every medical student. This data is useful only to those with knowledge of these positions and what being selected implies about the individual medical student's ability and performance. This example also highlights that underlying knowledge of the context in which forecasts are made is important in utilizing qualitative data. Additionally, qualitative data often need to be translated into numerical quantities before they can be used for forecasting purposes.

Prior research has shown a tendency to rely on qualitative skills and data when making forecasts. This is due to the human information processing system being better equipped to utilize information about qualitative aspects of forecasting tasks. Payne, Bettman & Johnson (1993) refer to this phenomenon as the effort/accuracy tradeoff. Because people are well-endowed to identify causal relationships but not well-endowed to process large amounts of numbers,

less cognitive effort is required in using qualitative data when making predictive judgments. Since less effort is required to achieve the same level of forecast accuracy (or improvement) when using qualitative as opposed to quantitative data, people prefer to rely on qualitative data when making forecasts. SRI International (1987) found this to be the case with financial analysts, in that when listing the most preferred source of data to be used in making forecasts of earnings per share, analysts indicated that information gained through contact with a company was the most desired type of information. As mentioned earlier, this phenomenon results from the nature of the human information processing system.

Undergraduate Training in Forecasting Skills

Undergraduate students tend to not receive training in the qualitative forecasting skills because of the nature of the knowledge base required to utilize such skills. A vital component of this knowledge base is heuristics developed through on-the-job experience. Undergraduate business courses focus on general concepts and principles rather than on the unique aspects and nuances of individual industries that are learned through experience. For example, accounting courses tend to focus on concepts and principles that can be applied to most firms rather than focusing on single industries and studying specific accounting systems used by those industries. To illustrate, introductory accounting students study the concept of uncollectible receivables, but are typically not introduced to the differences in how banks and manufacturing firms account for loans/receivables that are expected to be uncollectible. Because there is significant variation in the details of accounting systems between industries, it does not make sense for university educators to teach a single specific system that will not be used by the majority of their students. Rather, by focusing on concepts and principles that apply to as many accounting systems as possible and by illustrating the application of concepts and principles to specific systems, they can provide the greatest overall benefit to their students. Similarly, MIS students study the theory of management reporting systems (MRS) in a context that is not tied to any particular organization or industry. Instead, students develop an understanding of the types of reports typically found in MRSs, report schedule types which are prominent in MRSs, and the linkages between MRSs and Transaction Processing Systems (e.g Accounts Payable, Payroll, Sales; etc.).

Training for undergraduate business students in quantitative forecasting skills and methods is more likely than training in qualitative forecasting skills, but they are usually not covered in any detail. These quantitative methods will most generally be presented in a statistics course required in the undergraduate curriculum. However, the amount of time typically spent studying forecasting is limited to a relatively small portion of the course. This material is generally relegated to a single chapter in a textbook and the inclusion of such a chapter in a text by no means ensures that the topic is addressed in the course. Thus, undergraduate accounting students are likely to have developed limited quantitative forecasting skills and even fewer qualitative forecasting skills by the time they complete their undergraduate education.

The limited amount of coverage of forecasting skills, both qualitative and quantitative, in the undergraduate curriculum is problematic due to the growing importance of forward-looking information in the business environment. Forecasting skills need greater emphasis in the upperlevel undergraduate business curriculum, with the focus on developing quantitative forecasting skills. Because many forecasting methods are algorithmic in nature, they can be effectively taught and learned in the classroom setting. Most methods can be expressed using mathematical formulas, allowing instruction to initially focus on mastering the formulas and computations. Instruction can then proceed to applications to help students become proficient in using certain methods. The instructor can easily provide feedback because the algorithmic nature of

the methods lends itself to correct/incorrect solutions. The use of these skills across the curriculum is very probable since forecasting methods tend to be applicable to numerous contexts. For example, specific forecasting techniques could be applied to forecasting employee turnover, unit sales or expected catalog orders.

Once certain methods are mastered, the next step is to evaluate the efficacy of different methods by comparison to actual data. methods could be compared to determine the most appropriate method for a given context, helping the student to understand the strengths and weaknesses of different forecasting methods. Such exercises would develop useful skills that can be applied when students begin their careers. Students will be motivated to utilize (and hopefully learn) quantitatively demanding forecast methods when their evaluation is based upon how well they develop such skills. Because of the natural tendency to favor qualitative data and skills, students need external incentives to be motivated to put forth the effort to learn quantitative forecasting skills.

As mentioned earlier the development of the qualitative forecasting skills in the university setting is difficult because of the nature of these skills. Some modest qualitative skill development may take place because of the natural tendency to use these skills. This does not present a problem, however, since qualitative skill development will accelerate once employment begins. If students graduate with a reasonable set of quantitative skills, they will be in a good position to augment these with qualitative skills they learn while working. This strategy of preparing students is appropriate since quantitative forecasting skills alone do not provide the best set of tools for making optimal forecasts. Rather, the combination of quantitative and qualitative skills has been shown to produce the most accurate forecasts (Guerard, 1987; Conroy & Harris, 1987). Thus, it makes sense for business faculty to emphasize quantitative skills in their forecasting instruction since students will more effectively learn the qualitative skills as they progress through their careers.

Hypotheses

Based on the previous discussion, providing instruction in quantitative forecasting skills to students should result in their becoming more adept in using quantitative forecasting methods when faced with a problem requiring them to make predictive judgments. The first hypothesis (alternative form) to be tested is

H1: The forecasts of students trained in basic quantitative forecasting methods will exhibit smaller forecast errors than the forecasts of a control group that is not trained in any specific quantitative forecasting method.

Another interesting hypothesis relates to expectations about the amount to time taken by the different groups to make their forecasts. Because the experimental group will be instructed in a specific forecasting method, they will not need to develop a strategy for how to generate their forecasts. On the other hand, those students receiving no instruction will need to develop a strategy for making their forecasts and then will need to execute that strategy. Essentially, the control group will have two tasks whereas the experimental group will only have one task to complete. Thus, the second hypothesis (alternative form) to be tested is

H2: The control group will take more time preparing their forecasts than the experimental group.

Method

The foregoing discussion suggests that instruction in quantitative forecasting skills can help improve forecast quality. This assertion was tested via an experiment wherein subjects were asked to make forecasts after either being instructed in a specific quantitative forecasting

method (experimental group) or not receiving any training in forecasting (control group).

Subjects

Juniors and seniors from a state university in the southwest US were the subjects for the experiment. The experimental group was enrolled in an information systems class during a nine-and-a-half week summer session. The control group was enrolled in an accounting class during the following fall semester. Eighty-six subjects participated in the experiment, of which 50 were female and 36 were male. There were 44 in the experimental group and 42 in the control group. Both groups were given class credit as an incentive to make a good-faith effort.

Task

The experimental group and the control group were given the same task. Ten years of monthly cotton mill consumption data (USDA, 1968), ranging from August 1950 to July 1959 (120 periods), were given to each group and they were required to provide six monthly forecasts of cotton mill consumption. The data were taken from US government sources (USDA, 1968). The reason for choosing this data was to ensure that none of the subjects would have a forecasting advantage because of existing knowledge about the forecasting context. Using data from this time period eliminated concerns about the subjects having existing knowledge about cottonmill consumption in the 1950s since most of them were not yet born. The control group received the data in hard-copy form and the experimental group received the data in a computer file ready to use in the software on which they were trained.

Independent Variable

The independent variable manipulated in the experiment was training related to a forecasting method called multiplicative seasonal trend. The experimental group was trained to use this fore-

casting method by means of the *Number Cruncher Statistical System* software program. The concepts associated with the use of different values for the parameters alpha, beta, and gamma were presented. In addition, use of the parameters, R-squared, mean-squared error, and mean absolute-percentage error, as a means of determining the "goodness-of-fit" between the actual values and the predicted values over the 10-year period was discussed.

Students in the control group were given neither instruction about forecasting methods nor advice on how they should develop their forecasts. They were allowed to use any means they desired to arrive at their forecasts.

Dependent Variables

The main dependent variable was forecast error. Forecast error was computed for each of the subjects' six forecasts. Two forecast error measures were used to compute forecast error. One metric employed was mean squared error (MSE) and another was mean absolute percentage error (MAPE). In addition to forecast error, subjects were asked to provide data regarding tools used in developing their forecasts as well as the amount of time they spent developing their forecasts. One purpose in collecting this data is to have some indication as to whether or not the control group used tools that were different from the experimental group. This variable will also provide some indication, albeit a crude measure, of the process used in generating their forecasts.

Other Data

A questionnaire was administered upon completion of the forecasting exercise to gather demographic data (class standing, major, gender, etc.) about the subjects. Data was also collected regarding student perceptions regarding the importance of forecasting in the business world and forecasting training received in their studies in the undergraduate business curriculum.

Additionally, a separate survey was sent to accounting faculty in the US to solicit their perceptions about forecasting in the accounting curriculum. The purpose of this separate survey was to gather data that could be compared to that gathered from the students.

The surveys completed by both the students and faculty asked about perceptions regarding (1) the importance of forecasting in the day-to-day and long-term management of a business and (2) the level of forecasting skills possessed by those graduating with undergraduate degrees in busi-The questions about the importance of forecasting in managing a business sought the level of the participants agreement with statements that "forecasts are an integral part" of both day-to-day and long-term management. These questions had 7 point Likert scales anchored with "Strongly disagree" at the low end of the scale and "Strongly agree" at the high end. The question about students' forecasting skills was anchored with "Inadequate" at the low end and "More than adequate" at the high end.

Results

A priori, the instruction provided to the experimental group should result in improved forecasts, relative to the control group. Since the forecasting context is one with which the subjects are likely to be unfamiliar, they are assumed to have very little, if any, knowledge of qualitative data related to cotton mill consumption. The systematic approach provided through the in-class training is intended to give the subjects quantitative skills so they will be more likely to make use of the information available in the time-series data. Although the systematic approach taught to the students was not intended to be the optimal forecasting method for this context, it should enable those in the experimental group to have lower forecast error than those in the control group.

Students in both groups submitted six monthly forecasts, starting with the month after

the data series ended. Figure 1 depicts actual cotton-mill consumption for the subsequent six monthly periods, along with the predicted values (monthly averages) of both groups.

Clearly, the experimental group more accurately predicted cotton-mill consumption than did the control group. In addition to this, we computed the average differences (actual cotton mill consumption minus predicted cotton mill con-

sumption) for each group. This is shown in Figure 2.

Again, we see a clear distinction between the two groups. That is, the students who received formal instruction in forecasting techniques had smaller average differences than did their counterparts who received no instruction in forecasting techniques. The differences shown in these two figures are consistent with the sin-

Figure 1
Chart of Actual Cotton Mill Consumption/Average Predicted Values for Each Group

Experimental (1-39) - Students with formal instruction in forecasting techniques Control (40-78) - Students with no formal instruction in forecasting techniques

	Month	Month	Month	Month	Month	Month
	1	2	3	4	5	6
ACTUAL	691,376	797,070	666,761	638,585	719,067	635,071
Experimental (1-39)	632,718	696,276	718,552	668,302	649,188	712,918
Control (40-78)	934,224	1,126,076	1,026,018	985,903	961,601	1,047,004

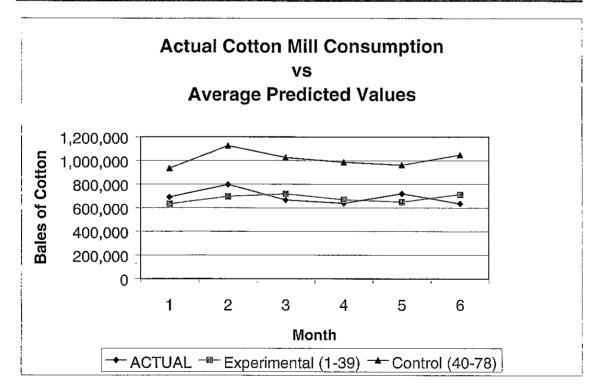
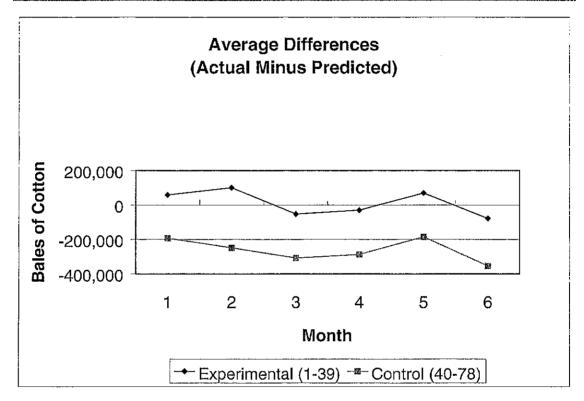


Figure 2
Chart of Average Differences for Each Group (Actual minus Predicted)

Experimental (1-39) - Students with formal instruction in forecasting techniques Control (40-78) - Students with no formal instruction in forecasting techniques

Page 100 Comments of the Comme	Month	Month	Month	Month	Month	Month
	1	2	3	4	5	6
Experimental (1-39)	58,658	100,794	-51,791	-29,717	69,879	-77,847
Control (40-78)	-192,473	-248,503	-307,737	-286,726	-185,084	-353,826



gle-factor analysis of variance (ANOVA) shown in table 1. The forecasts made by the students who received formal forecasting instruction had significantly smaller forecast errors than those made by the students who received no formal forecasting instruction.

Thus, the first hypothesis, that training in quantitative forecasting methods will reduce forecast error, is clearly supported.

The second hypothesis suggested that the control group would devote more time to the task since they had to develop a strategy to complete the task and then execute that task. This hypothesis was tested using a t-test. The mean time reported by the experimental group was .9 hours and 1.0 hours for the control group. The results of the t-test showed that there was no significant difference between the time taken by the two groups to complete the task (t = .69, p = .50). One difficulty with this test was that the

Table 1
Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Experimental Group	234	2729021.1	11662.48333	17425102613
Control Group	234	-61399561.7	-262391.2893	1.24043E+12

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	8.78734E+12	1	8.78734E+12	13.97195138	0.000209	3,86148713
Within Groups	2.9308E+14	466	6,28927E+11			
Total	3.01867E+14	467				

time data was self-reported rather than being measured by the experimenters. This design choice was made to allow the subjects to have access to whatever tools they desired. Having the subjects perform the task in a controlled environment would have limited the subjects' choice of tools. We choose to give up some precision in measurement in order to allow the subjects to have access to the tools they desired.

Other Results

The data gathered in the questionnaires and surveys provided some insight regarding perceptions about forecasting. Overall, 86 students responses were used and 95 faculty responses were used.1 Both the students and the faculty expressed the belief that forecasts are an important part of the management of a business. This was true for the question asking about day-to-day and long-term management of a business. Specifically, the average of the students' responses was 5.3 and 6.1 for the day-to-day and long-term questions, respectively. The corresponding average faculty responses were 5.4 and 5.9. The differences between the two groups for the two questions were not significant (t = 0.27, p =0.78; t = -0.90, p = .37).

However, on the question about forecasting skills, there was a significant difference between the students' and faculty perceptions. The average student response was 2.4 while the average faculty response was 3.5 (t = 5.1, p < 0.000). While the faculty felt new graduates possessed adequate forecasting skills, the students felt their skills were somewhat inadequate. Because the questionnaire was administered after the students performed the forecasting exercise, there may have been a treatment effect. Those who received formal forecasting instruction were likely to make a somewhat inflated assessment of their forecasting skills since they had just been trained. On the other hand, those receiving no formal forecasting instruction were likely to make a somewhat lower assessment of their forecasting skills since they were given no help in completing the forecasting exercise. The students' responses were combined so that any treatment effect is likely to be minimized.

One other interesting result emerged from the questionnaire data. The control group reported that the most common tools used in completing the exercise were pencil/paper and a calculator. Very few reported using graphs or pictorial displays of the data. In spite of this, it is clear from Figure 2 that their forecasts incorporated the seasonal aspect of the data. It is apparent that the students who received no instruction were sufficiently sophisticated to consider seasonality when making their forecasts. This is significant because of the cognitive difficulty in discerning data patterns when the data is presented in a list format.

Conclusions

The conclusions based upon the results of the experiment are first, that students can improve their forecasting skills through instruction in undergraduate curriculums. The university classroom is well suited to teaching quantitative forecasting skills and because forecasting skills are becoming more valued in the market, business schools can better fulfill their missions by increasing the forecasting training they provide to their students. Second, even though the perception of faculty and students were the same regarding the importance of forecasting skills in managing an actual business, they were significantly different on whether the students were developing proficiency in those skills. It would be interesting to know the perceptions of employers regarding new graduates' forecasting skills. This way, the divergence between student and faculty perceptions could be interpreted more effectively. Perhaps students are expressing a lack of confidence or perhaps faculty members are not closely attuned to the evolving skill set needed by students graduating from undergraduate business programs.

Finally, it may be that the strategies used by students in the forecasting task depended upon the tools they felt comfortable and confident with. Subjects in the control group relied most heavily on pencil and paper and calculators, tools they regularly use throughout their undergraduate education. This suggests that introducing additional tools for students to become familiar with may be an important part of seeking to help students develop more sophisticated skills.

The availability of more sophisticated tools may be as important as instruction in using those tools, since people will rely on the tools they know how to use.

Suggestions for Future Research

One direction for future research is to gather data regarding the perceptions of employers regarding the forecasting skills of their new hires. Given the reported differences is forecasting skill level between students and faculty, additional data from employers are likely to be useful in assessing the actual level of new graduates' forecasting skills.

Another direction for further inquiry is to survey university business schools to determine the amount of time spent teaching forecasting skills in the undergraduate business curriculum. Similarly, data could be gathered regarding any significant changes in the time devoted to forecasting instruction over the last five or ten years. This data, combined with data from business people about the importance of forecasting would be beneficial in understanding how effectively undergraduate business programs incorporate important emerging skills into their curricula.

Endnotes

1. The number of questionnaire responses is different than the number of responses used in the forecast analysis for two reasons. First, there were three responses in the control group that were outliers or in which it was apparent that subjects did not put forth a good faith effort in preparing their forecasts. This reduced the number of useable responses to 39. The second reason is that once the subject number of 39 was established for the control group, we randomly eliminated enough responses from the treatment group to have an equal number.

References

- American Institute of Certified Public Accountants, "Improving business reporting -A customer focus," New York, New York, 1994.
- 2. Conroy, R. and R. Harris, "Consensus fore-casts of corporate earnings: Analysts' fore-casts and time-series methods," *Management Science*, Vol. 33, pp. 725-738, 1987.
- Guerard, J. B. "Linear constraints, robustweighting and efficient composite modeling," *Journal of Forecasting*, pp. 193-199, 1987.
- Johnson, E. J. "Expertise and decision under uncertainty: performance and process," in *The Nature of Expertise*, M. T. H. Chi, R. Glaser and M. J. Farr (Eds), Erlbaum, Hillsdale, NJ, 1988.

- 5. Noll, D. J. and J. J Weygandt, "Business reporting: What comes next?" *Journal of Accountancy*, Vol. 183, No. 2, (Feb), pp. 59-62, 1997.
- 6. Payne, J. W., J. R. Bettman, E. J. Johnson *The Adaptive Decision Maker*, New York: Cambridge University Press, 1993.
- 7. SRI International, *Investor Information Needs and the Annual Report*, Financial Executives Research Foundation, Morristown, New Jersey, 1987.
- 8. USDA, "Statistics on cotton and related data, 1930-1967", Statistical Bulletin No. 417. Economic Research Service, Washington D.C., 1968.
- 9. Zarowin, S. "Changing hats," *Journal of Accountancy*, Vol. 182, No. 4, (Oct) pp. 71-73, 1996.

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