A SIMULATION STUDY OF ALTERNATIVE METHODS FOR TRANSLATING FINANCIAL STATEMENTS OF AUTONOMOUS FOREIGN ENTITIES

By

GALEN LEE RUPP

Bachelor of Science
in Business Administration
Bowling Green State University
Bowling Green, Ohio
1969

Master of Business Administration
Boise State University
Boise, Idaho
1976

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Graduate College of the
Oklahoma State University
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Thesis Approved:

James C Boatsman
Thesis Adviser

Laurence A. Hammer

P. L. Claypool

Robert C Dauffenbach

Norman N Durham
Dean of the Graduate College

PREFACE

This study is an attempt to identify the best translation method out of a group of four alternatives. The first critical problem is specifying a research criterion. That is, the standard of comparison that is used for evaluating the alternatives. A second problem, and perhaps more difficult, is selecting the best method when two alternatives produce almost identical results. Unfortunately, many of the ranking procedures that are used in studies of this type do not provide a definitive answer.

When two accounting models produce similar results, a relevant question is, "How much do the models cost?" The translation models in this study have a cost differential. If there is no evidence that one model provides better information, then the cost-benefit approach suggests that the least costly model should be selected.

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CHAPTER I

THE RESEARCH PROBLEM AND FRAMEWORK

Introduction

The international monetary system from the end of World War II to the early 1970s was generally based on a system of fixed exchange rates. This fixed, or par value, system and the creation of the International Monetary Fund resulted from the 1944 United Nations conference at Bretton Woods, New Hampshire. Member countries agreed to establish and maintain, within certain prescribed limits, a par value for their currency in terms of gold or the United States dollar. Adjustments in par values were allowed but only after prior approval by the International Monetary Fund (35).

The Bretton Woods agreement provided some stability in international transactions until its demise in the early 1970s. In contrast, its replacement, a system of floating exchange rates, introduced a significant degree of uncertainty into international business. Accordingly, exchange rate risk received a higher priority in all international investment and financing decisions (17).

Purpose and Contribution

Floating exchange rates also created a problem for

accountants—namely, the methodology to be used for translating foreign currency financial statements into the reporting currency for consolidated financial statements. Moreover, the accounting treatment of translation gains and losses (hereinafter, translation adjustments) became a major issue because floating exchange rates increased both the magnitude and volatility of these adjustments (47).

The Financial Accounting Standards Board (FASB) (20) required the temporal method for translating foreign financial statements in its Statement of Financial Accounting Standards (SFAS) No. 8. More importantly, they also required the immediate recognition of translation adjustments in income. And it was this specific requirement, more than any other feature, that caused the intense protest by corporate executives against the accounting standard. After reconsideration of the issue, the FASB (21) issued SFAS No. 52 to replace the earlier accounting standard. If foreign entities have a functional currency other than the United States dollar, the new accounting standard requires both the current rate method and the deferral of translation adjustments.

The primary justification for this study is the assumption that decision makers attach some special significance to the reported income figure. Since the net income figure might influence decisions, the accounting profession is obligated to provide the most useful information for decision makers (22). Sterling's (48) criticism of current

financial reporting is that it does not measure the relevant input for decision models. He suggests that decision makers really want to know their actual command over goods in the market place. The change in command over goods between two successive dates represents a relevant measure of the change in economic well-being.

The purpose of this study is to compare the accounting income measures generated by the current rate and temporal translation methods with a specific research criterion—that is, a current value version of Sterling's (48) command over goods measure. Since the research criterion is viewed as the relevant measure of economic well-being, the superior translation method is the one that generates the accounting income measure that more closely approximates the current value measure.

This study will be useful regardless of the outcome. Failure to identify a superior translation method will provide evidence that translation is really not that serious of a problem. And while it probably would not settle the dispute, the identification of a superior method would provide some evidence regarding the related accounting standards. In either case, the study provides quantitative evidence that has been conspicuously lacking in the debate.

Research Methodology

The Simulation Model

Since the translation controversy was triggered by

the introduction of floating exchange rates, this type of currency environment is retained in the research framework. An objective procedure using factor analysis and the actual data from 1972 to 1980 is used to simulate exchange rates, consumer price indexes, and interest rates. The principal advantage of this technique is that it preserves the inter-correlations of the variables. Thus, the behavior of the simulated rates is consistent with real world observations.

The next step uses a computer simulation model to generate local currency financial statements for foreign subsidiaries of a U. S. parent company. Specifically, these subsidiaries are located in Canada, France, West Germany, Japan, Switzerland, and the United Kingdom. Each subsidiary begins operations with the same U. S. dollar amount of assets. Financial statement data is generated for thirty time periods. The number of time periods selected was an arbitrary decision.

Certain major assumptions are presented here because they are essential for understanding the scope of the study. First, the foreign subsidiaries are autonomous operating units that generate local currency cash flows. While their operations are affected by internal factors such as general price levels and interest rates, they are not affected by the external factor of exchange rate movements. Second, the subsidiaries are manufacturing or service operations with a sizable investment in fixed assets. Finally, while the parent company makes no additional capital contributions

after its initial investment, the foreign subsidiaries may cover any capital shortage through unlimited short-term borrowing from local sources. The only intercompany transaction is the payment of dividends to the parent company.

Since simulation is ideally suited for sensitivity analysis, the computer model is run numerous times using different parameters. The key variables manipulated are the proportion of fixed assets to total assets (a measure of capital-intensity) and the debt-equity ratio. These key variables highlight the principal differences in the translation methods. While the operating results generally reflect moderately successful foreign operations, high and low profitability situations are evaluated by changing the cost parameters.

After the local currency financial data is generated, the simulation model translates the data into U. S. dollar amounts using the rules of the current rate and temporal methods. Since both methods are evaluated with translation adjustments both excluded and included in net income, there are four separate accounting income measures generated for each time period. While the current value measure (research criterion) is also based on the same underlying data, there are certain adjustments that must be made to the data. First, the historical cost values for the fixed assets and inventory are adjusted to current value (6). Second, the current value of the firm measured in foreign currency is converted into U. S. dollars. Finally, since command over

goods represents the physical units of some good that could be purchased in the market place, a simple price level adjustment converts the nominal dollars to command over goods. The relevant income for the period is then easily calculated as the change in command over goods.

Since the historical-cost accounting model does not compensate for the effects of inflation, it is not valid to compare the unadjusted accounting incomes generated by using alternative translation methods with the research criterion. Accordingly, the assumption is that financial statement users, who are well aware of inflation, make the price level adjustment to accounting income. The relevant comparison, then, is price level adjusted accounting income versus price level adjusted current value income.

The final step in the simulation is the consolidation of the foreign subsidiaries. Given the autonomous nature of the foreign operations and other assumptions, the consolidation process only involves adding the individual results of the six foreign subsidiaries. Accordingly, unless indicated otherwise, the statistical and other quantitative analyses are performed on the consolidated data.

Quantitative Analysis

The statistical analysis of the data begins with an analysis of variance of the 150 income observations (five treatments times 30 observations per treatment group) that are generated by each simulation run. The analysis of

variance serves two purposes. First, a test of the null hypothesis of no difference in treatment means is available through the F ratio. Second, the procedure determines the mean square error which is required by Dunnett's (15) procedure for multiple comparisons of treatments with a control treatment. This procedure identifies those treatments which are significantly different from the control.

Regardless of the outcome of the above statistical procedures, the data will be further analyzed using other quantitative techniques. The first method involves a rank order of mean income differences between the accounting income measures and the control treatment. If other things were equal, the translation method that minimizes the difference in mean income would be preferred. However, this technique provides no information about the period-by-period differences between the income measures. For example, it is conceivable that a translation method might provide approximately the same mean income but with large period-by-period deviations.

The other comparisons recognize that management and other interested parties often rely on periodic accounting signals as the basis for their decisions. The procedure is to calculate the difference between the accounting income measures and the control treatment for each time period. Because these differences might be positive or negative, the superior translation method is the one that minimizes the mean absolute differences. Again, however, it is possible

that a translation method might generate very large differences in some periods but perform reasonably well in most of the other periods. Thus, investors or management might be misled by the few large deviations. In order to check this possibility, the differences are squared. The superior translation method minimizes the mean squared differences.

The Multinational Framework

Cunningham (12, p. 4) defines multinational enterprises (MEs) as entities with "full scale operations in several different countries, and one in which management rationalizes operations globally, rather than regionally or nationally." Operating in several different countries is not surprising. Indeed, many MEs have establised a network of permanent foreign subsidiaries to manage their worldwide operations. While some of these may only be legal conveniences, there are many firms that operate as autonomous business entities. The latter are especially relevant for MEs because they clearly meet the guidelines of SFAS No. 52 for using the current rate method.

The countries in the multinational framework include all of the major foreign currencies. Specifically, the criteria of selection limited the countries to those with (1) a sizable proportion of the total U. S. direct foreign investment, and (2) a prominent role in world trade. The countries of Canada, France, West Germany, Japan, Switzerland, and the United Kingdom accounted for 73% of the total

U. S. foreign investment in developed countries at the end of 1979 (51). Moreover, the above countries including the U. S. account for 73% of the currency weights used for valuation of Special Drawing Rights by the International Monetary Fund (30). This measure reflects their share of world trade. Although not a member of the International Monetary Fund, Switzerland was chosen because of the international prestige of its currency.

Another recurring theme is that investments in foreign affiliates are primarily long-term commitments (7) (32). U. S. investors have consistently chosen to reinvest a substantial share of foreign earnings (51). Accepting the long-term nature of foreign investments has an important implication for accounting research—namely, the necessity of evaluating operating results over numerous time periods instead of focusing attention on a single time period or transaction (12). This important dimension is incorporated in the research framework.

Advantages and Disadvantages of Simulation

As mentioned previously, a computer simulation model is used to generate the financial data. Simulation is very useful in translation studies because of the need for data that would be too costly to obtain otherwise. This is extremely important considering the desirability of studying the translation process over an extended period of time.

Another important advantage of simulation is the ability to focus attention on and control the critical parameters in the model. Moreover, the parameters and input variables can be easily manipulated to test the model's sensitivity to changes in the values used (46).

Simulation, however, is not without some practical disadvantages. Numerous assumptions must be made in the development of the simulation model. Unfortunately, this tends to focus attention on the assumptions rather than on the reasonableness of the output. Moreover, the ability to generate data with relative ease requires very careful consideration of what data is actually necessary. As always, the quantity of data is not as important as the interpretation of the data. Finally, as Shannon (46) notes, the development and testing of a simulation model is an excellent way to learn the behavior of the system. The cost, however, is a considerable investment of time.

Limitations of the Study

A principal limitation is that only autonomous foreign entities are considered. For instance, some foreign subsidiaries may ship their entire output to a domestic operation for sale in the domestic market. Other foreign operations may serve as marketing centers to sell domestic output to foreign buyers. Since these operations are very different from autonomous foreign entities, the findings of this study will provide little evidence regarding the translation

problems of such operations.

Another limitation is that only manufacturing or service operations with a sizable proportion of depreciable fixed assets to total assets are covered. Other types of foreign operations may have asset compositions that reflect very little investment in fixed assets. In the case of trade or finance companies the asset valuation problems, especially for monetary assets, may also be quite different. Likewise, petroleum operations, which have their own unique accounting problems, may require different procedures.

A final limitation is that a specific foreign currency mix is assumed. Each multinational company has its own unique currency mix which might be quite different from the one considered in this study. Moreover, their currency mix may include currencies other than the major foreign currencies. Stated simply, each multinational firm is likely to view the translation issue from the narrow perspective of its own foreign currency situation.

Organization of the Study

Chapter II is devoted to a review of the literature. The translation controversy is traced from the period prior to SFAS No. 8 through the issuance of SFAS No. 52. The chapter includes a discussion of the various theoretical arguments for and against the translation methods. This approach serves to highlight the principal differences in the methodology required by the two accounting standards.

Additionally, Chapter II includes a review of the empirical evidence regarding SFAS No. 8.

The procedures used to simulate the financial data are explained in Chapter III. A detailed description of the factor analysis technique for simulating exchange rates, consumer price indexes, and interest rates is presented at the beginning of the chapter. Additional details explaining the simulated financial data and the simulation model are presented in the second section of Chapter III. The last section in Chapter III describes the current value income measure. The simulated data is analyzed in Chapter IV. Finally, Chapter V contains a summary of the research, conclusions, and implications for future research.

CHAPTER II

TRANSLATION METHODOLOGIES

The translation controversy has been covered extensively in the literature since the early 1970s. Thus, the purpose of this chapter is to critically examine the current rate and temporal translation methods. This approach provides the necessary background for a better understanding of the controversy and also highlights the principal differences between the translation methods.

As mentioned in Chapter I, there was widespread dissatisfaction with the temporal method of SFAS No. 8. Accordingly, the major criticisms of SFAS No. 8 are summarized in this chapter. The empirical evidence is then examined in order to assess the validity of the criticisms. The chapter concludes with some comments regarding the empirical evidence and the current viewpoints of the opposing sides in the controversy.

The Temporal Method

Prior to SFAS No. 8, many companies used the monetary-nonmonetary method for translating foreign currency statements (17). This method, developed by Hepworth (26), was the first to offer a theoretical foundation for the

translation process. Conceptually, there are few differences between the monetary-nonmonetary and temporal methods. In fact, many of the theoretical arguments for the temporal method have their origin in the monetary-nonmonetary approach.

Hepworth (26) based the monetary-nonmonetary method on the premise that the translation process should not change the underlying basis of measurement required by generally accepted accounting principles (GAAP). Fixed assets, for example, are recorded at historical cost under GAAP and this cost does not change. Moreover, depreciation is determined on this same historical cost. In the case of translated foreign account balances, the only way to preserve these historical measures is to use the exchange rate in effect at the date of the original transaction. That is, the use of any other exchange rate, such as the current rate, is a violation of GAAP because it alters the cost that was previously reported. The same argument applies to inventory and prepaid expenses because they are also valued at historical cost.

Foreign assets and liabilities that represent contractual rights to receive or disburse a fixed amount of currency (monetary items) are translated using the current exchange rate at the balance sheet date. Receivables, for example, are reported at net realizable value under GAAP. Ideally, according to Hepworth (26), receivables should be translated using the estimated exchange rate at the time the

cash is expected to be received. However, the impossibility of accurately projecting future exchange rates leaves little choice but to use the current rate as the best estimate. Similarly, the same argument applies to monetary liabilities in the context of amounts to be paid out in the future.

In its decision to require the temporal method, the FASB (20) accepted the basic premise that translation should not change the underlying measurement required by GAAP. Moreover, adherence to GAAP also supported the immediate recognition of translation adjustments in current income. Arguments for deferral of translation adjustments were rejected because of the absence of a criterion for their subsequent realization. In addition, they felt the recognition of translation adjustments in income would be in accordance with the all-inclusive income statement required for most business enterprises.

A Critique of the Temporal Method

Several writers object to the temporal method because it takes a home-country perspective and treats all transactions "as if" they were actually denominated in dollars (19) (32). They contend that this strict home-country perspective is unrealistic for many multinational firms. That is, the local operating units are much more than branches of the parent company. In many cases the foreign operations are distinct business entities that operate autonomously in completely different economic, social, and

legal environments. Decisions are often made on a local or worldwide perspective rather than a parent company perspective (32). Moreover, some argue that the "as if" assumption suggests, among other things, that all foreign earnings will be repatriated. This is clearly not the case for MEs that directly reinvest most of their foreign earnings (53).

Another criticism of the temporal method is that it does not equate accounting exposure with economic exposure. Those assets and liabilities translated at the current rate constitute accounting exposure. Economic exposure, however, is often not precisely defined. Indeed, Stanley and Block (47) found there was considerable confusion about economic exposure. That is, management did not know what it meant or, if they did, how to measure it. Dufey (13) suggests economic exposure is the U. S. dollar equivalent of the present value of the foreign subsidiary's future cash flows. Whether an exchange rate change will impact future cash flows depends on factors such as resource markets, output markets, and import competition. The point is that the foreign cash flow stream must be adjusted before the effect on the parent company can be determined. Clearly, an economic model must be used to measure economic exposure. Since the accounting model is not designed to measure this type of exposure, the criticism is really an indictment of the accounting model and not of translation practices.

Because translation adjustments are a function of accounting exposure and exchange rate changes, SFAS No. 8

can, in certain circumstances, produce results that are contrary to economic perceptions. Suppose, for example, the dollar depreciates against a foreign currency. Intuitively, the parent company is better off because its foreign subsidiary can generate more dollars with its dividends. But, if the subsidiary is sufficiently levered to cause a net liability exposure, a translation loss would be reported under SFAS No. 8 (44). A major complaint is that the treatment of inventory and fixed assets at historical rates and long-term debt at the current rate places many firms in a net liability position (45). This exposure, along with a depreciating dollar, may be responsible for the preoccupation with translation losses in much of the literature.

In addition to the possible erroneous signals, the treatment of fixed assets and long-term debt at different rates also raises a basic question as to what constitutes an effective hedge. That is, a portion of the cash flows generated by the fixed assets are used to retire the debt. Some writers suggest it is inconsistent to say the fixed assets are not exposed but the long-term debt is exposed (13) (44).

A final complaint against SFAS No. 8 is that it distorts the relationships in the foreign currency statements (21). There are two reasons for this alleged distortion. First, the use of both historical and current exchange rates for various assets, liabilities, revenues, and expenses

alters the basic internal relationships. Second, profitability ratios may be drastically changed because of the translation adjustments in current income. Indeed, Jacobi (32) notes that favorable local currency results are often translated into unfavorable consolidated results.

Empirical Evidence

An obvious result of including translation adjustments in income, at least in the context of fluctuating exchange rates, is that reported earnings will be more volatile. Several studies indicate that management views volatility of earnings as a major concern because it might adversely impact security prices (3) (17). This would occur only if the market considered translation adjustments as part of the normal earnings stream. Management, for the most part, was genuinely concerned that security analysts would be misled by the reported results (47).

The question of interest, however, is not what management thought might happen but rather what actually happened as a result of SFAS No. 8. The evidence regarding the impact on reported earnings is mixed. An overwhelming majority of respondents in a study by Cooper, Fraser, and Richards (11) indicated no significant impact on earnings from SFAS No. 8. Likewise, Choi, Lowe, and Worthley (10) found only minimal effects in their survey. However, both of these studies appear limited because of methodology (questionnaires) and relatively small sample size. In

contrast, there is objective evidence that specific firms have reported huge translation adjustments as a result of compliance with SFAS No. 8 (9).

An impact on securities prices of MEs would indicate that SFAS No. 8 information had changed the market's evaluation of those firms. However, as Dukes (14) points out, security prices might change because of two different reasons. First, the new information could be considered relevant and useful by the market. Second, the information is distorted and misleading and analysts do not make that distinction. On the other hand, an absence of any reaction would suggest that the market views translation adjustments as an accounting anomaly. In an extensive market study for the FASB, Dukes (14) found no significant market reaction to SFAS No. 8. Likewise, Cooper, Fraser, and Richards (11) indicate a majority of their respondents reported no impact on the market prices of their securities.

In a simulation study of translation methods, Mensah and Biagioni (36) tested the distortion of internal financial statement relationships by using financial ratios for predicting the failure or nonfailure of foreign subsidiaries. A significant finding, in the context of their study, was that no single translation method could be regarded as better than the others in predicting success or failure. Moreover, whether translation adjustments were included in net income or excluded had no significant impact in their study.

In addition to possible economic impacts, there was considerable concern about the behavioral implications of SFAS No. 8. The principal concern was that management's aversion to volatility would compel them to take certain courses of action to reduce the magnitude of translation adjustments (11). Since management has no control over exchange rates, these actions involve ways to reduce accounting exposure. Within certain limits, a majority of the corporate executives surveyed by Evans, Folks, and Jilling (17) felt they could successfully manage accounting exposure. A popular method was increasing or decreasing the borrowing levels in the various foreign currencies. Another possible alternative, and very much linked with debt management, was increasing or decreasing earnings repatriations. However, Evans, Folks, and Jilling (17) found little evidence that this had been a major response to SFAS No. 8.

Another interesting question is the alleged dysfunctional behavior resulting from SFAS No. 8. Specifically, management might reduce the magnitude of translation losses at the expense of future cash flows (47). For example, debt swapping is dysfunctional if higher cash interest payments are required on the new debt. However, there is no empirical evidence to support these allegations (36). The problem is that such behavior, if it occurred, would be impossible to measure from published financial information (13).

The Current Rate Method

The principal arguments in support of the current rate method in SFAS No. 52 have already been discussed as criticisms of SFAS No. 8. The new accounting standard, for the most part, effectively addresses and alleviates all of the major criticisms. The problem of volatility of earnings was easily handled by the deferral of translation adjustments until the sale or liquidation of the foreign investment. Although exchange rate changes might ultimately impact the proceeds from sale or liquidation, the FASB (21) concluded that the impact is so uncertain that periodic recognition of translation adjustments in income is not justified.

The dissenters (SFAS No. 52 was adopted by a 4 to 3 vote) object to the current rate method because it violates certain features of GAAP that have both a long tradition and are still required for domestic enterprises. First, the current rate method deviates from the valuations of the historical-cost accounting model. The earlier discussion about fixed assets serves as an excellent example. Second, it is not consistent with the basic underlying concepts of consolidated financial statements. In addition, the dissenters believe there is a lack of compatibility in the standard's underlying premises (21).

An important concept in SFAS No. 52 is that only the parent company's net investment is exposed to exchange rate

risk. The lack of concern for the separate assets and liabilities of the foreign entity is not consistent with the principal emphasis in consolidation accounting—that is, the line-by-line presentation of assets and liabilities. More importantly, a net investment approach implies a U. S. dollar measure of risk. However, as the dissenters point out, this is not consistent with the functional currency approach in SFAS No. 52 which emphasizes the retention of the internal relationships in foreign currency financial statements. Succinctly, SFAS No. 52 defines risk but makes no attempt to measure it (21).

Conclusions Regarding the Translation Methods

The empirical evidence does not generally support the major criticisms of SFAS No. 8. In regard to economic impacts, the evidence indicates there was no significant reaction by the securities market to SFAS No. 8 (11) (14). Likewise, SFAS No. 8 apparently had little impact from a behavioral standpoint (17) (36). A possible explanation for the latter observation is that management decided to concentrate its effort on repeal of the standard rather than making any adjustment to live with the standard.

In closing, it is apparent that the two sides are divided over some rather fundamental issues. Advocates of the temporal method maintain it is the only method consistent with and supported by GAAP. They also believe the

temporal method provides more useful information to investors and creditors for assessing future cash flows. Not surprisingly, the supporters of SFAS No. 52 contend their method is superior for assessing future cash flows.

CHAPTER III

THE SIMULATION MODEL

As discussed in Chapter I, the data for this study is simulated. Accordingly, the purpose of this chapter is to explain the procedures used to generate the data. The first section explains the factor analysis technique used for the simulated exchange rates, consumer price indexes, and interest rates. The second section explains the simulated financial data that is generated for each foreign subsidiary. Additionally, more of the underlying assumptions for the simulation model are discussed. The third section explains the procedure used to determine the current value income measure (research criterion).

Simulated Rates

The Purchasing Power Parity (PPP) theory states there is a direct relationship between the currency exchange rate and general price levels of two countries. The relative version of PPP states the proportional change in the exchange rate during a period of time is equal to the ratio of the changes in the general price levels of the two countries (33). Prior to floating exchange rates, the PPP theory was supported by considerable empirical evidence (2)

(33). However, recent evidence by Frenkel (23) indicates the PPP theory has little explanatory power for exchange rate changes in the 1970s. He concludes that PPP should not be considered, at least in the short-run, as a theory of exchange rate determination.

The recent evidence, however, does not suggest an absence of a long-run linkage between exchange rates and general price levels. As Frenkel (23) notes, a country should not expect to follow inflationary policies without ultimately realizing an exchange rate effect. A practical interpretation, and one relevant for simulation studies, is that the PPP theory is not appropriate as a short-run estimating technique. This was verified by using the procedure suggested by Aliber and Stickney (2) for calculating the annual percentage deviation from the PPP theory. For the period from 1973 to 1980, the annual deviations ranged from -24% to 26% and were generally quite volatile.

In view of these deviations from the PPP theory, a technique based on factor analysis, adopted from Boatsman and Robertson (5), was used to simulate the exchange rates, consumer price indexes, and interest rates. The first step in the procedure was to obtain a restricted sample of nine observations (1972-1980) for the 26 variables in Table I. Means and standard deviations of the variables were then determined. The actual data used and these statistics are presented in Appendix A. In addition, the intercorrelations of all the variables were obtained. This confirmed

that many of the variables were, in fact, significantly correlated.

The next step was to factor analyze the sample data. Three factors had eigenvalues greater than unity and are presented in Table I. The overall behavior of the variables is generally explained by the relatively high loadings on Factor 1. Positive loadings for consumer prices reflect the inflationary environment of the period. The negative loadings for the exchange rates of France, West Germany, Japan, and Switzerland indicate those currencies were appreciating against the U. S. dollar. In contrast, the U. S. dollar appreciated against the Canadian dollar and was relatively stable against the United Kingdom's currency.

The elements of the factor loading matrix F represent the correlation coefficients of the variables and principal components. Matrix X contains computer generated pseudo-random numbers from a population with mean=2 and variance=1. Multiplying F by X generates matrix Z which retains the intercorrelations of the original variables. In matrix form the procedure appears as

$$\underset{(26 \times m)}{\underset{F}{\begin{bmatrix}\text{Factor loading matrix}\end{bmatrix}}} \quad \underset{(m \times p)}{\underset{X}{\begin{bmatrix}\text{Pseudo-random numbers}\end{bmatrix}}} = \underset{(26 \times p)}{\underset{Z}{\begin{bmatrix}\text{Simulated rates}\end{bmatrix}}}. \qquad (3.1)$$

At this point the matrix Z has rows with means and standard deviations equal to the pseudo-random numbers.

TABLE I

VARIMAX ROTATED FACTOR LOADING MATRIX

VARIABLES	FACTOR 1	FACTOR 2	FACTOR 3	COMMU-NALITY
Year-End Exchange:				
Canada	1.0002	-.0196	-.0078	1.0009
France	-.6517	-.3957	.0425	.5830
West Germany	-.8427	-.3277	-.3224	.9215
Japan	-.9257	.0713	.0047	.8620
Switzerland	-.8418	-.2949	-.4015	.9569
United Kingdom	-.0605	-.1890	.9150	.8766
Average Exchange:				
Canada	.9923	.0573	-.1205	1.0025
France	-.4884	-.4496	.1346	.4588
West Germany	-.8891	-.3775	-.2147	.9790
Japan	-.9485	-.1281	.1783	.9478
Switzerland	-.8888	-.3050	-.3253	.9888
United Kingdom	.2404	-.2246	.8730	.8704
Consumer Prices:				
Canada	.9316	.2300	.2064	.9633
France	.9276	.2288	.1944	.9506
West Germany	.8862	.2719	.3428	.9767
Japan	.8621	.2324	.4321	.9839
Switzerland	.7848	.3584	.4790	.9738
United Kingdom	.9280	.1864	.2084	.9393
United States	.9151	.2664	.1576	.9332
Interest Rates:				
Canada	.7451	.6082	-.1448	.9460
France	.2858	.8656	-.1296	.8478
West Germany	-.0761	.5306	-.6938	.7687
Japan	-.2789	.8822	-.2823	.9358
Switzerland	-.9279	.2227	.1098	.9227
United Kingdom	.3583	.6741	-.0650	.5869
United States	.7700	.5473	-.2988	.9817

Accordingly, the third step was a linear transformation of Z to Z^* by

$$Z^* = \left[\left[\frac{S^*}{S}\right] A \# Z\right] - \left[\left[\left[\frac{S^*}{S}\right] A \# MA\right] - M^*A\right] \quad (3.2)$$

where: Z^* and Z = the simulated rate matrices of order 26 by p with rows having the means and standard deviations of the sample data and pseudo-random numbers, respectively,

S^* and S = the vectors of standard deviations of the sample data and rows of matrix Z, respectively,

M^* and M = the vectors of means of the sample data and rows of matrix Z, respectively,

A = a vector of p elements each equal to one, and

# denotes the operator for element multiplication. After the above transformation, Z^* has the same means and standard deviations as the original sample data. However, there are p observations instead of the original nine.

The fourth step in the procedure was to arrange the columns of Z^* in ascending order. It is well known that changing the order of a set of numbers does not change their correlations (43). Accordingly, the columns of Z^* were rearranged so that the U. S. consumer price index would be in ascending order. This was easily accomplished by re-arranging the columns of matrix X so that Z^* came out in the desired order.

The final step in the procedure was to verify that Z^* retained the intercorrelations of the original sample data. The technique used was to calculate a residual matrix by subtracting the simulated rate correlation matrix from the sample data correlation matrix. Since most of the elements in the residual matrix were close to zero, the factor analysis procedure had achieved the objective of preserving the intercorrelations of the variables.

Simulated Financial Data

The simulation model is run for foreign subsidiaries that operate in three different industries. Table II contains the salient features of these industries. Manufacturing operations are represented by Industries 1 and 2. Industry 3 is a capital-intensive service operation. Each foreign subsidiary begins operations with assets of $3.5 million U. S. dollars. This amount is allocated to the asset categories by the percentages shown in Table II.

The operating parameters for the various industries were developed from an analysis of selected firms contained in The Value Line Investment Survey (50): Industry 1 is Electrical Components, Industry 2 is Integrated Steel, and Industry 3 is Hotel-Gaming. The purpose of this procedure was to provide face-validity for the cases. That is, the simulated financial data has selected turnover ratios which are compatible with real world observations. However, there was no attempt made to replicate the actual operating and

financial ratios of any specific firm or group of firms.

TABLE II

BEGINNING ASSET COMPOSITION AND OPERATING PARAMETERS

Item	Industry 1	Industry 2	Industry 3
Assets:			
Inventory	40%	16%	3%
Other working capital	15%	8%	12%
Fixed assets	45%	76%	85%
Operating parameters:			
Debt-equity ratio	0-75%	0-75%	0-75%
Real growth rate	3%	3%	3%
Depreciation rate	10%	10%	5%
Inventory turnover	4.0	7.0	16.0
Working capital turnover	15.0	19.0	6.0
Fixed assets turnover	5.0	2.0	1.0

The simulated financial statement elements for the foreign subsidiaries are listed in Table III. Since the complete simulation model used to generate the financial data is included as Appendix C, this section will not duplicate the actual equations. However, it is necessary to explain the specific underlying assumptions for certain of the financial statement elements.

TABLE III

SIMULATED FINANCIAL STATEMENT ELEMENTS
AND TRANSLATION EXCHANGE RATES

Item	Translation Exchange Rates	
	Current Rate Method	Temporal Method
Balance sheet:		
Inventory	Current	Historical
Other working capital	Current	Current
Fixed assets	Current	Historical
Short-term debt	Current	Current
Common stock	Historical	Historical
Dividends	Historical	Historical
Retained earnings	Residual balancing figure	
Income statement:		
Sales	Average	Average
Cost of sales	Average	Historical
Selling and administrative	Average	Average
Depreciation expense	Average	Historical
Interest expense	Average	Average
Income taxes	Average	Average

A major operating assumption is that management has a superior forecasting ability. Thus, they correctly anticipate required inventory levels and fixed asset additions. A superior forecasting ability, along with other assumptions, results in moderately successful foreign operations. Mensah and Biagioni (36) provided for a superior forecasting ability as well as for consistent over- or underestimates in their simulation study. However, these latter choices could

generate unrealistic results at the end of multiple time periods. Although other situations do exist in the real world, a moderately successful operating environment is considered reasonable. In contrast, unsuccessful operations over an extended period suggests management should consider getting out of the business.

Certain pervasive assumptions apply to revenue and cost behavior across all industries. Sales change at the general rate of inflation and the real growth rate. Variable costs of manufacturing or service and selling and administration are tied directly to sales by keeping the cost ratios constant. Likewise, inventory and other working capital vary in the same manner as sales. Finally, fixed manufacturing and selling and administrative costs increase at the general rate of inflation but only by a specified proportion of the real growth rate. The scale factor applied to fixed costs reflects a minor adjustment for economies of size.

The procedure for fixed assets is more complicated. These assets are considered to actually deteriorate at the same rate used for depreciation purposes. Thus, the first step determines the actual decline in real capacity from deterioration. The total real additions are the sum of the amount necessary to maintain real capacity and the amount needed to provide for real growth. This real measure of additions is converted to local currency amounts by a price level adjustment which assumes that fixed asset prices change at the general rate of inflation.

Two options are provided for short-term debt and dividends because they are directly related in the simulation model. First, the debt-equity ratio may be held constant at any desired level. However, this automatically makes dividends a variable item. Second, dividend payout can be fixed at any proportion of net income and short-term debt becomes a variable item. In any event, the interest expense is determined by taking the short-term debt at the beginning of the period times the simulated interest rate.

Finally, an income tax rate of 50% is used for all countries for practical reasons. The attempt to achieve more realism by strict compliance with foreign tax laws and statutory rates would introduce complexity without providing any real benefits. This result is expected because many of the foreign countries have rates very close to 50%. Moreover, some of the foreign taxes paid might be available to the U. S. parent as foreign tax credits (9). Similarly, dividend withholding taxes are also ignored.

The various translation methods are listed in Table IV. The methods differ only to the extent that historical or current exchange rates are used to translate the financial statement elements (see Table III). In the case where inventory was translated at historical rates, a first-in, first-out cost flow was assumed. Additionally, it was assumed that the historical rate was equal to the average exchange rate. Thus, the impact of inventory was equal to the difference between the current and average exchange

rates. Finally, it was assumed that all dividends, fixed asset additions, and short-term financing transactions occurred at the end of each time period.

TABLE IV

ALTERNATIVE TRANSLATION METHODS

Model Code#	Description	Accounting Standard	Translation Adjustment in Income
CRE	Current rate method	SFAS No. 52	No
CRI	Current rate method		Yes
TME	Temporal method		No
TMI	Temporal method	SFAS No. 8	Yes

#The third letter indicates the treatment of the translation adjustment: I is included and E is excluded.

Consolidated results of foreign operations were generated by adding the individual results of the six foreign subsidiaries. As previously mentioned, the only intercompany transaction was payment of dividends to the parent company. Accordingly, elimination entries for such items as intercompany sales and profit in inventory were not necessary. Also, it was not necessary to simulate data

for the parent company. Inclusion of the parent company, in the context of this study, would only involve adding an arbitrary amount to the income measures.

The Control Treatment

As Chambers (6) notes, certain adjustments are necessary to transform financial statement amounts carried at cost to current values. Specifically, beginning of the period fixed assets were assumed to increase in value at the general rate of inflation less an allowance for deterioration based on the same rate used for depreciation. Additionally, it was assumed that fixed assets were discarded at the end of their useful life. Thus, fixed assets did not remain forever in the current value pool. End of the period additions required no adjustment as they would automatically be stated at current value.

Inventory was adjusted to current value for the manufacturing operations by using the same markup as achieved during the period. On the other hand, it was assumed that the service operation (Industry 3) had purchased their inventory for use in their operations. Since such firms do not add value to inventory, it was assumed that current value was equal to inventory cost. In either case, disposal costs were considered neglibible.

After inventory and fixed assets were adjusted to their estimated current values, the local currency valuation of a foreign subsidiary was determined. The formula for this

valuation was

$$CV_t = CI_t + CF_t + WC_t - SD_t \qquad (3.3)$$

where: CV_t = the current value of the subsidiary at the end of period t,

CI_t = the current value of inventory at the end of period t,

CF_t = the current value of fixed assets at the end of period t,

WC_t = the book value of other working capital at the end of period t, and

SD_t = the book value of short-term debt at the end of period t.

The parent company's well-being was measured by cash dividends and the change in the U. S. dollar equivalent of the foreign subsidiary's current value. The measurement of the nominal (number of dollars) change in well-being was calculated by

$$OW_t = \frac{CV_t}{E_t} - \frac{CV_{t-1}}{E_t} + \frac{DI_t}{E_t} \qquad (3.4)$$

where: OW_t = the nominal change in well-being during period t,

CV_t and CV_{t-1} = the current value of the foreign subsidiary measured in its local currency at the end of periods t and t-1, respectively,

E_t and E_{t-1} = the currency exchange rate expressed as the number of foreign currency units per U. S. dollar at the end of

periods t and t-1, respectively, and

DI_t = the local currency cash dividends remitted during period t.

As discussed in Chapter I, command over goods is a physical measure of well-being. Thus, the final step required the conversion of the nominal measure of well-being to command over some universal good. Since it was assumed the price of this universal good changed at the general rate of inflation, the measurement was easily calculated by multiplying the nominal measure, OW_t, by a price level adjustment based on the change in the U. S. simulated consumer price index. The same price level adjustment was applied to the accounting measures so that a valid comparison of physical measures could be made. The results of these comparisons are presented in Chapter IV.

Comments Regarding the Simulation Model

Simulated exchange rates, consumer price indexes, and interest rates were generated by an objective procedure based on factor analysis. The behavior of the simulated rates was consistent with the actual data in Appendix A. Thus, the simulated exchange rates reflect a situation where the U. S. dollar was declining substantially with respect to most of the major foreign currencies. Since the simulated currency environment is similar to the actual situation faced by many multinational firms during the 1970s, this

study is useful in understanding some of the reasons why corporate executives were so vehemently opposed to the old accounting standard.

The detailed discussion in the chapter regarding the simulated financial data emphasizes the number of complexities inherent in translation studies. There were numerous assumptions that had to be made in order to simulate the data. While some of these assumptions may represent slight departures from real world situations, the relevant question is whether the simulated data is reasonable. Various operating and financial ratios were generated so that the simulated data could be checked for face-validity. This verification procedure is discussed further in Chapter IV.

CHAPTER IV

ANALYSIS OF SIMULATED DATA

The simulation model was run eight times for each industry using the parameters shown in Table V. For the purpose of evaluating face-validity, selected turnover ratios and return on investment were generated for each foreign subsidiary. The 24 runs (hereinafter, cases), with the possible exception of the low profitability cases, all had reasonable face-validity. Generally, the cases represent moderately successful foreign operations with an average return on investment varying between 10% and 20%. The low profitability cases are somewhat abnormal because management might have chosen to disinvest rather than continue operations.

As discussed in Chapter I, the purpose of this study is to identify the best translation method from the alternatives in Table IV. Since the current value income measure (control treatment) is considered the relevant income measure, the best translation method is the one that produces an accounting income signal which serves as the best predictor of the control treatment measure. Unfortunately, the process of identifying the best method is not an easy task.

TABLE V

DEBT AND DIVIDEND PAYOUT RATIOS

Case	Debt-Equity Ratio	Dividend Payout Ratio	Comments
[δ].10	.00	Variable	
.20	.25	Variable	
.30	.50	Variable	
.40	.75	Variable	
.31	.50	Variable	High profitability
.32	.50	Variable	Low profitability
.33	Variable	.50	Beginning debt-equity=.50
.43	Variable	.50	Beginning debt-equity=.75

[δ]The first digit identifies the industry.

Ranking the Translation Models

There are numerous problems inherent in ranking prediction error distributions. According to Boatsman and Baskin (4), a possible approach is to define a utility function over prediction errors and then use that function to evaluate the expected utility from each alternative. Although this procedure would provide a distinct ranking, they emphasize that the results would be dependent on the specific utility function used in evaluating the prediction errors. Given that decision makers have different attitudes about prediction errors, the practical problem is specifying

a procedure that covers a broad class of possible utility functions.

Boatsman and Baskin (4) indicate that Hadar and Russell's (25) criterion of second-degree stochastic dominance (SSD) has the important property of being able to provide rankings that are consistent with the rankings provided by a broad class of utility functions. Boatsman and Baskin (4) explain SSD:

> In words, the SSD criterion states that (for all risk-averse decision makers who prefer smaller prediction errors) one error distribution will be preferred to another if the area to the left of some point under its cumulative probability function is greater—regardless of the point at which these areas are computed (p. 48).

Unfortunately, they emphasize that SSD is restricted to situations where complete domination prevails—that is, where the cumulative area under one model's distribution function is greater than that of another model for all points. In the absence of complete domination, SSD is not appropriate for ranking two prediction error distributions.[1]

Although SSD is not used in this study, the above discussion highlights the conceptual problems in ranking

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[1]Absolute percentage prediction errors were calculated for all 720 observations (30 periods times 24 cases) generated by each translation model. The cumulative probability distributions of the prediction errors are presented in Table XV, Appendix B. The consolidated results indicate that the cumulative probability for model CRI is greater than the other models at all points. However, this result does not prevail when Canada and Japan are individually evaluated.

prediction error distributions. More importantly, it serves to emphasize that the simple ranking procedures discussed below should be viewed as a practical expedient. Mean prediction error is evaluated using Dunnett's (15) statistical procedure and a simple ranking of the mean income differences. Another section presents a ranking of the models according to mean absolute differences.

Statistical Analysis

Dunnett's (15) procedure for multiple comparisons with a control uses the mean square error in calculating the test statistic. Accordingly, the first step was an analysis of variance of the data. The experimental design in this study is described as repeated measurements. That is, the treatments are applied to the same underlying data in each of the thirty time periods. Since the underlying data changed from one period to the next, a portion of the total variation was identified by blocking time periods (54).

Although the main purpose of the analysis of variance was to obtain the mean square error, a test of the null hypothesis of no difference in treatment means was available through the calculated F ratio. In 23 of the 24 cases, the null hypothesis was not rejected because the observed significance level was greater than .05. However, the individual comparisons with the control treatment are made regardless of the significance of the F ratio.

The mean square error (MSE) from the analysis of

variance was then used to calculate the test statistic. The general form is

$$\text{Dunnett's } t = \frac{\bar{X}_c - \bar{X}_t}{\sqrt{2MSE/r}} \qquad (4.1)$$

where: $\bar{X}_c$ and $\bar{X}_t$ = the mean of the control treatment and other treatment being compared, respectively, and

r = the number of observations per treatment group (15).

The current value measure (CVM) served as the standard of comparison, or control treatment, in all cases analyzed. Table XII, Appendix B contains the means of the control treatment and the four accounting income measures for all 24 cases.

Dunnett's (15) procedure was applied by selecting the treatment with the largest difference from the control treatment and then working in descending order. If the null hypothesis was not rejected for the treatment with the largest difference from the control treatment, then the other treatments were also viewed as not significantly different from the control. In the 24 cases, the null hypothesis of no difference in treatment means was rejected 18 times for the current rate method of SFAS No. 52. In contrast, the other accounting measures, except for one case involving the temporal method, did not differ

significantly from the control treatment in any of the cases.

The above results were based on the assumption that the treatments had homogeneous variances. However, an examination of the variances in Table XIII, Appendix B disclosed that the homogeniety of variances had been violated. In fact, the variance of the control treatment is significantly larger than the variances of all the other treatments. Thus, the test statistic for comparing groups with unequal variances was calculated using

$$\text{Dunnett's } t = \frac{\bar{X}_c - \bar{X}_t}{\sqrt{(S_c^2 + S_t^2)/r}} \qquad (4.2)$$

where: S_c^2 = the estimated variance for the control treatment,

S_t^2 = the pooled estimate of variance for the four accounting treatments, and

r = the number of observations per treatment group (15).

The applicable test statistics for both homogeneous and unequal variances are shown in Table VI. The critical value of the test statistic for unequal variances would be adjusted upward from 2.47 if the procedures (for example, the degrees of freedom are less) recommended by Dunnett (15) were followed. This was not necessary because the calculated test statistics for unequal variances in Table VI are

well below the critical value of 2.47. Thus, the current rate method of SFAS No. 52 does not differ significantly from the control treatment. Also, because the treatments in Table VI have the largest difference, the summary statement is that none of the accounting treatments in Table IV are significantly different from the control treatment at the .05 level.

TABLE VI

CALCULATED TEST STATISTICS FOR THE ACCOUNTING TREATMENT WITH THE LARGEST DIFFERENCE FROM THE CONTROL TREATMENT

Case	Homogeneous Variances			Unequal Variances		
	Industry			Industry		
	1	2	3	1	2	3
.10	2.50	2.36	2.40	1.21	1.25	1.36
.20	2.66	2.46	2.50	1.29	1.35	1.48
.30	2.73	2.47	2.51	1.40	1.46	1.62
.31	2.96	2.59	2.53	1.34	1.40	1.57
.32	2.49	2.36	2.48	1.46	1.53	1.67
.33	2.66	2.53	2.56	1.26	1.37	1.52
.40	2.59	2.31	2.52	1.51	1.57	1.89
.43	2.74	2.54	2.57	1.30	1.42	1.58

Critical value:[δ]

Dunnett's $t_{.95}(5,116) = 2.47$

[δ]The decision rule may be stated as: Reject the null hypothesis that the two treatments generate the same average income measures if the calculated value of the test statistic is greater than the critical value.

Table VII presents a rank order comparison of the mean income differences. The concentration of cases in the first two ranks indicates the models were consistent across the majority of cases. Perhaps the most interesting observation is that the current rate method (CRI and CRE) produced the smallest and the largest difference in 20 of the 24 cases. Another interesting point is that SFAS No. 8 (TMI) generated a smaller difference than SFAS No. 52 (CRE) in all but one case. Both of these observations are consistent with the fact that the current rate method produced translation gains because of the trend of the simulated exchange rates. Not surprisingly, the accounting treatment of the translation gains had an impact on the reported measures.

Mean Absolute Differences

As discussed in Chapter I, it is likely that periodic accounting signals influence the decisions made by management and other interested parties. Thus, the second method of comparison was done on a period-by-period basis. Again the current value measure (CVM) served as the standard of comparison using

$$T = \frac{1}{r}\left[\sum_{i=1}^{r} \left|X_{ci} - X_{ti}\right|\right] \qquad (4.3)$$

where: X_{ci} and X_{ti} = the income measures of the control treatment and accounting treatment in period i, respectively.

TABLE VII

MEAN INCOME DIFFERENCES BETWEEN ACCOUNTING INCOME MEASURES AND CONTROL TREATMENT, CONSOLIDATED (in millions)

Case	Mean Income Differences (Smallest to Largest) 1	2	3	4	Number of Cases Observed
Rank A:	CRI	TMI	TME	CRE	11
1.10	.858	.981	1.177	1.515	
1.20	.858	.981	1.031	1.369	
1.33	.858	.981	1.120	1.457	
1.43	.858	.981	1.063	1.400	
2.10	.830	1.001	1.194	1.457	
2.20	.830	1.001	1.050	1.312	
2.33	.830	1.001	1.090	1.352	
2.43	.830	1.001	1.008	1.271	
3.10	.876	1.133	1.315	1.483	
3.20	.876	1.133	1.174	1.342	
3.33	.876	1.133	1.203	1.371	
Rank B:	CRI	TME	TMI	CRE	9
1.30	.858	.884	.981	1.222	
1.31	1.020	1.097	1.144	1.435	
2.30	.830	.906	1.001	1.169	
2.31	.890	1.001	1.062	1.263	
2.32	.779	.839	.950	1.102	
3.30	.876	1.032	1.133	1.200	
3.31	.876	1.050	1.133	1.218	
3.32	.876	1.015	1.133	1.183	
3.43	.876	1.123	1.133	1.291	
Rank C:	TME	CRI	TMI	CRE	3
1.32	.713	.720	.844	1.051	
1.40	.737	.858	.981	1.075	
2.40	.762	.830	1.001	1.024	
Rank D:	CRI	TME	CRE	TMI	1
3.40	.876	.891	1.058	1.133	

The specific rank orders observed are shown in Table VIII. The concentration of cases in the first rank order indicates two important findings. First, the current rate method with translation adjustments included in income minimized the mean absolute differences in all cases. Second, although SFAS No. 8 had a smaller mean income difference than SFAS No. 52, it did not perform as well under this evaluation technique in the majority of cases. Both of these observations are discussed further below.

The final comparison was to square the period-by-period differences instead of taking the absolute value. This is useful to check whether a translation method generates substantial deviations in some periods but performs reasonably well in the other periods. Succinctly, the large deviations might mislead decision makers. The results of this comparison are presented in Table XIV, Appendix B. The specific rank orders noted are identical to those shown in Table VIII for the mean absolute differences. Accordingly, any comments regarding the mean absolute differences are also valid for the mean squared differences.

The Best Translation Method

A major criticism of SFAS No. 8 was that it provided erroneous signals. Intuitively, the depreciating U. S. dollar reflected in most of the simulated exchange rates suggests an improvement in the parent company's well-being. Yet SFAS No. 8 generated translation losses as the share

TABLE VIII

MEAN ABSOLUTE DIFFERENCES BETWEEN ACCOUNTING INCOME MEASURES AND CONTROL TREATMENT, CONSOLIDATED (in millions)

Case	Mean Absolute Differences (Smallest to Largest) 1	2	3	4	Number of Cases Observed
Rank A:	CRI	TME	CRE	TMI	16
1.30	1.727	2.652	3.075	3.270	
1.31	1.982	3.006	3.424	3.527	
1.32	1.516	2.290	2.676	3.054	
1.40	1.727	2.054	2.397	3.270	
2.30	1.844	2.817	3.088	3.642	
2.31	1.935	2.976	3.244	3.735	
2.32	1.768	2.668	2.876	3.564	
2.40	1.844	2.235	2.443	3.642	
2.43	1.844	3.048	3.279	3.642	
3.20	2.022	3.520	3.607	3.632	
3.30	2.022	2.943	3.030	3.632	
3.31	2.022	2.968	3.055	3.632	
3.32	2.022	2.907	2.993	3.632	
3.33	2.022	3.409	3.496	3.632	
3.40	2.022	2.419	2.500	3.632	
3.43	2.022	3.088	3.175	3.632	
Rank B:	CRI	TMI	TME	CRE	4
1.10	1.727	3.270	3.887	4.447	
1.33	1.727	3.270	3.454	3.928	
2.10	1.844	3.642	4.133	4.431	
3.10	2.022	3.632	4.117	4.242	
Rank C:	CRI	TME	TMI	CRE	4
1.20	1.727	3.251	3.270	3.761	
1.43	1.727	3.162	3.270	3.605	
2.20	1.844	3.463	3.642	3.760	
2.33	1.844	3.383	3.642	3.674	

of debt in the capital structure was increased. This is clearly shown in Table VII. As the debt ratio went from .25 to .50, TMI and TME reversed in the first two ranks.

The reason that SFAS No. 8 generated a smaller mean income difference than SFAS No. 52 is explained by the trend of the simulated exchange rates. A depreciating U. S. dollar caused SFAS No. 8 to report a lower cost of sales and less depreciation expense than SFAS No. 52. In fact, the reduced charges for depreciation and cost of sales more than offset the translation losses reported in many of the cases. However, this does not provide any support for SFAS No. 8. In a strengthening U. S. dollar environment, the results would be reversed because SFAS No. 8 would generate greater charges for depreciation and cost of sales than SFAS No. 52. These results were verified by examining the detailed information for the various foreign subsidiaries.

Considering all of the evaluation techniques, the best translation methodology would be the current rate method with translation adjustments included in income. However, this finding must be viewed in the context of the simulated exchange rates. The results, for the most part, reflect the strong foreign currencies of West Germany, Switzerland, and Japan.

Since the simulated exchange rates for Canada reflect a strengthening U. S. dollar, the effect of the currency environment was evaluated by examining the results reported

TABLE IX

MEAN INCOME DIFFERENCES BETWEEN ACCOUNTING INCOME MEASURES AND CONTROL TREATMENT, CANADA (in millions)

Case	Mean Income Differences (Smallest to Largest) 1	2	3	4	Number of Cases Observed
Rank A:	CRE	TMI	TME	CRI	12
1.30	.051	.067	.077	.078	
1.31	.062	.081	.088	.093	
1.33	.043	.067	.069	.078	
1.43	.050	.067	.076	.078	
2.30	.052	.063	.074	.079	
2.31	.055	.068	.077	.084	
2.33	.052	.063	.074	.079	
3.30	.060	.065	.076	.086	
3.31	.059	.065	.075	.086	
3.32	.062	.065	.078	.086	
3.33	.058	.065	.074	.086	
3.43	.065	.065	.081	.086	
Rank B:	CRE	TME	TMI	CRI	6
1.10	.027	.053	.067	.078	
1.20	.039	.065	.067	.078	
2.10	.027	.050	.063	.079	
2.20	.039	.062	.063	.079	
3.10	.036	.052	.065	.086	
3.20	.048	.064	.065	.086	
Rank C:	TMI	CRE	CRI	TME	4
1.32	.055	.055	.067	.081	
2.32	.059	.065	.074	.088	
2.40	.063	.065	.079	.087	
3.40	.065	.072	.086	.088	
Rank D:	CRE	TMI	CRI	TME	2
1.40	.063	.067	.078	.089	
2.43	.059	.063	.079	.082	

for Canada. Table IX presents the rank order comparison of the mean income differences. Interestingly, in 19 of the 24 cases, SFAS No. 52 (CRE) reported the smallest difference.[2]

The above results are, of course, conflicting with the results in Table VII. The interpretation is that translation gains should be recognized (Table VII) and losses should be deferred (Table IX). Obviously, such an approach would not be compatible with accounting practice. However, the results in Tables VII and IX simply reflect the fact that the research criterion measure was the largest in both currency environments. In contrast, if the research criterion measure had been less than the accounting measures, the more acceptable alternative of recognizing losses and deferring gains would have resulted.

In summary, the results regarding the current rate method must be viewed as contextual with respect to (1) a depreciating or appreciating U. S. dollar, and (2) the research criterion measure being greater than the accounting income measures. Thus, this study provides no conclusive evidence regarding the accounting treatment of translation adjustments. The importance of this finding, especially as it relates to SFAS No. 52, is discussed in Chapter V.

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[2]A ranking of the mean absolute differences for Canada did not clearly indicate that any particular model was able to outperform the other models. The only noteworthy observation was that TMI had the largest difference in 16 of the 24 cases. Although the U. S. dollar strengthened against the Canadian dollar, the magnitude of that change was considerably less than that shown by other foreign currencies.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary of the Research

This research compared selected accounting alternatives for the purpose of identifying a superior method for translating foreign currency financial statements. Specific emphasis was place on the question of whether translation adjustments should be included in net income or treated as a separate component of stockholders' equity. Two translation models, the current rate method and the temporal method, were evaluated using both alternatives for translation adjustments. Since two of these alternatives are the translation procedures of SFAS No. 8 and SFAS No. 52, the research was also a comparison of the old and new accounting standards.

Accounting measures of well-being (inflation adjusted accounting income) generated by the various translation methods were systematically compared with the research criterion. The latter measure was based on a current value measure of Sterling's (48) command over goods criterion. Translation methods were evaluated on the basis of minimizing (1) the difference in mean income, and (2) the mean

absolute differences between the accounting income measure and research criterion.

The research framework included three important elements: (1) the long-term nature of foreign investments, (2) a system of floating exchange rates, and (3) operations in several major foreign currency environments. These three elements were considered simultaneously in the context of a U. S. based multinational company with subsidiaries located in Canada, France, West Germany, Japan, Switzerland, and the United Kingdom. This approach was considered reasonable because it includes a large segment of the population that has been, and will continue to be, intensely involved in the translation controversy.

Simulated exchange rates, consumer price indexes, and interest rates were generated using an objective procedure based on factor analysis. A floating exchange rate environment was replicated by using the actual data from the period 1972 to 1980 to capture the behavior of the exchange rates in a floating system. The factor analysis technique preserved the intercorrelations, means, and standard deviations of all the variables. The simulated currency environment was, for the most part, dominated by the strong foreign currencies of Japan, West Germany, and Switzerland.

The foreign operating units were autonomous entities that generated local currency cash flows. The operations simulated were manufacturing and service companies with a relatively high proportion of fixed assets to total assets.

While their operations were affected by the internal factors of consumer price levels and interest rates, there was no external influence from exchange rate movements. Although no additional investments were made by the parent company, the subsidiaries had unlimited short-term financing available from local sources. Finally, the only intercompany transaction was the remittance of dividends to the parent company.

A computer simulation model was used to generate all of the financial data for the six foreign subsidiaries. Three different industries with various proportions of inventory and fixed assets to total assets were simulated. Moreover, sensitivity analysis was performed using various debt-equity and dividend payout ratios. A total of 24 separate cases, eight for each industry, were run for 30 time periods.

Conclusions

In regard to the temporal method of SFAS No. 8, the overall conclusion is that it did not perform as well as the current rate method of SFAS No. 52. SFAS No. 8 was extremely sensitive to the proportion of debt in the capital structure. As the debt ratio reached a certain level, SFAS No. 8 started to generate translation losses rather than gains. This was the principal reason why it performed the worst in the mean absolute differences technique. In regard to minimizing the difference in mean income with the

research criterion, the results were dependent on the currency environment. In a depreciating U. S. dollar environment, SFAS No. 8 had a smaller difference than SFAS No. 52. Whereas, the situation was reversed in an appreciating U. S. dollar environment.

Along with its failure to perform as well as the current rate method, SFAS No. 8 has higher compliance costs because of its more complicated bookkeeping requirements. While it may be impossible to accurately measure the benefits of the information provided by the translation methods, the cost-benefit approach at least suggests that SFAS No. 8 must yield greater benefits in order to justify its higher cost. However, based on the research criterion used in this study, there is no evidence to support the assertion that SFAS No. 8 provides better information.

Although the current rate method is considered the best approach, the results are mixed regarding the treatment of translation adjustments. Based on the research criterion used and a depreciating U. S. dollar, the evaluation techniques indicate that translation adjustments should be included in income. In contrast, an appreciating U. S. dollar environment indicates that translation adjustments should not be included in income. These observations, however, are contingent on the research criterion measure being greater than the accounting measures in both currency environments. Accordingly, this study provides no conclusive evidence for or against the recognition of

translation adjustments in income.

Given the contextual nature of whether to include translation adjustments in income, the FASB's (21) choice of accumulating and reporting such adjustments as a separate component of stockholders' equity is reasonable in the circumstances. It definitely has merit from a political standpoint. Should the U. S. dollar strengthen against a foreign currency, management will be pleased because they get both higher earnings and less volatility. In contrast, a depreciating U. S. dollar indicates they accept lower earnings but still have the reduced volatility. In either case, the major criticism against SFAS No. 8 has been eliminated.

Policy Recommendations

It is likely that volatility of reported earnings is a pervasive issue in accounting standards. While translation certainly has more features that make it unique, there is at least one inference that is relevant to guide the FASB in setting future accounting standards. Specifically, any accounting standard that increases volatility of reported earnings should be adequately supported by appropriate theoretical or empirical evidence. The criticism that SFAS No. 8 arbitrarily increased volatility of reported earnings is at least partially confirmed by the FASB's reversal. That is, it confirms that SFAS No. 8 lacked the necessary support to justify its continuance.

Another important consideration for the FASB concerns making changes in the historical-cost accounting model. The research criterion in this study, a current value measure of income, turned out to be more volatile than any of the accounting measures. If corporate management really has an aversion to volatility, they will find little comfort in alternative accounting models that increase volatility. Thus, advocates of radical changes in the accounting model need to consider the political ramifications of their proposals.

Implications for Future Research

Due to the contextual nature of the findings in this study, especially in the treatment of translation adjustments, future research appears warranted in several areas. There are many different research criteria that might be used to evaluate the translation methods. Some of the criteria might have more or less volatility than the current value measure used in this study.

Another area of possible investigation is other types of foreign operations. As discussed in Chapter I, trade, finance, and petroleum operations probably warrant special study. Moreover, foreign operations that ship their entire output to the U. S. should also be studied. These operations have no local currency cash flows and they depend on transfers from the U. S. to cover their operating requirements. Such firms could also carry some local debt as long

as transfers from the U. S. were made to service the debt. Under the guidelines of SFAS No. 52, the temporal method will continue to be used for this type of foreign operation.

Two special considerations apply to captive foreign operations that make them quite different from the autonomous foreign entities considered in this study. First, the transfer of goods indicates there will be a transfer pricing problem for tax purposes. Indeed, it is likely that tax authorities in both the foreign country and the U. S. will be involved (52). Second, there is the question of whether the foreign operation can be viewed in isolation. For instance, if the dollar depreciates against the foreign currency, more dollars will be required to cover the operating expenses. Thus, it is similar to any other cost increase. Whether the parent company's well-being has suffered is really dependent on the domestic side of the market. If these cost increases can be passed on to the consumer, the parent company would be in the same position as before the exchange rate change.

The translation controversy has lasted a long time and may not be over yet. However, accountants have not been the only ones frustrated by the complexities of international business. According to Hymer (27, p. 441): "At the outset, we should note that the multinational corporation raises more questions than economic theory can answer." Perhaps more than accounting theory can answer as well.

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APPENDIX A

ACTUAL RATES

TABLE X

CURRENCY EXCHANGE RATES

Year	Canada	France	West Germany	Japan	Switzer-land	United Kingdom
Year-End:						
1972	0.996	5.125	3.202	302.0	3.774	0.426
1973	0.996	4.708	2.703	280.0	3.244	0.430
1974	0.991	4.445	2.410	301.0	2.540	0.426
1975	1.016	4.486	2.622	305.2	2.620	0.494
1976	1.009	4.970	2.363	292.8	2.451	0.587
1977	1.094	4.705	2.105	240.0	2.000	0.525
1978	1.186	4.180	1.828	194.6	1.620	0.492
1979	1.163	4.020	1.732	239.7	1.580	0.450
1980	1.195	4.516	1.959	203.0	1.761	0.419
Mean	1.072	4.573	2.325	262.0	2.399	0.472
Std. Dev.	.088	.351	.473	43.7	.752	.057
Average:						
1972	0.991	5.044	3.189	303.1	3.819	0.400
1973	1.000	4.454	2.673	271.2	3.167	0.408
1974	0.978	4.810	2.588	291.5	2.979	0.428
1975	1.017	4.286	2.460	296.8	2.581	0.450
1976	0.986	4.780	2.518	296.6	2.500	0.554
1977	1.064	4.913	2.322	268.5	2.404	0.573
1978	1.141	4.513	2.009	210.5	1.788	0.521
1979	1.171	4.255	1.833	219.2	1.663	0.471
1980	1.184	4.422	1.911	210.7	1.722	0.419
Mean	1.059	4.609	2.389	263.1	2.514	0.469
Std. Dev.	.084	.285	.428	39.1	.728	.065

Source: (31)

TABLE XI

CONSUMER PRICE INDEXES
AND INTEREST RATES

Year	Canada	France	West Germany	Japan	Switzer-land	U. K.	U. S.
Consumer Prices:							
1972	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1973	107.50	107.40	106.90	111.80	108.80	109.10	106.30
1974	119.30	122.10	114.40	139.00	119.40	126.60	117.90
1975	132.10	136.40	121.20	155.50	127.40	157.20	128.70
1976	142.00	149.50	126.40	170.00	129.60	183.20	136.20
1977	153.40	163.60	131.00	183.70	131.60	212.30	145.00
1978	167.10	178.40	134.70	190.70	132.60	229.90	156.00
1979	182.40	197.50	140.10	197.50	137.50	260.70	173.60
1980	200.90	223.90	147.90	213.40	142.90	309.10	197.00
Mean	145.00	153.20	124.70	162.40	125.50	187.60	140.10
Std. Dev.	34.20	41.70	15.70	39.00	13.80	71.60	31.70
Interest Rates:*							
1972	6.00	7.10	6.69	4.71	7.00	8.50	6.33
1973	9.50	10.40	11.89	10.47	7.50	14.00	10.08
1974	11.00	12.40	8.35	13.46	8.50	13.00	11.64
1975	9.75	8.60	3.92	7.96	7.50	12.00	8.29
1976	9.75	9.60	5.03	7.11	7.50	15.00	7.28
1977	8.25	9.30	3.24	5.01	6.75	7.75	8.77
1978	11.50	8.80	3.56	4.57	5.00	13.50	12.22
1979	15.00	11.50	9.02	8.05	5.00	16.00	15.81
1980	18.25	12.25	9.16	9.49	5.65	15.00	15.71
Mean	11.00	9.99	6.76	7.87	6.71	12.75	10.68
Std. Dev.	3.65	1.79	3.03	2.96	1.23	2.88	3.45

*Short-term rates for the U. S., Canada, and France are bank prime lending rates; West Germany, day-to-day loans; Japan, call money; Switzerland and U. K., bank overdraft rates.

Source: (41)

APPENDIX B

SIMULATED DATA

TABLE XII

CONSOLIDATED MEAN INCOME
(in millions)

Case	Control	Accounting Income			
		CRE	CRI	TME	TMI
Industry 1:					
1.10	5.562	4.047	4.704	4.385	4.581
1.20	5.014	3.645	4.156	3.983	4.032
1.30	4.464	3.242	3.607	3.580	3.483
1.31	7.137	5.702	6.117	6.039	5.993
1.32	1.545	.495	.825	.833	.702
1.33	4.987	3.529	4.129	3.867	4.006
1.40	3.915	2.840	3.057	3.178	2.934
1.43	4.744	3.343	3.886	3.681	3.762
Industry 2:					
2.10	4.711	3.254	3.881	3.516	3.709
2.20	4.167	2.855	3.337	3.117	3.166
2.30	3.621	2.453	2.791	2.715	2.620
2.31	5.386	4.123	4.496	4.385	4.324
2.32	1.557	.455	.779	.718	.607
2.33	3.943	2.590	3.113	2.853	2.941
2.40	3.074	2.050	2.244	2.312	2.073
2.43	3.602	2.331	2.772	2.593	2.600
Industry 3:					
3.10	4.605	3.122	3.729	3.290	3.472
3.20	4.080	2.739	3.204	2.906	2.947
3.30	3.555	2.355	2.679	2.523	2.422
3.31	4.454	3.236	3.578	3.404	3.321
3.32	2.640	1.457	1.764	1.625	1.507
3.33	3.870	2.499	2.994	2.667	2.737
3.40	3.030	1.972	2.154	2.140	1.897
3.43	3.576	2.285	2.700	2.453	2.443

TABLE XIII

VARIANCES OF CONSOLIDATED INCOME MEASURES

Case	Control	Accounting Measures			
		CRE	CRI	TME	TMI
Industry 1:					
1.10	38.033	2.394	20.931	5.089	7.774
1.20	27.563	1.926	13.124	4.596	4.327
1.30	18.998	1.532	7.226	4.177	2.788
1.31	26.954	4.311	11.491	7.684	6.252
1.32	13.470	.254	4.163	2.087	1.728
1.33	32.359	2.239	16.446	5.005	6.264
1.40	12.342	1.209	3.234	3.830	3.156
1.43	28.086	2.200	13.534	4.986	5.403
Industry 2:					
2.10	34.243	1.387	17.969	2.431	3.865
2.20	24.581	1.031	10.860	2.042	1.940
2.30	16.751	.756	5.581	1.735	1.850
2.31	20.464	2.053	7.770	3.345	3.337
2.32	13.866	.194	3.499	.767	2.228
2.33	24.990	.971	10.755	2.000	2.502
2.40	10.756	.559	2.134	1.505	3.593
2.43	20.627	.859	7.744	1.880	2.508
Industry 3:					
3.10	30.342	.969	16.114	1.306	2.464
3.20	21.591	.670	9.537	.974	1.063
3.30	14.585	.448	4.707	.719	1.408
3.31	15.727	.944	5.635	1.306	1.896
3.32	13.622	.134	3.913	.309	1.182
3.33	21.457	.589	9.151	.887	1.377
3.40	9.324	.303	1.621	.542	3.498
3.43	17.666	.532	6.518	.821	1.581

TABLE XIV

MEAN SQUARED DIFFERENCES BETWEEN ACCOUNTING INCOME MEASURES AND CONTROL TREATMENT, CONSOLIDATED

Case	Mean Squared Differences (Smallest to Largest) 1	2	3	4	Number of Cases Observed
Rank A:	CRI	TME	CRE	TMI	16
1.30	4.869	10.545	14.506	17.138	
1.31	6.482	13.493	17.990	19.902	
1.32	3.719	8.675	11.750	15.017	
1.40	4.869	6.673	8.996	17.138	
2.30	5.380	11.857	14.279	20.376	
2.31	5.890	13.117	15.673	21.381	
2.32	4.977	11.123	13.202	19.553	
2.40	5.380	7.513	9.104	20.376	
2.43	5.380	14.724	17.424	20.376	
3.20	6.263	19.216	20.373	20.791	
3.30	6.263	13.209	14.093	20.791	
3.31	6.263	13.425	14.320	20.791	
3.32	6.263	13.006	13.875	20.791	
3.33	6.263	19.087	20.246	20.791	
3.40	6.263	8.829	9.439	20.791	
3.43	6.263	15.733	16.744	20.791	
Rank B:	CRI	TMI	TME	CRE	4
1.10	4.869	17.138	23.664	30.900	
1.33	4.869	17.138	19.209	25.188	
2.10	5.380	20.376	25.697	29.778	
3.10	6.263	20.791	26.851	28.279	
Rank C:	CRI	TME	TMI	CRE	4
1.20	4.869	16.211	17.138	21.809	
1.43	4.869	16.029	17.138	21.279	
2.20	5.380	17.919	20.376	21.173	
2.33	5.380	18.158	20.376	21.345	

TABLE XV

ABSOLUTE PERCENTAGE PREDICTION ERRORS

Percentage Error (Less than or equal to)	Cumulative Probability Distribution			
	CRE	CRI	TME	TMI
Consolidated:				
10%	.021	.118	.014	.010
20%	.050	.213	.063	.051
40%	.215	.525	.292	.213
60%	.538	.775	.571	.472
80%	.733	.857	.746	.657
Maximum	1.000	1.000	1.000	1.000
Canada:				
10%	.067	.128	.117	.067
20%	.174	.283	.243	.157
40%	.469	.533	.533	.436
60%	.736	.736	.767	.649
80%	.825	.822	.850	.760
Maximum	1.000	1.000	1.000	1.000
Japan:				
10%	.061	.049	.074	.082
20%	.138	.156	.160	.144
40%	.232	.438	.282	.251
60%	.413	.654	.497	.419
80%	.665	.776	.699	.594
Maximum	1.000	1.000	1.000	1.000

APPENDIX C

FORTRAN SOURCE PROGRAM

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00100C  FORTRAN SOURCE PROGRAM-SIMULATION MODEL
00110C  PROGRAM MARTS (CANDY,OUTPUT,PUNCH,TAPE5=CANDY,
00120+    TAPE6=OUTPUT,TAPE7=PUNCH)
00130C  VARIABLES USED IN SIMULATION MODEL
00140C  AD    = ACCUMULATED DEPRECIATION
00150C  ADH   = ACCUM DEPREC-HISTORICAL RATES
00160C  ARPC  = ACCUM REDUCTION-REAL CAPACITY
00170C  BFM   = BASE FIXED MANUFACTURING COST
00180C  BFS   = BASE FIXED SELLING AND ADMIN COSTS
00190C  BS    = BASE SALES
00200C  CASE  = CASE IDENTIFICATION NUMBER
00210C  CA3   = CHANGE IN NET ASSETS-MODEL CRE VS. TME
00220C  CF4   = CURRENT VALUE OF FIXED ASSETS-MODEL CVM
00230C  CG1   = CONTROL TREATMENT VS. ACE
00240C  CG2   = CONTROL TREATMENT VS. CRI
00250C  CG3   = CONTROL TREATMENT VS. CRE
00260C  CG4   = CONTROL TREATMENT VS. TME
00270C  CG5   = CONTROL TREATMENT VS. TMI
00280C  CI4   = CURRENT VALUE OF INVENTORY-MODEL CVM
00290C  CO    = INITIAL INVESTMENT
00300C  CS    = COST OF SALES
00310C  CT1   = CUMULATIVE TRANS ADJ-MODEL ACE
00320C  CT2   = CUMULATIVE TRANS ADJ-MODEL CRE
00330C  CT3   = CUMULATIVE TRANS ADJ-MODEL TMI
00340C  CV4   = CURRENT VALUE OF FIRM-MODEL CVM
00350C  CW4   = CHANGE IN OWNERS WEALTH-MODEL CVM
00360C  DA3   = DIFFERENCE IN NET ASSETS-MODEL CRE VS. TME
00370C  DCS   = DIFFERENCE IN COS-MODEL CRE VS. TME
00380C  DDE   = DIFFERENCE IN DEPREC-MODEL CRE VS. TME
00390C  DE    = DEPRECIATION EXPENSE
00400C  DEH   = DEPREC EXPENSE-HISTORICAL RATES
00410C  DEL   = LOWER LIMIT-DEBT/EQUITY RATIO
00420C  DEM   = UPPER LIMIT-DEBT/EQUITY RATIO
00430C  DI    = DIVIDENDS
00440C  DIT   = TRANSLATED DIVIDENDS
00450C  DP    = SPECIFIED DIVIDEND PAYOUT
00460C  DPO   = ACTUAL DIVIDEND PAYOUT
00470C  DQ    = DEBT/EQUITY RATIO
00480C  DR    = DEPRECIATION RATE
00490C  DRPC  = DEPRECIATION-REAL CAPACITY
00500C  DTM   = CONTROL TREATMENT MEAN VS. OTHER TREATMENTS
00510C  EGR   = ESTIMATED GROWTH RATE
00520C  FG    = FIXED ASSETS-GROSS
00530C  FGH   = FIXED ASSETS-GROSS-HISTORICAL RATES
00540C  FMC   = FIXED MANUFACTURING COSTS
00550C  FN    = FIXED ASSETS-NET
00560C  FNH   = FIXED ASSETS-NET-HISTORICAL RATES
00570C  FP    = FIXED ASSET ADDITIONS
00580C  FSA   = FIXED SELLING AND ADMIN COSTS
00590C  GI    = INVENTORY
00600C  GM    = GROSS MARGIN
00610C  GR    = ACTUAL GROWTH RATE
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00620C  GTO  = SPECIFIED INVENTORY TURNOVER
00630C  IZ   = COUNTRY ID
00640C  N    = USEFUL LIFE OF FIXED ASSETS
00650C  OE   = OWNERS EQUITY
00660C  PT   = PROFIT AFTER TAX
00670C  PT1  = TRANSLATED INCOME-MODEL ACE
00680C  P1A  = TRANSLATED INCOME-MODEL CRI
00690C  PT2  = TRANSLATED INCOME-MODEL CRE
00700C  PT3  = TRANSLATED INCOME-MODEL TME
00710C  P3A  = TRANSLATED INCOME-MODEL TMI
00720C  P1   = SCALE FACTOR FOR SALES PRICE
00730C  P2   = SCALE FACTOR FOR COSTS
00740C  P3   = SCALE FACTOR FOR GROWTH RATE
00750C  RE   = RETAINED EARNINGS
00760C  RFP  = PRICE ADJUSTED FIXED ASSET ADDITIONS
00770C  RFPP = PRICE ADJUSTED FIXED ASSET POOL
00780C  RI1  = REAL INCOME-MODEL ACE
00790C  R1A  = REAL INCOME-MODEL CRI
00800C  RI2  = REAL INCOME-MODEL CRE
00810C  RI3  = REAL INCOME-MODEL TME
00820C  R3A  = REAL INCOME-MODEL TMI
00830C  RI4  = REAL INCOME-MODEL CVM
00840C  RNPC = PRICE ADJUSTED FIXED ASSETS-NET
00850C  ROI  = RETURN ON INVESTMENT
00860C  ROS  = RETURN ON SALES
00870C  SA   = SELLING AND ADMIN EXPENSE
00880C  SD   = SHORT-TERM DEBT
00890C  SFR  = FIXED ASSET TURNOVER
00900C  SGI  = INVENTORY TURNOVER
00910C  SI   = INTEREST EXPENSE
00920C  SR   = SALES
00930C  SWC  = WORKING CAPITAL TURNOVER
00940C  TA   = TOTAL ASSETS
00950C  TA1  = TRANSLATION ADJUSTMENT-MODEL ACE
00960C  TA2  = TRANSLATION ADJUSTMENT-MODEL CRE
00970C  TA3  = TRANSLATION ADJUSTMENT-MODEL TMI
00980C  TE   = TOTAL EXPENSES
00990C  TQ   = TOTAL EQUITY
01000C  TX   = INCOME TAXES
01010C  VM   = VARIABLE MANUFACTURING COST RATIO
01020C  VS   = VARIABLE SELLING AND ADMIN COST RATIO
01030C  WC   = WORKING CAPITAL
01040C  WTO  = SPECIFIED WORKING CAPITAL TURNOVER
01050C  Z1   = END OF YEAR EXCHANGE RATES
01060C  Z2   = AVERAGE EXCHANGE RATES
01070C  Z3   = CONSUMER PRICE LEVELS
01080C  Z4   = INTEREST RATES
01090C  Z5   = CONSUMER PRICE LEVEL CHANGES
01100C
01110   DIMENSION SR(6,31),CS(6,31),DE(6,31),SI(6,31)
01120   DIMENSION TX(6,31),TE(6,31),PT(6,31),DI(6,31)
01130   DIMENSION ROI(6,31),SFR(6,30),GR(31),EGR(30)
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01140    DIMENSION GI(6,31),WC(6,31),FG(6,31),AD(6,31)
01150    DIMENSION TA(6,31),SD(6,31),CO(6,31),RE(6,31)
01160    DIMENSION TQ(6,31),FP(6,32),BS(6),BFM(6)
01170    DIMENSION Z1(6,31),Z2(6,31),Z3(7,31),Z4(7,31)
01180    DIMENSION Z5(7,30),SGI(6,30),SWC(6,30),FMC(6,30)
01190    DIMENSION FSA(6,30),RFP(6,31),RFPP(6,31)
01200    DIMENSION DRPC(6,31),IZ(7),ARPC(6,31),RNPC(6,31)
01210    DIMENSION ROS(6,30),DPO(6,30),SA(6,31),DQ(6,30)
01220    DIMENSION BFS(6),GM(6,30),FN(6,31),OE(6,31)
01230    DIMENSION ADH(6,31),CA3(6,30),CF4(6,31),CG1(7,31)
01240    DIMENSION CG2(7,31),CG3(7,31),CG4(7,31),CG5(7,31)
01250    DIMENSION CI4(6,31),CT1(7,31),CT2(7,31),CT3(7,31)
01260    DIMENSION CV4(6,31),CW4(7,31),DCS(6,30),DDE(6,30)
01270    DIMENSION DEH(6,30),DIT(7,31),FNH(6,31),PT1(7,31)
01280    DIMENSION P1A(7,31),PT2(7,31),P3A(7,31),TA1(7,31)
01290    DIMENSION TA2(7,31),TA3(7,31),R1A(7,31),RI2(7,31)
01300    DIMENSION RI3(7,31),R3A(7,31),RI4(7,31),DTM(7,5)
01310    DIMENSION DA3(6,30),FGH(6,31),PT3(7,31),RI1(7,31)
01320    READ (5,*) ((Z1(J,K),K=1,31),J=1,6),((Z2(J,K),
01330+     K=1,31),J=1,6),((Z3(J,K),K=1,31),J=1,7),
01340+     ((Z4(J,K),K=1,31),J=1,7),GI(1,1),WC(1,1),
01350+     FN(1,1),SD(1,1),CO(1,1),BS(1,1),BFM(1,1),
01360+     BFS(1,1),(GR(K),K=1,31),P1,P2,P3,DEL,DEM,DP,
01370+     DR,VM,VS,GTO,WTO,N,CASE
01380    IZ(1) = 7HCANADA
01390    IZ(2) = 7HFRANCE
01400    IZ(3) = 7HGERMANY
01410    IZ(4) = 7HJAPAN
01420    IZ(5) = 7HSWITZ
01430    IZ(6) = 7HU. K.
01440    IZ(7) = 7HCONSOL
01450    NN = N - 1
01460C   GENERATE EXPECTED GROWTH RATE
01470    DO 598 K=1, 30
01480      EGR(K) = GR(K+1)
01490    598 CONTINUE
01500C   GENERATE BASE BALANCE SHEET DATA
01510    DO 599 J=2, 6
01520      GI(J,1) = GI(1,1)*Z1(J,1)/Z1(1,1)
01530      WC(J,1) = WC(1,1)*Z1(J,1)/Z1(1,1)
01540      FN(J,1) = FN(1,1)*Z1(J,1)/Z1(1,1)
01550      SD(J,1) = SD(1,1)*Z1(J,1)/Z1(1,1)
01560      CO(J,1) = CO(1,1)*Z1(J,1)/Z1(1,1)
01570      BS(J) = BS(1)*Z1(J,1)/Z1(1,1)
01580      BFM(J) = BFM(1)*Z1(J,1)/Z1(1,1)
01590      BFS(J) = BFS(1)*Z1(J,1)/Z1(1,1)
01600    599 CONTINUE
01610C   GENERATE OTHER BASE DATA
01620    DO 600 J=1, 6
01630      FG(J,1) = FN(J,1)
01640      AD(J,1) = 0.0
01650      TA(J,1) = GI(J,1)+WC(J,1)+FN(J,1)
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01660      RE(J,1) = 0.0
01670      OE(J,1) = CO(J,1)
01680      TQ(J,1) = SD(J,1)+OE(J,1)
01690      FP(J,1) = FN(J,1)
01700      RFP(J,1) = FP(J,1)
01710      RFPP(J,1) = FN(J,1)
01720      RNPC(J,1) = FN(J,1)
01730      ARPC(J,1) = 0.0
01740    600 CONTINUE
01750C   GENERATE CONSUMER PRICE LEVEL CHANGES
01760    DO 602 J=1, 7
01770      DO 603 K=1, 30
01780        Z5(J,K) = Z3(J,K+1)/Z3(J,K)
01790      603 CONTINUE
01800    602 CONTINUE
01810C   GENERATE FINANCIAL DATA
01820    DO 700 J=1, 6
01830      DO 800 K=1, 30
01840C   GENERATE SALES
01850      IF (K .LE. 1) GO TO 705
01860      SR(J,K) = SR(J,K-1)*(P1*Z5(J,K))*(1.0+GR(K))
01870      GO TO 710
01880      705  SR(J,K) = BS(J)
01890C   GENERATE INVENTORY
01900      710  IF (K .LE. 1) GO TO 711
01910      GI(J,K+1) = GI(J,K)*(P2*Z5(J,K))*(1.0+EGR(K))
01920      GO TO 712
01930      711  GI(J,K+1) = SR(J,K)/GTO
01940C   GENERATE COST OF SALES
01950      712  IF (K .LE. 1) GO TO 713
01960      FMC(J,K) = FMC(J,K-1)*(P2*Z5(J,K))*
01970+                    (1.0+(P3*EGR(K)))
01980      GO TO 714
01990      713  FMC(J,K) = BFM(J)
02000      714  CS(J,K) = GI(J,K)+(VM*SR(J,K)*(1.0+(P3*
02010+                       EGR(K))))+FMC(J,K)-GI(J,K+1)
02020C   GENERATE SELLING AND ADMIN EXPENSE
02030      IF (K .LE. 1) GO TO 716
02040      FSA(J,K) = FSA(J,K-1)*(P2*Z5(J,K)*
02050+                    (1.0+(P3*EGR(K)))
02060      GO TO 717
02070      716  FSA(J,K) = BFS(J)
02080      717  SA(J,K) = (VS*SR(J,K))+FSA(J,K)
02090C   GENERATE DEPRECIATION EXPENSE
02100      IF (K .LE. N) GO TO 725
02110      DE(J,K) = (FG(J,K)-FG(J,K-N))*DR
02120      GO TO 730
02130      725  DE(J,K) = FG(J,K)*DR
02140C   GENERATE INTEREST EXPENSE
02150      730  SI(J,K) = SD(J,K)*Z4(J,K)/100.0
02160C   GENERATE INCOME TAXES
02170      TX(J,K) = (SR(J,K)-CS(J,K)-SA(J,K)-DE(J,K)-
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02180+                  SI(J,K)*.50
02190C  GENERATE TOTAL EXPENSES
02200     TE(J,K) = CS(J,K)+SA(J,K)+DE(J,K)+SI(J,K)+
02210+                  TX(J,K)
02220C  GENERATE PROFIT AFTER TAX
02230     PT(J,K) = SR(J,K)-TE(J,K)
02240C  GENERATE COMMON STOCK
02250     CO(J,K+1) = CO(J,K)
02260C  GENERATE DIVIDENDS
02270     IF (PT(J,K) .LE. 0.0) GO TO 745
02280     DI(J,K) = PT(J,K)*DP
02290     GO TO 750
02300     745  DI(J,K) = 0.0
02310C  GENERATE RETAINED EARNINGS
02320     750  RE(J,K+1) = RE(J,K)+PT(J,K)-DI(J,K)
02330C  GENERATE OWNERS EQUITY
02340     OE(J,K+1) = CO(J,K+1)+RE(J,K+1)
02350C  GENERATE WORKING CAPITAL
02360     WC(J,K+1) = SR(J,K)/WTO
02370C  GENERATE FIXED ASSET DATA
02380     AD(J,K+1) = AD(J,K)+DE(J,K)
02390     IF ( K .LE. N) GO TO 775
02400     DRPC(J,K) = (RFPP(J,K)-RFPP(J,K-N))*DR
02410     GO TO 780
02420     775  DRPC(J,K) = RFPP(J,K)*DR
02430     780  ARPC(J,K+1) = ARPC(J,K)+DRPC(J,K)
02440     IF (EGR(K) .LE. 0.0) GO TO 785
02450     RNPC(J,K+1) = RNPC(J,K)*(1.0+EGR(K))
02460     GO TO 786
02470     785  RNPC(J,K+1) = RNPC(J,K)
02480     786  RFPP(J,K+1) = RNPC(J,K+1)+ARPC(J,K+1)
02490     RFP(J,K+1) = RNPC(J,K+1)-RNPC(J,K)+DRPC(J,K)
02500     FP(J,K+1) = RFP(J,K+1)*(Z3(J,K+1)/Z3(J,1))
02510     FG(J,K+1) = FG(J,K)+FP(J,K+1)
02520     FN(J,K+1) = FG(J,K+1)-AD(J,K+1)
02530C  GENERATE TOTAL ASSETS
02540     TA(J,K+1) = GI(J,K+1)+WC(J,K+1)+FN(J,K+1)
02550C  GENERATE SHORT-TERM DEBT
02560     SD(J,K+1) = TA(J,K+1)-OE(J,K+1)
02570     IF (SD(J,K+1).GE.DEL*TA(J,K+1)) GO TO 790
02580     SD(J,K+1) = DEL*TA(J,K+1)
02590     GO TO 791
02600     790  IF (SD(J,K+1) .LE. DEM*TA(J,K+1)) GO TO 799
02610     SD(J,K+1) = DEM*TA(J,K+1)
02620     791  OE(J,K+1) = TA(J,K+1)-SD(J,K+1)
02630     TQ(J,K+1) = OE(J,K+1)+SD(J,K+1)
02640     RE(J,K+1) = OE(J,K+1)-CO(J,K+1)
02650     DI(J,K) = RE(J,K)+PT(J,K)-RE(J,K+1)
02660     IF  (DI(J,K) .GE. 0.0) GO TO 800
02670     SD(J,K+1) = SD(J,K+1) + ABS (DI(J,K))
02680     DI(J,K) = 0.0
02690     RE(J,K+1) = RE(J,K)+PT(J,K)
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02700      OE(J,K+1) = CO(J,K+1)+RE(J,K+1)
02710      GO TO 800
02720C   GENERATE TOTAL EQUITY
02730      799  TQ(J,K+1) = OE(J,K+1)+SD(J,K+1)
02740      800 CONTINUE
02750    700 CONTINUE
02760C   GENERATE RATIOS
02770    DO 810 J=1, 6
02780      DO 820 K=1, 30
02790      DQ(J,K) = SD(J,K+1)/TQ(J,K+1)
02800      ROI(J,K) = (PT(J,K)/((OE(J,K)+OE(J,K+1))
02810+                    /2.0))*100.0
02820      SFR(J,K) = SR(J,K)/FN(J,K+1)
02830      SGI(J,K) = CS(J,K)/GI(J,K+1)
02840      SWC(J,K) = SR(J,K)/WC(J,K+1)
02850      GM(J,K) = (SR(J,K)-CS(J,K))/SR(J,K)
02860      ROS(J,K) = PT(J,K)/SR(J,K)
02870      DPO(J,K) = DI(J,K)/PT(J,K)
02880      820 CONTINUE
02890    810 CONTINUE
02900C   CLEAR VECTORS
02910      DO 825 J=1, 6
02920        SR(J,31) = 0.0
02930        CS(J,31) = 0.0
02940        SA(J,31) = 0.0
02950        DE(J,31) = 0.0
02960        SI(J,31) = 0.0
02970        TX(J,31) = 0.0
02980        TE(J,31) = 0.0
02990        PT(J,31) = 0.0
03000        DI(J,31) = 0.0
03010        FP(J,32) = 0.0
03020        ROI(J,31) = 0.0
03030      825 CONTINUE
03040C   SUM VECTORS
03050    DO 826 J=1, 6
03060      DO 827 K=1, 30
03070      SR(J,31) = SR(J,31)+SR(J,K)
03080      CS(J,31) = CS(J,31)+CS(J,K)
03090      SA(J,31) = SA(J,31)+SA(J,K)
03100      DE(J,31) = DE(J,31)+DE(J,K)
03110      SI(J,31) = SI(J,31)+SI(J,K)
03120      TX(J,31) = TX(J,31)+ TX(J,K)
03130      TE(J,31) = TE(J,31)+TE(J,K)
03140      PT(J,31) = PT(J,31)+PT(J,K)
03150      DI(J,31) = DI(J,31)+DI(J,K)
03160      FP(J,32) = FP(J,32)+FP(J,K+1)
03170      ROI(J,31) = ROI(J,31)+(ROI(J,K)/30.0)
03180      827 CONTINUE
03190    826 CONTINUE
03200C   GENERATE DATA FOR TRANSLATION MODEL
03210    DO 845 J=1, 6
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03220      FGH(J,1) = FG(J,1)/Z1(J,1)
03230      FNH(J,1) = FGH(J,1)
03240      ADH(J,1) = 0.0
03250      CF4(J,1) = FN(J,1)
03260      CI4(J,1) = GI(J,1)
03270      CV4(J,1) = OE(J,1)/Z1(J,1)
03280    845 CONTINUE
03290C   CLEAR VECTORS
03300    DO 846 J=1, 7
03310      DO 847 K=1, 31
03320      PT1(J,K) = 0.0
03330      P1A(J,K) = 0.0
03340      PT2(J,K) = 0.0
03350      PT3(J,K) = 0.0
03360      P3A(J,K) = 0.0
03370      CW4(J,K) = 0.0
03380      TA1(J,K) = 0.0
03390      TA2(J,K) = 0.0
03400      TA3(J,K) = 0.0
03410      CT1(J,K) = 0.0
03420      CT2(J,K) = 0.0
03430      CT3(J,K) = 0.0
03440      RI1(J,K) = 0.0
03450      R1A(J,K) = 0.0
03460      RI2(J,K) = 0.0
03470      RI3(J,K) = 0.0
03480      R3A(J,K) = 0.0
03490      RI4(J,K) = 0.0
03500      CG1(J,K) = 0.0
03510      CG2(J,K) = 0.0
03520      CG3(J,K) = 0.0
03530      CG4(J,K) = 0.0
03540      CG5(J,K) = 0.0
03550      DIT(J,K) = 0.0
03560      847 CONTINUE
03570    846 CONTINUE
03580C   TRANSLATION MODEL
03590    DO 850 J=1, 6
03600      DO 900 K=1, 30
03610      PT1(J,K) = PT(J,K)/Z1(J,K+1)
03620      TA1(J,K) = OE(J,K)*((1.0/Z1(J,K+1))-
03630+                    (1.0/Z1(J,K)))
03640      P1A(J,K) = PT1(J,K)+TA1(J,K)
03650      PT2(J,K) = PT(J,K)/Z2(J,K+1)
03660      TA2(J,K) = P1A(J,K)-PT2(J,K)
03670      DIT(J,K) = DI(J,K)/Z1(J,K+1)
03680C   GENERATE DATA FOR SFAS NO. 8
03690      IF (K .LE. 1) GO TO 857
03700      IF (K .LE. N) GO TO 856
03710      DEH(J,K) = DEH(J,K-1)+((FP(J,K)/Z1(J,K))*DR)-
03720+                    ((FP(J,K-N)/Z1(J,K-N))*DR)
03730      GO TO 858
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03740      856  DEH(J,K) = DEH(J,K-1)+((FP(J,K)/
03750+                        Z1(J,K))*DR)
03760      GO TO 858
03770      857  DEH(J,K) = (FP(J,K)/Z1(J,K))*DR
03780      858  ADH(J,K+1) = ADH(J,K)+DEH(J,K)
03790      FGH(J,K+1) = FGH(J,K)+(FP(J,K+1)/Z1(J,K+1)
03800      FNH(J,K+1) = FGH(J,K+1)-ADH(J,K+1)
03810      DDE(J,K) = (DE(J,K)/Z2(J,K+1))-DEH(J,K)
03820      IF (K .LE. 1) GO TO 865
03830      DCS(J,K) = (GI(J,K)/Z2(J,K+1))-
03840+                   (GI(J,K)/Z2(J,K))
03850      GO TO 866
03860      865  DCS(J,K) = (GI(J,K)/Z2(J,K+1))-
03870+                        (GI(J,K)/Z1(J,K))
03880      866 PT3(J,K) = PT2(J,K)+DCS(J,K)+DDE(J,K)
03890      DA3(J,K) = (GI(J,K+1)/Z1(J,K+1))-(GI(J,K+1)/
03900+       Z2(J,K+1))+(FN(J,K+1)/Z1(J,K+1))-FNH(J,K+1)
03910      IF (K .LE. 1) GO TO 875
03920      CA3(J,K) = DA3(J,K)-DA3(J,K-1)
03930      GO TO 876
03940      875 CA3(J,K) = DA3(J,K)
03950      876 TA3(J,K) = TA2(J,K)-CA3(J,K)-DCS(J,K)-
03960+                    DDE(J,K)
03970      P3A(J,K) = PT3(J,K)+TA3(J,K)
03980      IF (K .LE. 1) GO TO 880
03990      CT1(J,K) = CT1(J,K-1)+TA1(J,K)
04000      CT2(J,K) = CT2(J,K-1)+TA2(J,K)
04010      CT3(J,K) = CT3(J,K-1)+TA3(J,K)
04020      GO TO 881
04030      880  CT1(J,K) = TA1(J,K)
04040           CT2(J,K) = TA2(J,K)
04050           CT3(J,K) = TA3(J,K)
04060C   GENERATE CURRENT VALUE OF FIRM
04070      881  IF (K .LE. NN)  GO TO 885
04080      CF4(J,K+1) = ((CF4(J,K)-(FP(J,K-NN)*Z3(J,K)/
04090+       Z3(J,K-NN)*((1.0-DR)**NN)))*Z5(J,K)*
04100+       (1.0-DR))+FP(J,K+1)
04110      GO TO 886
04120      885  CF4(J,K+1) = (CF4(J,K)*Z5(J,K)*(1.0-DR))+
04130+                         FP(J,K+1)
04140      886  IF (CASE .LE. 3.0) GO TO 887
04150      CI4(J,K+1) = GI(J,K+1)
04160      GO TO 888
04170      887  CI4(J,K+1) = GI(J,K+1)/(1.0-GM(J,K))
04180      888  CV4(J,K+1) = (CF4(J,K+1)+CI4(J,K+1)+
04190+             WC(J,K+1)-SD(J,K+1))/Z1(J,K+1)
04200      CW4(J,K) = CV4(J,K+1)-CV4(J,K)+DIT(J,K)
04210      900 CONTINUE
04220    850 CONTINUE
04230C   GENERATE CONSOLIDATED RESULTS
04240    DO 910 K=1, 30
04250      DO 911 J=1, 6
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04260       PT1(7,K) = PT1(7,K)+PT1(J,K)
04270       P1A(7,K) = P1A(7,K)+P1A(J,K)
04280       PT2(7,K) = PT2(7,K)+PT2(J,K)
04290       PT3(7,K) = PT3(7,K)+PT3(J,K)
04300       P3A(7,K) = P3A(7,K)+P3A(J,K)
04310       CW4(7,K) = CW4(7,K)+CW4(J,K)
04320       TA1(7,K) = TA1(7,K)+TA1(J,K)
04330       TA2(7,K) = TA2(7,K)+TA2(J,K)
04340       TA3(7,K) = TA3(7,K)+TA3(J,K)
04350       CT1(7,K) = CT1(7,K)+CT1(J,K)
04360       CT2(7,K) = CT2(7,K)+CT2(J,K)
04370       CT3(7,K) = CT3(7,K)+CT3(J,K)
04380       DIT(7,K) = DIT(7,K)+DIT(J,K)
04390       911 CONTINUE
04400     910 CONTINUE
04410     DO 912 J=1, 7
04420       DO 913 K=1, 30
04430       PT1(J,31) = PT1(J,31)+(PT1(J,K)/30.0)
04440       P1A(J,31) = P1A(J,31)+(P1A(J,K)/30.0)
04450       PT2(J,31) = PT2(J,31)+(PT2(J,K)/30.0)
04460       PT3(J,31) = PT3(J,31)+(PT3(J,K)/30.0)
04470       P3A(J,31) = P3A(J,31)+(P3A(J,K)/30.0)
04480       CW4(J,31) = CW4(J,31)+(CW4(J,K)/30.0)
04490       TA1(J,31) = TA1(J,31)+(TA1(J,K)/30.0)
04500       TA2(J,31) = TA2(J,31)+(TA2(J,K)/30.0)
04510       TA3(J,31) = TA3(J,31)+(TA3(J,K)/30.0)
04520       CT1(J,31) = CT1(J,31)+(CT1(J,K)/30.0)
04530       CT2(J,31) = CT2(J,31)+(CT2(J,K)/30.0)
04540       CT3(J,31) = CT3(J,31)+(CT3(J,K)/30.0)
04550       DIT(J,31) = DIT(J,31)+DIT(J,K)
04560       913 CONTINUE
04570     912 CONTINUE
04580C    GENERATE REAL INCOME
04590     DO 914 J=1, 7
04600       DO 915 K=1, 30
04610       RI1(J,K) = PT1(J,K)*Z3(7,1)/Z3(7,K+1)
04620       R1A(J,K) = P1A(J,K)*Z3(7,1)/Z3(7,K+1)
04630       RI2(J,K) = PT2(J,K)*Z3(7,1)/Z3(7,K+1)
04640       RI3(J,K) = PT3(J,K)*Z3(7,1)/Z3(7,K+1)
04650       R3A(J,K) = P3A(J,K)*Z3(7,1)/Z3(7,K+1)
04660       RI4(J,K) = CW4(J,K)*Z3(7,1)/Z3(7,K+1)
04670       915 CONTINUE
04680     914 CONTINUE
04690C    COMPARISON WITH CONTROL TREATMENT
04700     DO 920 J=1, 7
04710       DO 921 K=1, 30
04720       CG1(J,K) = RI4(J,K)-RI1(J,K)
04730       CG2(J,K) = RI4(J,K)-R1A(J,K)
04740       CG3(J,K) = RI4(J,K)-RI2(J,K)
04750       CG4(J,K) = RI4(J,K)-RI3(J,K)
04760       CG5(J,K) = RI4(J,K)-R3A(J,K)
04770       921 CONTINUE
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04780    920 CONTINUE
04790C   GENERATE MEANS
04800    DO 925 J=1, 7
04810      DO 926 K=1, 30
04820      RI1(J,31) = RI1(J,31)+(RI1(J,K)/30.0)
04830      R1A(J,31) = R1A(J,31)+(R1A(J,K)/30.0)
04840      RI2(J,31) = RI2(J,31)+(RI2(J,K)/30.0)
04850      RI3(J,31) = RI3(J,31)+(RI3(J,K)/30.0)
04860      R3A(J,31) = R3A(J,31)+(R3A(J,K)/30.0)
04870      RI4(J,31) = RI4(J,31)+(RI4(J,K)/30.0)
04880      CG1(J,31) = CG1(J,31)+ABS(CG1(J,K))
04890      CG2(J,31) = CG2(J,31)+ABS(CG2(J,K))
04900      CG3(J,31) = CG3(J,31)+ABS(CG3(J,K))
04910      CG4(J,31) = CG4(J,31)+ABS(CG4(J,K))
04920      CG5(J,31) = CG5(J,31)+ABS(CG5(J,K))
04930      926 CONTINUE
04940    925 CONTINUE
04950C   COMPARISON OF TREATMENT MEANS
04960    DO 930 J=1, 7
04970      DTM(J,1) = RI4(J,31)-RI1(J,31)
04980      DTM(J,2) = RI4(J,31)-R1A(J,31)
04990      DTM(J,3) = RI4(J,31)-RI2(J,31)
05000      DTM(J,4) = RI4(J,31)-RI3(J,31)
05010      DTM(J,5) = RI4(J,31)-R3A(J,31)
05020    930 CONTINUE
05030C   PUNCH OUTPUT
05040    DO 1520 J=1, 7
05050      L=1
05060      PUNCH (7,230)  (L,K,RI4(J,K),K=1,30)
05070      L=L+1
05080      PUNCH (7,230)  (L,K,RI2(J,K),K=1,30)
05090      L=L+1
05100      PUNCH (7,230)  (L,K,R1A(J,K),K=1,30)
05110      L=L+1
05120      PUNCH (7,230)  (L,K,RI3(J,K),K=1,30)
05130      L=L+1
05140      PUNCH (7,230)  (L,K,R3A(J,K),K=1,30)
05150      DO 1525 K=1, 30, 2
05160        PUNCH (7,231)  RI4(J,K),RI2(J,K),R1A(J,K),
05170+             RI3(J,K),R3A(J,K),RI4(J,K+1),RI2(J,K+1),
05180+             R1A(J,K+1),RI3(J,K+1),R3A(J,K+1)
05190      1525 CONTINUE
05200C
05210      PUNCH (7,232)  CASE,DTM(J,3),DTM(J,2),
05220+             DTM(J,4),DTM(J,5)
05230    1520 CONTINUE
05240    230 FORMAT(6(I2,I3,F8.3))
05250    231 FORMAT(10F8.3)
05260    232 FORMAT(2X,F4.2,4F11.5)
05270    STOP
05280    END
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VITA

Galen Lee Rupp

Candidate for the Degree of

Doctor of Philosophy

Thesis: A SIMULATION STUDY OF ALTERNATIVE METHODS FOR TRANSLATING FINANCIAL STATEMENTS OF AUTONOMOUS FOREIGN ENTITIES

Major Field: Business Administration

Biographical:

Personal Data: Born in Whitehouse, Ohio, October 27, 1943.

Education: Graduated from Anthony Wayne High School, Whitehouse, Ohio, in May, 1961; received Bachelor of Science in Business Administration degree from Bowling Green State University, Bowling Green, Ohio, in March, 1969; received Master of Business Administration degree from Boise State University, Boise, Idaho, in December, 1976; completed requirements for the Doctor of Philosophy degree at Oklahoma State University in July, 1982.

Professional Experience: Management Accountant, The Bendix Corporation, 1969-1975; Visiting Assistant Professor, College of Idaho, 1977; graduate teaching associate, School of Accounting, Oklahoma State University, 1977-1981; Assistant Professor, Department of Accounting, University of Nevada, Las Vegas, 1981-1982.

Professional Organizations: Institute of Management Accounting; American Accounting Association.