Faculty Working Papers

TOWARD DEVELOPING GENERAL ACCOUNTING THEORY:
A PARADIGM FOR DEVELOPING FORMAL EMPIRICALLY
TESTABLE THEORIES IN ACCOUNTING

William S. Hopwood, Assistant Professor,
Department of Accountancy
Michael Barrett, University of Illinois at
Chicago Circle

#707

College of Commerce and Business Administration
University of Illinois at Urbana-Champaign

FACULTY WORKING PAPERS

College of Commerce and Business Administration

University of Illinois at Urbana-Champaign

August 29, 1980

TOWARD DEVELOPING GENERAL ACCOUNTING THEORY: A PARADIGM FOR DEVELOPING FORMAL EMPIRICALLY TESTABLE THEORIES IN ACCOUNTING

William S. Hopwood, Assistant Professor,
Department of Accountancy
Michael Barrett, University of Illinois at
Chicago Circle

#707

Summary

This paper takes Gibb's method for constructing formal empirically testable theory and demonstrates an application in accounting. We argue that accounting could benefit from a common "language of theory construction." In addition we feel that it would be useful to see existing and further accounting theories set forth in a formal framework. This could pave the way for linking theories which share common variables. The result could eventually lead to an integrated overall accounting theory.

Theory is an often used term in accounting. Because its definition has neither been clearly specified nor a single definition generally agreed upon, theory suggests several meanings to accountants. The Committee on Accounting Theory Construction and Verification [1971, pp. 55, 63], hereafter C T C V, for example, considered the nature of theory and concluded accountants do not even know how accounting theories are constructed. This paper applies a blueprint developed in Sociology by Gibbs [1972] to constructing accounting theories which can be scientifically subjected to empirical confirmation. The discussion is divided into four main sections: (1) the need for formal empirically testable accounting theories, (2) a blueprint of a formal empirically testable theory, (3) the evaluation of a formal empirically testable theory and (4) an application of the paradigm to the FASB's Tentative Conclusions on Objectives of Financial Statements of Business Enterprises [1976].

THE NEED FOR FORMAL EMPIRICALLY TESTABLE ACCOUNTING THEORIES

Definition

In this section formal empirically testable theories are defined by considering the following terms: theory, formal theory, empirical theory, and testable theory.

Theory

Within science the most common definition of theory is probably that it is a set of logically interrelated propositions. A proposition is a statement that specifies a relation between more than two variables. [In the second part of this paper we will formalize this definition].

Formal Theory

A formal theory is one in which (1) the logical part is separated from the empirical, (2) each component is specifically labeled as either logical or empirical and (3) argumentation is excluded. The CTCV (p. 56) defined a formal theory as, "The syntactical or logical part of a theory can be abstracted and studied in isolation from the empirical part of the theory. This process is called an axiomatic or formal system." Gibbs (1972, p. 7) states that a formal theory is one in which the components are differentiated and systematically identified with argumentation excluded. Finally, Hempel (1965, p. 182) states that a formal theory should be stated in list form where all of the components are identified.

Empirical Theory

An empirical theory refers to propositions which are synthetic (i.e., their truth value depends on the existential world).

Testable Theory

To be testable there must be a procedure that permits a conclusion regarding the truth or falsity of the theory. Such a conclusion might be probabilistic and hence, subjective in nature. There are two ways a formal empirical theory can be tested: (1) it can be tested for logical consistency or (2) it can be tested by studying its assertions in relation to the experiential world. (A nonemipirical formal theory can only be subjected to the first type of testing.)

The Need for Formal Empirical Testable Theories in Accounting

We begin with the assumptions that accounting is an empirical discipline and that accounting research demands the use of scientific methodology. More specifically it is assumed that accounting or some subject of accounting ought to be a science composed of laws. Given these assumptions it follows that general laws must be developed. To specify such laws it is necessary to construct theories which are verifiable or testable.

To summarize the above: If accounting is to be empirical science empirically testable theories are needed. Thus, it is necessary to show that formality is necessary to construct such theories.

Formality and Empirical Testability

The problem with nonformal theories is that they are difficult or if not impossible empirically to test. The fact that a large number of existing theories are not subject to empirical verification has been recognized by the CTCV. This is because nonformal theories generally are interspersed with opinions, wise adages, value judgements and anecdotal evidence. Chambers wrote (p. 371) that the "actual state of accounting is not that it has no theories, but that it has almost an inexhaustible quantity of implicit, partial and contradictory theories." Such theories are virtually impregnable against scientific empirical testing because it is often difficult to pinpoint their primary assertions or propositions. In addition it is often difficult to analyze the logical relationships between propositions.

THE PARADIGM

Assumptions Regarding the Proposed Mode of Theory Construction

There are three assumptions relating to the proposed paradigm: (1) prediction is assumed to be the primary criterion for assessing the existence of a theory, (2) assertions of causations are not included in the theory and (3) the acceptance or rejection of a theory lies in the hands of the general academic community.

Causation is excluded because it is controversial. Many believe that it is not subject to empirical verfication (see Gibbs, p. 22). The first assumption is chosen over another commonly cited criterion, explanation. Explanation has not been well specified beyond saying that it depends on successful prediction. Prediction refers to the degree of agreement between formally derived testable statements of theory and the factual world.

The Language of Formal Theory Construction

Yu writes (p. 11) that, "There are a number of terms, such as 'hypothesis,' 'theories,' 'models,' and 'laws,' which are of particular importance to theorization, but some of these terms connote essentially the same meaning and thus they can be used interchangeablely. Others vary in the degree of exactness or certainty, hence they must be properly differentiated. Precise and explicit identification of these terms in a scientific discipline is necessary because ambiguous terms used indiscriminately lead to confusion." One might think that it is possible to turn to the philosophy of science for terminology. This, however, is not the case as can be seen from Gibb's (p. 90) statement that the philosophy of science literature does not display a "conspicuous agreement in definition of conventional labels (e.g., hypothesis, propositions)."[1]

If there are no commonly agreed upon terms of theory construction, what can be done? One answer is given by Yu (p. 85). He says that, "In scientific research we need precise definitions in terms of determinancy and uniformity, which call for the development of artifical language." More specifically, Hempel (p. 182) states, "Formally, a scientific theory may be considered as a set of sentences in terms of a scientific vocabulary."

The above statements imply: (1) There is no common special language of theory construction, and (2) in order to develop a mode of theory construction an artificial language must be created. For these reasons it is necessary to introduce a special language similar to the one developed by Gibbs (1972). To emphasize this we will henceforth underline words that belong to this special language.

The Specification of an Artifical Language

Before proceeding to develop a language recall that: A theory is a logically interrelated set of assertions,[2] where each assertion implies a relationship between two or more variables. From this statement different types of assertions and variables are identified.[3]

Types of Variables

Three types of variables are identified: (1) constructs, (2) concepts and (3) referentials. The distinction between these three lies in their degree of abstraction from reality. A construct is the most abstract and a referential is the least.

Specifically, a construct is a variable which is not empirically applicable or complete in the researcher's opinion. A concept is a variable the researcher considers to be empirically complete. For example, it is likely that a theorist would consider that the variable "income" is not empirically complete while the variable "average corporate income" is empirically complete. It must be stressed that the researcher must exercise judgement here.[4]

The third type of variable is a referential. It is less abstract than either the construct or concept. The primary characteristic of this type of variable is that it has an associated operational definition which is called a referential formula. For example, we might have the referential "EPS." A referential formula for earnings per share may be of the following form: $EPS_t = \frac{\sum_{i=1}^{N} EPS}{N}$; where N is the number of industrial firms listed on the NYSE and EPS_t is the unweighted average earnings per share in period t.

Referentials are necessary to construct an empirically testable theory. Gibbs (p. 98) states that, in sociology there is no defect which "is more glaring than the omission of formulas and procedures for obtaining data. This defect is rationalized by the myth that the investigator will know what formulas and procedures are appropriate for tests of a theory."

A final note, variables also must be temporarily specified. For example, consider the construct "wealth". It is not clear whether one means wealth at one point in time or the change in wealth over time (income). The temporal dimension of a referential must be specified as either cross sectional or longitudinal.

Types of Assertions

An assertion is a statement that implies the existence of a relation between variables, where the asserted relation references either a positive or a negative association between a set of variables. At least four types of assertions can be identified; (1) an axiom is an asserted relation between two constructs, (2) a postulate is an asserted relation between a concept and a construct, (3) a transformation statement is an asserted relation between a concept and a referential. Figure 1 elaborates these four types of assertions.

Place Figure 1 about here.

In Figure 1 the solid lines represent assertions. The signs affixed parenthetically to the different relationships state whether the assertion is thought to express either a positive or negative association.

A fourth type of assertion is the derived assertion. Because the two referentials in Figure 1 are logically linked to each other via five assertions, it is possible to derive an asserted relation between the two referentials. The sign of the derived association between referential 1 and referential 2 is the same as the sign of $(-1)^j$ where j is the number of assertions connecting the two referentials expressing a negative association. In Figure 2 the only assertion having a negative association is transformation statement 2. Therefore, $j = 1$. The derived association between referential 1 and referential 2 has the same sign as $(-1)^1 = -1$ which is negative. Therefore, if j is odd the derived referential association is negative; otherwise it is positive.

The derivation of this fourth type of assertion produces a theorem which is displayed in Figure 2. (It is shown below that this theorem leads to empirical testing.)

Place Figure 2 about here.

This referential theorem completes the structure of a formal empirically testable theory. It is now possible to discuss the evaluation of such a theory.

EVALUATION OF THE FORMAL EMPIRICALLY TESTABLE THEORY

General Criteria for Evaluation

Although there has been very little work on theory construction in accounting, even less has been devoted to theory evaluation [CTCV pp. 53, 59]. In addition to empirical testing there are several general criteria which can be used to evaluate a theory. General evaluation criteria include: (1) A theory's potential testability, (2) predictive range, and (3) its parsimony. Each of these are defined as follows:

(1) Potential testability--The total number of theorems
(2) Predictive range--The total number of variables
(3) Parsimony--The ratio of the number of theorems to the total number of (axioms, postulates, etc.)

A Specific Criterion for Evaluating a Theory--Testing

Hypothesis derivation--In order to test the theory in Figure 2, an additional assertion called a hypothesis is derived. The researcher must apply referential formulas for each referential to collect data which produce referents (empirical observations). Assertions then must be derived among the referents. This linkage is presented diagrammatically in figure 3.

Place Figure 3 about here.

Two additional types of assertions have been added in Figure 3: (1) epistimic statements and (2) hypotheses. Epistimic statements are assertions that the referents are positively associated with their related referentials. Hypotheses are derived assertions between referents. The sign of the hypothesis can be derived in the same manner as that of a theorem. If one proceeds in the direction of the circular flow shown at the bottom of Figure 3, it will be found that there is an odd number of negative association assertions between referents 1 and 2. This means that it is expected that referent 1 and 2 are negatively associated.

The Test and Its Interpretation

A test determines whether or not the hypothesized relation among two or more referents corresponds to an observed relation between the same referents. Confirmation in the form of a predicted association does not assure that all of the assertions in a theory are correct. Offsetting errors with respect to the sign relations in the theory can result in hypotheses that predict in the right direction.[5] The observed relation between a set of referents may also be subject to statistical error. These two statements together imply that no theory can ever be confirmed absolutely to be either correct or incorrect. One can place only varying degrees of confidence in a theory.

Theory Revision

A theory should not be revised unless it has been tested repeatedly, and a theory should not be rejected unless another theory has a better record of prediction. If revision is considered desirable after repeated testing, certain rules should be kept in mind. The primary rule is conservation. The researcher should modify the referents before modifying the referentials, the referentials before the concepts and the concepts before the constructs. In addition, referential formulas should be modified before transformation statements, transformation statements before postulates and postulates before axioms. The conservative strategy is useful because the abandonment of an axiom for example, will negate the lower level postulates, transformation statements, referentials and referents.

AN APPLICATION OF THE PARADIGM

Recently the FASB issued, Tentative Conclusions on Objectives of Financial Statements of Business Enterprises [1976]. In discussing accounting information for investors, the board relied on four propositions:

(1) The primary interest of the investor is a return on investment in the form of cash flows [p. 45].
(2) Earnings as measured by accrual accounting are generally thought to be the most relevant indicator of an enterprise's case earning ability [p. 45].
(3) The fundamental approach to financial analysis focuses on the earning power of an enterprise to estimate the intrinsic value of a potential investment in a common stock [p. 57], and
(4) The most important single factor in determining a stock's value is now held to be its expected average future earning power [p. 57].
(5) The Board concludes that EPS is a useful measure of earning power.

The Board's propositions can be stated in the form of a formal empirically testable theory.[6]

The Variables of the Theory

A theory with six variables can be constructed.

(A) Constructs
(1) A change in the stock market's expectations regarding the expected future average cost flows of the firm is ΔECF.
(2) A change in the utility of owning a firm's stock is ΔEUO.

(B) Concepts
(1) A change in the stock market's expectations regarding the future accounting income produced by the firm is ΔEAI.
(2) A change in the expected economic value of the firm is ΔEV.

Referentials

(1) ΔEPS
ΔSR = individual component of the stock return

Both referentials have referential formulas: (1) $\Delta EPS = EPS_t - EPS_{t-1}$ where t refers to year t, and EPS denotes primary earnings per share before extraordinary items and adjusted for capital changes, and (2) ΔSR = the cumulative abnormal return for the 12 months prior to the earnings announcement date (for more detail see Foster [1977]). In practice these formulas would be more specific and give the details for computing EPS and abnormal return.

The constructed theory asserts that all these assertions together produce a hypothesis predicting positive association between referents.

Place Figure 4 about here.

Conclusion

This paper has taken the method of Gibbs [1972] for constructing formal empirically testable theory and demonstrated an application in accounting. It is argued that accounting could benefit from a common "language of theory construction." In addition we feel that it would be useful to see future and existing accounting theories set forth in a formal framework. This could pave the way for linking theories which share common variables. The result could eventually lead to an integrated overall accounting theory.

FIGURE 1

Types and Levels of Assertions

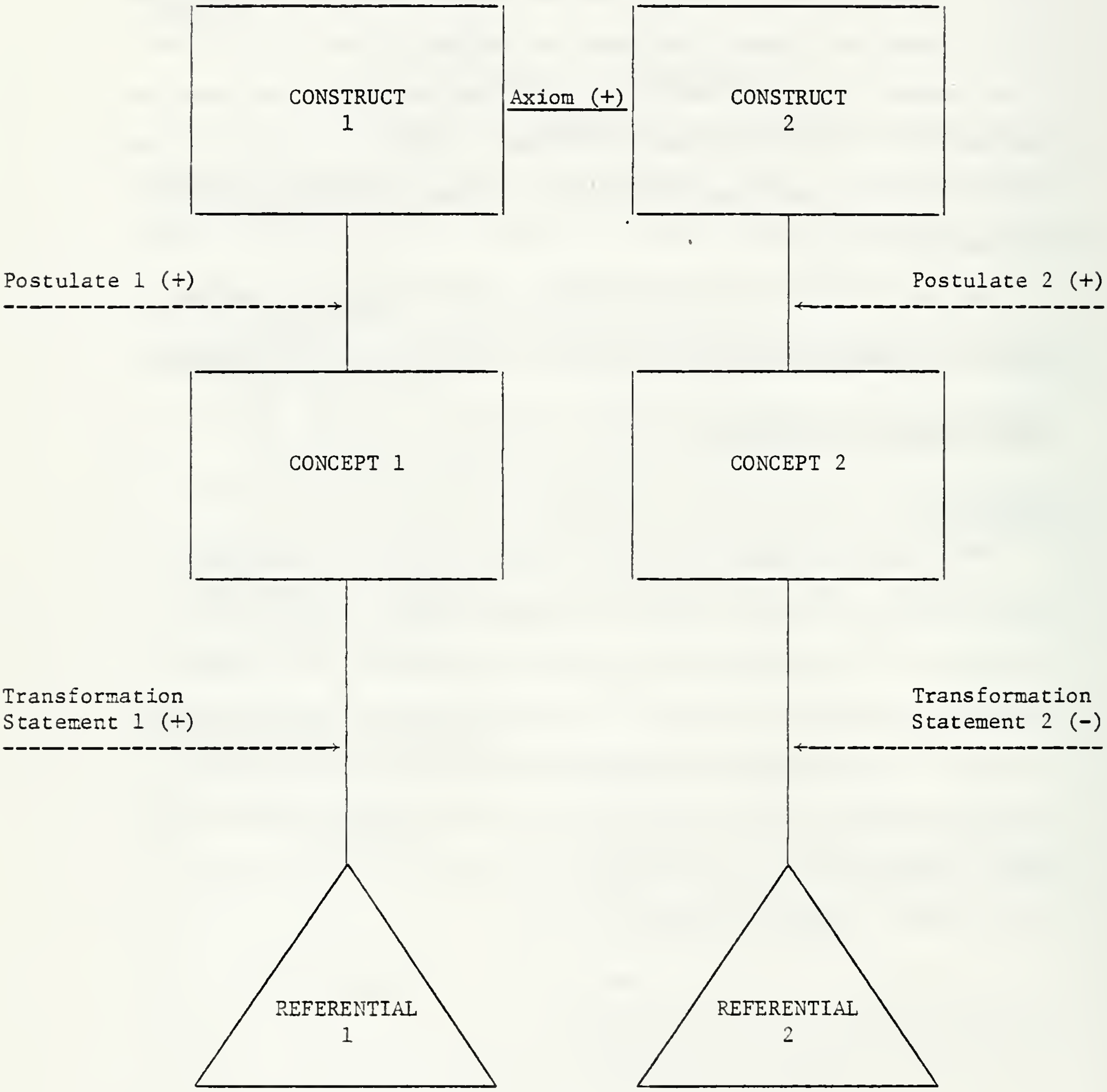


FIGURE 2

Types and Levels of Assertions

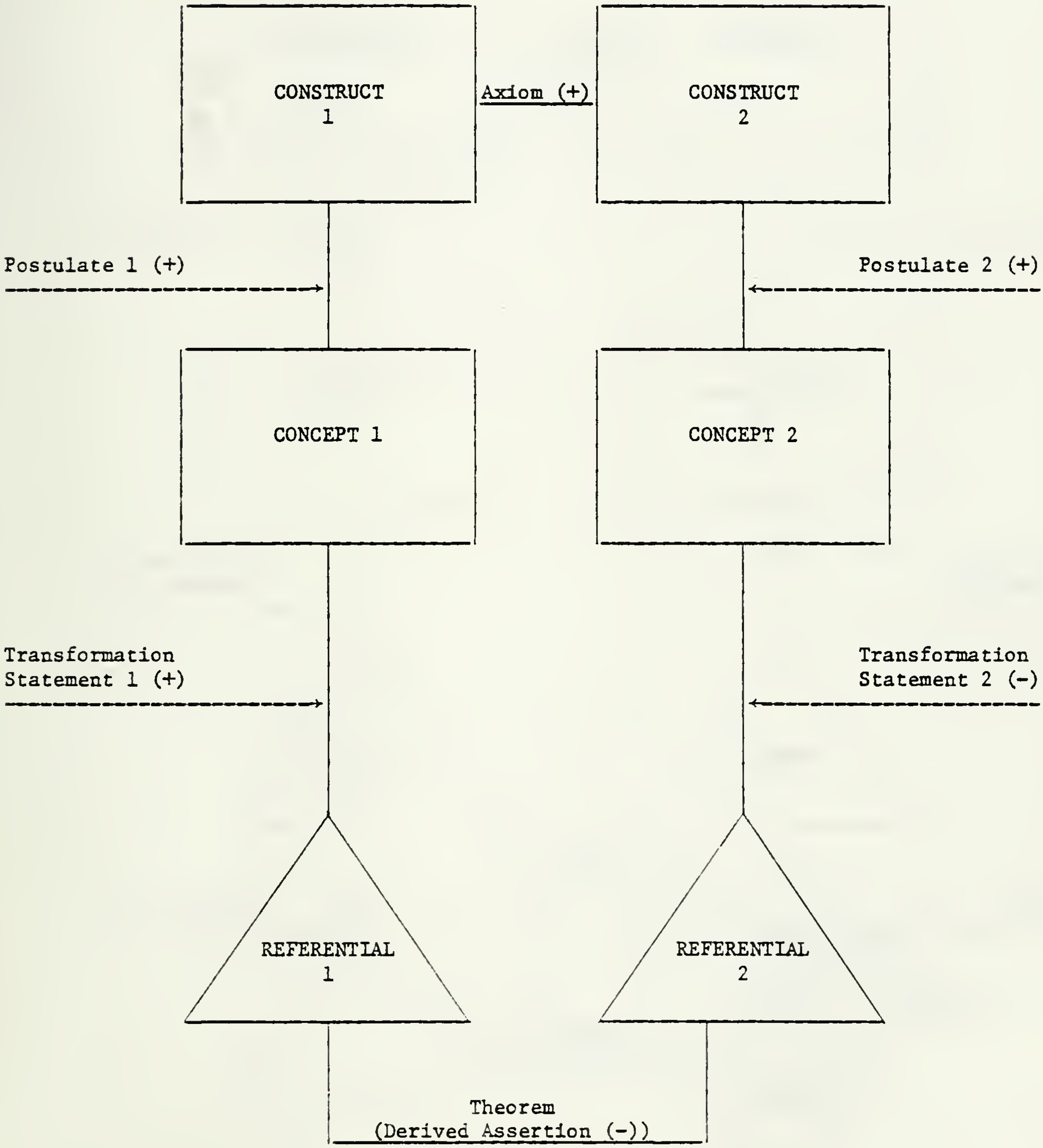


FIGURE 3

An Example of Hypothesis Derivation

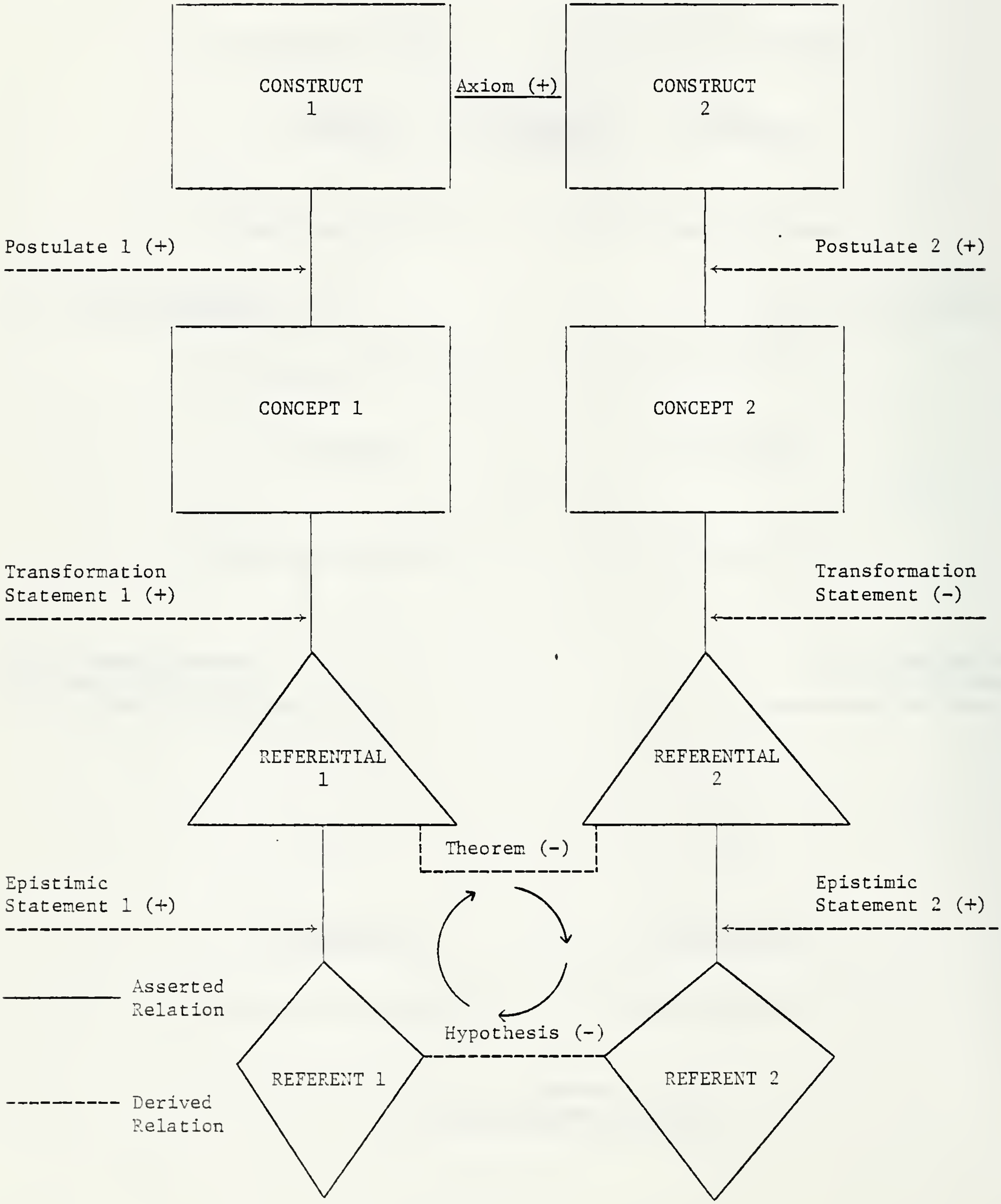
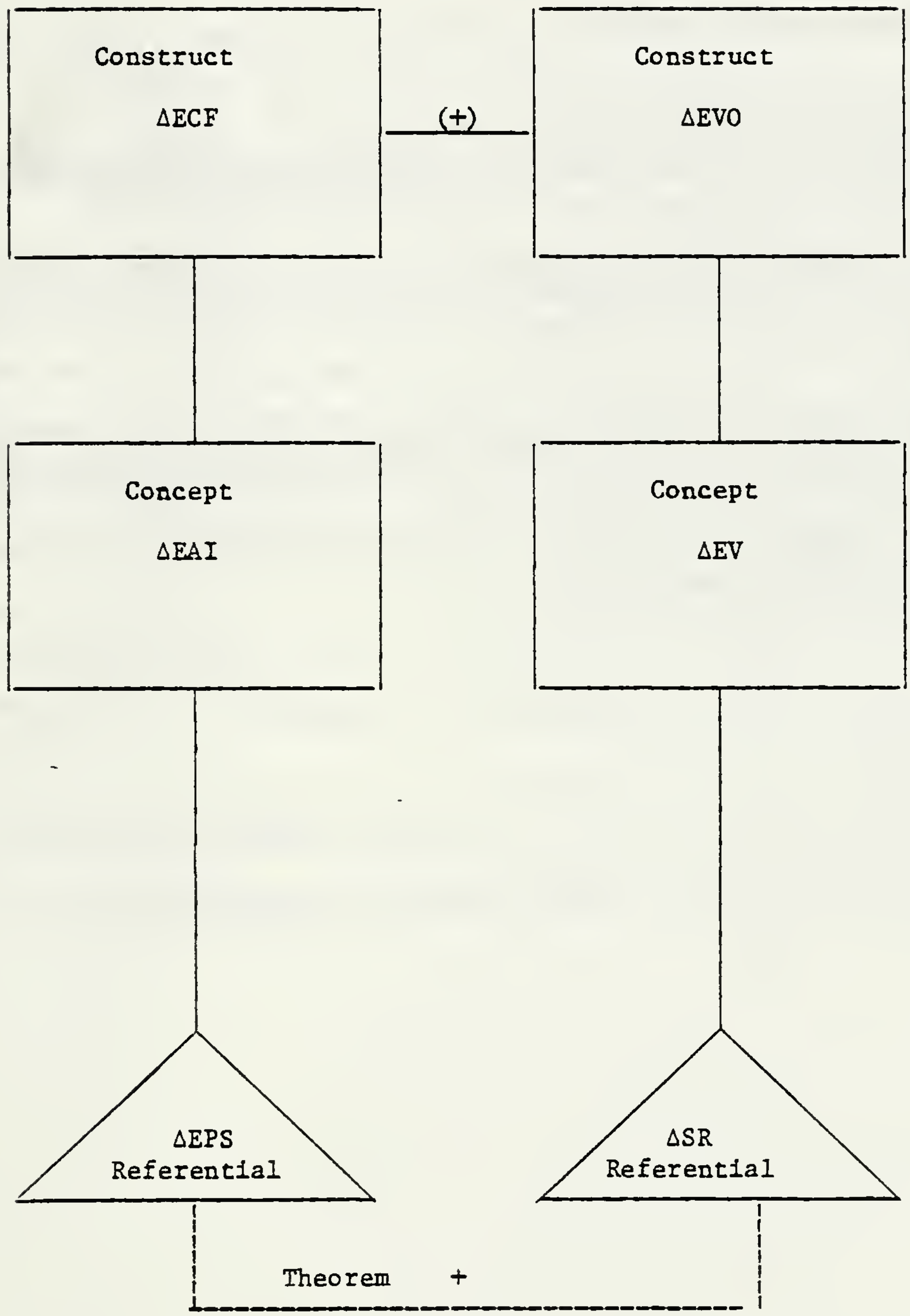


FIGURE 4

Stock Valuation Theory



Footnotes

[1]Parenthetical not added.

[2]We refer to empirical assertions (i.e., their confirmation depends on the factual world).

[3]"Assertions" and "variables" are taken as primitive, undefined terms (with the restriction that the assertions be empirical).

[4]The distinction between different levels of generality is recognized by Yu [p. 94], who refers to theoretical constructs and concepts and Margeneau [1966], who distinguishes between theoretical and operational concepts.

[5]For example in Figure 3, the signs of postulates 1 and 2 might be altered incorrectly. This would result in no change in the sign of the hypothesis because the incorrect predictions would cancel each other.

[6]The example presented is only intended to be demonstrative and therefore is highly simplified.

REFERENCES

Chambers, R. J. Accounting Evolution and Economic Behavior (Prentice Hall, 1966).

Financial Accounting Standards Board, Tentative Conclusions on Objectives of Financial Statements of Business Enterprises, (Financial Accounting Standards Board, 1976)

Foster, George. "Quarterly Accounting Data: Time-Series Properties and Predictive-Ability Results," Accounting Review, January 1977, pp. 1-21.

Gibbs, Jack P. Sociological Theory Construction (Dryden Press, 1972).

Hempel, Carl G. Aspects of Scientific Explanation and Other Essays in the Philosophy of Science (The Free Press, 1965).

Machlup, F. "Operationalism and Pure Theory in Economics," in S. R. Krupp (ed.) Structure of Economic Science (Prentice Hall, 1966).

Margenau. "What is a Theory?" in Sherman Roy Krupp (ed.), The Structure of Economic Science (Prentice Hall, 1966), pp. 25-37.

Meehan, Eugene J. Explanation in the Social Sciences (The Dorsey Press, 1968).

"Report of the Committee on Accounting Theory Construction and Verification," The Accounting Review, supplement to Vol. XLVI, 1971, pp. 55-63.

Yu, S. C. The Structure of Accounting Theory (unpublished manuscript, University of Florida).