



# THE RISE AND SIGNIFICANCE OF MODERN ANALYTICAL METHODS IN ACCOUNTING

## A Review Essay of the *Economics of Accounting, Vol. I*, of P. O. Christensen and G. A. Feltham

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### Abstract

This is Part II of some review essays dealing with the development of analytical accounting, and particularly, the application of information economics to accounting [for Part I, see Mattessich 2003a]. The current essay discusses the *Economics of Accounting; Volume I: Information in Markets* by Peter O. Christensen and Gerald A. Feltham [2003]. Although this book deals with the same subject matter as the one discussed in Part I [i.e., Christensen and Demski, 2003], the “new” work is not only more comprehensive but offers a better overall survey of information economics as applied to accounting. Thus it may also serve as an excellent and rigorous reference work, offering a large number of mathematical theorems and their proofs. On the other side, it has hardly any intuitive illustrations and is less pedagogically oriented than the book discussed in Mattessich [2003a]. The first volume (here discussed) deals with the basic decision-facilitating role of information and, above all, with public information and private investor information as well as the disclosure of private information (by owners), all in equity markets (in contrast to the second and forthcoming volume that has a more internal orientation, dealing with Performance Evaluation and Agency Theory).

**Keywords:** accounting, decision theory, information economics, equity markets, disclosure of information.

### 1. Introduction

In the late 1970s Joel Demski and Jerry (G.A.) Feltham intended to write on invitation of the American Accounting Association a monograph on “the state of the art in information economics and its impact on accounting”. But after years of experimentation they found the pertinent literature not complete enough. At first, they postponed the project and ultimately abandoned it. But twenty years later, after

much new research by an ever-increasing number of scholars (above all, by Feltham, Demski and Ohlson), the idea of this project found realization in the work by Christensen and Feltham [2003 (and 2005, forthcoming)]. It is based on repeated improvements and expansions of the lecture notes used in two doctoral seminars offered by Feltham at the University of British Columbia in Vancouver (Peter Christensen is a former student of Feltham, and now Professor at the Southern University of Denmark-Odense; he collaborated for years with Feltham on both volumes of this book).

## 2. General remarks

Despite the authors' assertion that they mainly concentrated on fundamentals, the material offers a fairly closed overview of this "new" trend. Only a few areas were neglected, such as the economics of auditing, tax and bankruptcy issues, as well as accounting reports for the use of debt holders (so far little explored in the analytical literature). More surprising is that such traditionally important areas as inflation and current value accounting remain virtually unmentioned. The justification for this may be that in Christensen and Feltham [2003, and 2005] all accounting systems are claimed to be 'equivalent'; in other words, their theory does not apply to normative statements about which system is better for a particular situation.

The book title, *Economics of Accounting*, may remind the reader of a renowned work by Canning [1929], *The Economics of Accountancy*. Yet this latter book had the sub-title "A Critical Analysis of Accounting Theory"—something fully justified by a conceptual basis that was more closely tied to traditional accounting. The two volumes by Christensen and Feltham [2003, 2005], on the other hand, belong to a very different realm, though it must be admitted that there is some endeavour to relate it to traditional accounting (for details, see below)—after all, Feltham was trained as a Chartered Accountant (in contrast to many other scholars working in this particular area of specialization). Nevertheless, we are here dealing with a specific perspective of accounting, namely its economic analytical aspect. And this cross-pollination of ideas may become a trend that may well dominate our field in the 21st century. Because in addition to the economics of accounting, there is, for example, emerging a *philosophy of accounting*, with its own ontology, epistemology, methodology and ethics (see Mattessich [1970, 1995, and 2003b], and as a general philosophic foundation to it Mattessich [1978]). There also exists the *behavioural science of accounting*, with its own sociology and psychology. To this have to be added further specializations of more traditional fields such as the *history of accounting*, or the *technique* as well as *technology of accounting*, with the advent of computerized spreadsheets and other "innovations".

If such a general trend should continue, it would enrich the scientific status and sophistication of our discipline, but it also might endanger its unity and the ultimate goal of economic and administrative stewardship. Though the desirability of such a tendency may be a matter of debate, the centrifugal forces of specialization seem to be the inevitable cost of scientific “progress”. Perhaps we can create a counter-force by avoiding a one-sided training of accounting students and young scholars. Thus, by offering them an education that is broad and well rounded (e.g., impregnating them with a philosophic point of view), the dangers of over-specialization may be mitigated. Nevertheless, the most important factor in favour of this new economics of accounting (as presented in the book under consideration) is the undeniable fact that it constitutes a scientific training more rigorous than any other encountered in our discipline. A very different question is whether the immense effort expended during recent decades by economists and accountants in exploring intricate mathematical models (accessible only to a small minority of colleagues) is a worthwhile effort. Boland [2002], in the first issue of *Energeia*, seems to question such an undertaking. But should this be a reason for not *discussing* a trend that has captured many leading scholars of economics, finance and accounting of North America?

Nevertheless, the question arises to what extent such an abstract analytical methodology (relying on innumerable simplifying assumptions) can be fruitful to an applied science such as accounting or even to accounting practice. If it were merely a cost/benefit problem of serving present-day accounting practice, there can be little doubt that improving the ethics of executives in business and public accounting firms would have been a better educational investment—at least in the short run. But this is not the way science works. When we are confronted with a serious and rigorous scientific approach, we are obliged to respect it and await its long-term results.

At this juncture one may invoke some words emphasized in the Foreword by the book’s serial editor: “the challenge Peter and Jerry provide is not simply to master this material. It is to digest and act upon it, to offer accounting thought that is matched, so to speak, to the importance of accounting institutions” [Demski, p. xv, in Christensen and Feltham 2003].

### **3. Structure of the book**

This volume deals with investor preferences relating to the firm’s operations, concentrating on “decision facilitating information” or simply on information economics as applied to investment activity in equity markets. Vol. II (still to be published) forms the basis for examining the intricacies of Performance Evaluation (and “deci-

sion influencing information” for motivating managers) and tackles, what I would call, the mathematical version and extension of agency theory.

The first volume—consisting (apart from an introductory chapter explaining the notion of “information in equity markets”) of four Parts (A to D)—deals with the significance of information in capital markets. Part A (Chapters 2 to 4) explains basic concepts and relations of information economics and decision theory. Part B (Chapters 5 to 10) deals with public information available in equity markets (e.g., information released by corporations) while Part C (Chapters 11 and 12) explains the impact of private information held by investors in such markets (e.g., information available to managers, majority shareholders) in such markets. Finally, Part D (Chapters 13 to 15) deals with the disclosure of private owner information in equity as well as product markets.<sup>2</sup> The total of 15 chapters (including the introductory one) are highly structured (i.e., each with between three to seven sections, and many subsections) comprising a total of xx + 593 pages (including references sections for each chapter; and at the end, an Author Index of 3 pages, and a Subject Index of almost 9 pages). The total number of mathematical “propositions” (i.e., theorems with rigorous proofs) in the first volume alone is some hundred twenty-four.

#### **4. Essence and content**

Chapter 1 (Introduction to Information in Markets [for products and capital]) offers a non-mathematical but fairly rigorous survey of the entire book, explaining key concepts and basic ideas. This volume (in contrast to the second one) does not explicitly regard managers as economic agents with personal preferences and in need of particular incentives.

Chapter 2 (Single Person Decision Making under Uncertainty) presents concisely and rigorously the probabilistic tools and concepts for decision making under uncertainty. It begins with single person decision making, discusses the representation of uncertainty, the nature of random variables, different forms of probability distributions, the representation of preferences (e.g., over lotteries) by means of various utility functions, risk aversion, mean variance approximations and preferences, stochastic dominance, etc.

Chapter 3 (Decision-Facilitating Information) offers an intense recapitulation of the basic notions of information economics. Since the reader of this paper may be unfamiliar with the idea of information economics (which after all is the basis of this book), I shall first try to outline its essence in a much simpler fashion than done in this book. Information economics grew out of *statistical decision theory* and can

best be illustrated by comparing it with the basic *decision model*, then pointing out the differences.<sup>3</sup>

Statistical decision theory conceives a pay-off matrix that relates to different events or “states of nature” (columns) with a variety of human actions or “strategies” (rows). Thus each individual cell in the pay-off matrix reveals either the utility or, more simply, a \$-amount to be received for each action, given a certain event occurs. It assumes the probability of each event (occasionally called the “prior” probability or belief) is known. With these data it is possible to calculate the “expected value” (i.e., the mean value) of each action by weighting the corresponding event probability with each pay-off for a specific action. From the expected values attributed to the various actions one chooses the highest value. This in turn indicates the optimal action to be chosen (though other decision criteria may also be chosen, depending on a person’s attitude towards risk and other circumstances).

Information economics extends this decision model by introducing an information system that supplies information for each action, given the occurrence of a certain event, in form of conditional probabilities (also called “posterior” probabilities or beliefs). Thus, in the search for the optimal action, it is no longer sufficient to choose the action with the highest extant expected value maximized among the expected values for all actions (as in the simple decision model). Now the optimal action can only be chosen after observing the information “signal”. The value of the information is determined by selecting the action that has the highest value for a given signal; then, these values are weighted by the probability of each signal. The result is a kind of “gross-gross” value of a particular information system. However, this value still has still to be compared with the optimal value from the simple decision model (otherwise the advantage of the information system would not be evident). The difference between those two values is the “gross value” of the particular information system. But if this system is not costless, the information costs have to be deducted from it to yield the net value of this particular information system. If several information systems are available, the previous procedure has to be repeated for each of those systems. Only then can a choice of the optimal information system be made, namely by selecting the highest value from all competing information systems. As Christensen and Feltham [2003] point out, for such a system to have economic value to a decision maker, the latter must deem that his outcome beliefs will be changed by some possible signals and, for at least some of the signals, those belief changes will be sufficient to alter his action preference.

Chapter 4 (Risk Sharing, Congruent Preferences, and Information in Partnerships) deals with *multi-personal* decision making as encountered in dual or multiple part-

nerships where partners agree on some *sharing rules* despite their personal preferences and their different *risk tolerances*. Risk sharing of the outcome is solved by the well-known notion of *Pareto efficiency*.

Part B (Chapters 5 to 8) deals with public information in equity markets and emphasizes the *clean surplus model* (for details, see [Mattessich 2002], in *Energeia*). Here the emphasis is on the relationship between dividends and stock values in terms of future expectations. The first three of these chapters deal with pure exchange and the *exogenous* production choice of the manager (in Vol. II these choices become endogenous to the model). In such a setting, changes in public information (accounting reports) do not facilitate a Pareto Equilibrium. A major feature of Part B is the addition of further assumptions (e.g. that of ? clean surplus?) to the dividend discount model, and the creation of an accounting valuation model. The latter can be separated into “financial” and “operative” activities. But as Christensen and Feltham [2003, p.11] point out: “The key insight is that we only need forecasts of the operating activities”.

Chapters 5 and 6 (Arbitrage and Risk Sharing in Single-period Markets, and Arbitrage and Risk Sharing in Multi-period Markets, respectively) stress the assumption of no-arbitrage (stipulating that a portfolio and its prices are such that is impossible “to get something for nothing”). As the titles of these chapters reveal, the main difference lies in the change from single-period to a multi-period situation, as well as the examination of the relation between equilibrium and efficient risk sharing.

Chapter 7 (Public Information in Multi-period Markets) begins by examining the efficiency of an information system and the impact of public information on securities markets. Further topics are the relations between information and prices as well as trades volumes, etc. When assessing the conditions under which a more informative system is Pareto preferred, the authors admit that “to be honest, for an accountant, the results are disappointing!” [Christensen and Feltham, 2003, p.245].

Chapter 8 (Production Choice in Efficient Markets) switches to production activities and examines the impact of changes in the information system under various conditions (e.g., under the impact of public information, in two-period economies, etc.). The chapter also raises the question whether general equilibrium analysis can be usefully employed for accounting (answered in the affirmative by our authors).

Chapter 9 (Relation Between Market Values and Future Accounting Numbers) endeavours to examine the crucial relationship between accounting and equity val-

ues whereby security prices are expressed in relation to current book value (of equity) and future expected (residual) income. Although different accounting policies may be differently affect the current book value and expected income, the market value of owner's equity will be unchanged under certain assumptions. A major focus is on the separation between financial and operating activities as well as on anticipated equity transactions (including new stock issues and contingent debt claims).

Chapter 10 (Relation between Market Values and Contemporary Accounting Numbers) continues to examine how market values (of shares) relate to contemporary accounting numbers. But this “analysis merely describes the representational effects of accounting policies—there are no normative statements with respect to what the accounting policies should be” [Christensen and Feltham, 2003, p.315]. Their assumptions express the belief that the operating activities (rather than those of financing) are critical for accounting valuation. An important task of this chapter is to show how to infer “other information” from analyst' forecasts by discussing the problems of *non-accounting information* and other complicating aspects (including such basic questions as “how to *infer private information from equilibrium prices?*”).

Chapter 11 (Impact of Private Investor Information in Equity Markets) is, to some extent, an extension of Chapter 7. It demonstrates how uninformed investors can infer from equilibrium prices the private information held by informed investors. It employs two major models (GS and HV) dealing with rational investors assumed to be “risk averse price takers”. The GS type model supposes all investors have identical and constant risk aversion and are able to obtain shared private signals. The HV type, on the other hand, assumes investors having different degrees of *risk aversion* and being able to procure different *private signals* or infer the competitors' private information from market prices. Hence risk aversion and the investor's reaction to private information as well as the impact of and the interrelation with public reports (e.g., from accounting) are major issues. Further concerns (of this and the next chapter) are variability in equity prices, the impact of trading volumes, and the timing of the release of public information.

Chapter 12 (Strategic Use of Private Investor Information in Equity Markets) extends this investigation to the equilibrium investments made by *insiders* trying to hide (at least to some extent) their private information. It also introduces the notion of the *market-maker* and deals with the endogenous and exogenous informativeness of private information as well as public reports.

Chapters 13 to 15 investigate the *relationship between current owners* (with private

information) and new investors (lacking such information). To some extent the former group is interested in revealing information (based on auditors verifications, etc.) in order to encourage new investments by outsiders—thereby the well-known notion of *Nash Equilibrium* and other game-theoretic tools are employed. While Chapter 13 (Disclosure of Private Information by an Undiversified Owner) assumes a *single risk averse owner*, the subsequent two chapters deal with *well-diversified risk neutral* investors.

Chapter 14 (Disclosure of Private information by Diversified Owners)—assuming (as in Chapter 8) that investors are well-diversified in a setting of perfect and, later, imperfect competition—concentrates on *a manager who maximizes the market value of the firm*. Thereby the amount of information released by the manager, and the possibility of investments open to new owners become important. A series of possibilities and variations as to the pertinent information (complete vs. incomplete disclosure, costless vs. costly, exogenously vs. endogenously generated, etc.) are considered.

Chapter 15 (Disclosure of Private Information in Product Markets)—assuming similar conditions as in the previous chapter—now deals with *two competing firms* (duopoly) in a setting with products subject to downward sloping demand curves and either *Cournot* or *Bertrand competition*. The problem of *ex ante* versus *ex post* disclosure or even *lack of disclosure* (by the manager to the owners) is central to this discussion.

## 5. Conclusion

This book, as a synthesis of the information economics approach to accounting, has a good chance of becoming a classic.<sup>4</sup> Apart from the immense, systematic and concentrate labour invested in it, it not only is an excellent and integrated survey of the entire field, but also offers a great wealth of details necessary to train doctoral students for pertinent research. Although it may have been intended as a textbook for doctoral students, it definitely goes beyond it. In contrast to the book by J. A. Christensen and Demksi [2003] with which it overlaps in some respects, the work under review possesses to a much lesser extent features of a textbook. On the one side, it lacks the many numerical examples and possibly other pedagogic characteristics. On the other, this work (particularly if one takes both of its two volumes into consideration) constitutes, as a synthesis, a comprehensive and rigorous theory with numerous assumptions, definitions and, for both volumes, over 250 propositions, lemmas and corollaries, many of them with mathematical proofs.<sup>5</sup> This work may not only serve the future academic accounting community at large, it also



constitutes an *economic theory of accounting* unmatched by any other extant theory related to accounting. Some experts might even be tempted to compare the compiling of this masterwork with the heroic efforts invested in generating the *Principia Mathematica* by Whitehead and Russell [1910-1913] over ninety years ago. Even if this comparison may go too far for many experts, the two volumes by Christensen and Feltham [2003, 2005] seem to be the mathematically most sophisticated survey of the economics of accounting available at this stage.

But the mentioning of Whitehead and Russell invokes a saying attributed to the former in a conversation with the latter. Whitehead said to Russell (and I paraphrase): there exist only two kinds of scholars, simple-minded ones, as you Bertie, and muddle-headed ones, as myself.<sup>6</sup> The wisdom of such a statement might no less be in good stead for accountants. The more we benefit from the high precision of the mathematical approach, the more we suffer from its many simplifying assumptions. So some of us try to compensate with a more realistic and sweeping view of accounting, only to suffer from its vagueness and imprecision. Nevertheless, the book may well serve accountants and other academics to inform themselves about this kind of research, provided they are willing to absorb the esoteric conceptual apparatus required to master this fairly difficult material. My major criticism is the lack of intuitive illustrations—but this might have required three instead of two volumes.

## Notes

<sup>1</sup> Financial support from the Social Sciences and Humanities research Council of Canada for this project is gratefully acknowledged.

<sup>2</sup> Volume II of the same work [Christensen and Feltham, 2005, still forthcoming] deals with performance evaluation that also has four Parts (E to H) and gradually builds up by stepwise relaxing more and more restrictive assumptions and/or introducing further complications. Thereby Part E deals with the evaluation in a situation of single-period and single-agent; Part F deals with information disclosure of private management information for single periods and a single agent; Part G illuminates contracting activity in a multi-period situation with a single agent; while Part H deals with such contracting when several agents are involved.

<sup>3</sup> For a more detailed overview of the development of statistical decision theory and the emergence of information economics, see Mattessich [1978, pp. 197-233].

<sup>4</sup> In this paper, only volume 1 of this work will be discussed. The thrust lies in conveying to the reader, *uninitiated* in analytical accounting, the essence of this work in rough strokes, but without going into technical details.

<sup>5</sup> In mathematical economics and financial texts it is often customary to deal with the assumptions (axioms) informally in the text, while the definitions, lemmas, propositions and their proofs are being

given much better visible and mathematical exposure. One wonders whether the reason for this practice may lie in the often embarrassingly unrealistic or oversimplified nature of those assumptions. Another peculiarity is the usage of calling the conclusions “propositions” instead of addressing them as “theorems” — particularly when considering that there exist so many propositions in science, philosophy and every-day life that are not conclusions at all, but assertions or other statements.

<sup>6</sup> It is no secret that the impetus to writing the *Principia Mathematica* as well as most of the contributions to it came from Russell (although he listed himself as second co-author—probably due to the reference he had for his teacher). Whitehead, as his later publications revealed, leaned less to the precise philosophical-mathematical thinking of the “simple-minded” Russell, but was more prone to metaphysical speculations.

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