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Fisherian analysis, the Sarbanes-Oxley Act of 2002, and the new Rule 702 of the Federal Rules of Evidence of 2000

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Abstract

Purpose – The purpose of this paper is to contend that Fisherian analysis that is used to resolve ranking conflicts of mutually exclusive projects is misspecified, invalid, and cannot do what it purports to do. Misspecified and invalid models cannot realistically be operationalised, and are likely to result in incorrect valuations and misallocations of capital. An implication of these deficiencies is that it cannot satisfy the criteria prescribed by Rule 702 of the Federal Rules of Evidence of the USA, and as a consequence significantly impacts upon the admissibility of its use as part of expert witness testimony and the role played by the trial court in the USA. These deficiencies also place Fisherian analysis at risk of conflict with the Sarbanes-Oxley Act of 2002, in particular Section 807 §1348 that deals with the use of invalid and unreliable valuation criteria.

Design/methodology/approach – A secondary survey of Fisherian analysis, recent USA legislation and the literature of corporate financial management was undertaken. Fisherian analysis is part of the capital controversy debate, and the Cambridge-UK school devoted much time and effort in discussing issues germane to the controversy. The approach of corporate and managerial finance as evidenced by the literature, has been to unquestioningly recommend and implement a valuation criterion that is wrong and with little exception is based on numerical examples of such extreme disproportions as to qualify as inelegant examples of sophistry.

Findings – This paper contends that Fisherian analysis does not do what it purports to do, namely provide valid and reliable valuations for allocating capital. It is misspecified and invalid, is unlikely to be acceptable as expert witness testimony in terms of Rule 703 of the Federal Rules of Evidence, and if used for valuations and allocations of capital by listed corporations, can result in a conflict with the fundamental purpose and specific provisions of the Sarbanes-Oxley Act of 2002. Application of Fisherian analysis effectively prostrates the definition and function of the cost of capital for it imposes the stricture of a constant cost of capital across all mutually exclusive projects with ranking conflicts irrespective of the differences in the characteristics of these projects.

Practical implications – Management of listed corporations that use invalid and unreliable valuation criteria not only endanger the financial wellbeing of the corporation by misallocating capital, but also expose themselves unnecessarily to the risk of not complying with legal requirements. The judiciary does not condone less than complete practice by those possessed of expert knowledge and skills, education, or seniority in corporate hierarchies, especially when the issues are clear cut.

Originality/value – The paper provides useful information on Fisherian analysis.

Keywords Capital, Schools, Capital budgeting, Research methods, Evidence

Paper type Research paper

> . . . To me it is far more pleasant to agree than to differ; but it is impossible that one who has any regard for the truth can long avoid protesting against doctrines which seem to be erroneous (Jevons, 1970, p. 260).

International Journal of Law and Management
Vol. 51 No. 6, 2009
pp. 389-400

1754-243X
DOI 10.1108/17542430911005927

Introduction

Scientific, technical or other specialised evidence that does not satisfy the criteria prescribed by the new Rule 702 of the Federal Rules of Evidence of 2000 of the USA (henceforth Rule 702) significantly impacts upon the admissibility of expert witness testimony and the role played by the trial court in the USA. The criteria of Rule 702 relate to testimony that is based on sufficient facts or data, namely empirical evidence, testimony that is the product of reliable principles and methods (sound research methodology and rigorous epistemology), and testimony that the witness has applied the principles and methods reliably to the facts of the case. Where scientific, technical or other specialised evidence that does not satisfy the criteria prescribed by the new Rule 702, is used to perform valuations, allocate capital, make any financial decisions or manage listed corporations, it is questionable whether it will be in accordance with the main purpose and specific provision of the Sarbanes-Oxley Act of 2002 (henceforth SOX). The analysis that is used in capital budgeting to resolve conflicts in project rankings between the net present value (henceforth NPV) and internal rate of return (henceforth IRR) criteria, namely Fisherian analysis, does not satisfy the requirements defined in Rule 702 because it is in invalid criterion. From an epistemological perspective, Fisherian analysis can perhaps be described as a special case. When management of listed corporations apply Fisherian analysis to corporate operations situations, the inference can be drawn that they are at risk of conflict with specific provisions as well as the main purpose of SOX.

This article shows that Fisherian analysis is based on an invalid criterion in terms of Rule 702; it also shows how allocation of financial capital in terms of Fisherian analysis can conflict with the spirit and content of SOX. The article commences with a presentation of Rule 702 and relevant sections of SOX, is followed by a discussion of Fisher's model and its decision rules, and concludes with a brief discussion of the implications of using the invalid and misspecified Fisherian criterion..

Legal requirements

As a result of the high-tech stock market crash of 2000, and the financial scandals and misconduct of management, stockbrokers, bankers and other financial professionals that intentionally manipulated and systematically distorted the financial position and valuation of financial assets, as well as the demise of, *inter alia*, ENRON, WORLDCOM, and Arthur Andersen, new legislation was enacted in the USA with the specific purpose of protecting investors.

In 2000 an important change was made to the rules of evidence in the USA with the enactment of the new Rule 702 of the Federal Rules of evidence (henceforth Rule 702) that replaced the Daubert rule. Rule 702 attempts to provide guidance for the courts and litigants regarding the factors that need to be considered in determining whether an expert witness's testimony is reliable.

The new Rule 702 of the Federal Rules of Evidence of the USA states:

> If scientific, technical, or other specialised knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training or education, may testify thereto in the form of an opinion or otherwise if:
>
> a) the testimony is based upon sufficient facts of data,
>
> b) the testimony is the product of reliable principles and methods, and,
>
> c) the witness has applied the principles and methods reliably to the facts of the case.

Clearly Rule 702 requires an expert witness to provide sufficient supportive empirical evidence and reliable methodology in order to provide a sufficient basis for application, and furthermore; furthermore, it requires a proper (judicious) application of the methodology to the facts of the case under discussion. Scientific, technical or other specialised evidence that does not satisfy the criteria prescribed by Rule 702 significantly impacts upon the admissibility of expert witness testimony and the role played by the trial court in the USA. Where a financial expert has made use of unreliable and invalid methodologies to perform valuations, allocate capital, or make any financial decisions for listed corporations, it is likely to contravene the spirit and content of SOX.

SOX substantially augments the Securities Act of 1933 and the Securities Exchange Act of 1934, and has the stated express purpose of protecting investors by improving the accuracy and reliability of corporate disclosures, that in turn are contingent on valid and reliable data, methodologies, and application processes. Presentation of expert testimony that does not satisfy Rule 702 to attempt justify or attempt to defend corporate financial valuations and their subsequent implementation by management, may be construed as a violation SOX. Analysts involved in capital budgeting fall specifically within the ambit of Section 501 of SOX, and Sections 702 and 705 include investment bankers. Management and other professionals possessed of expert knowledge, skill, experience and education, or by virtue of the position of seniority they occupy within a corporation, should exercise the utmost caution when attempting to apply principles, criteria, techniques and decision rules that do not satisfy the first and second requirements of Rule 702, for they run the risk of falling foul of SOX Section 807, §1348 regarding securities fraud:

> Whoever knowingly executes, or attempts to execute, a scheme or artifice … to obtain, by means of false or fraudulent pretences, representations, or promises … shall be fined under this title, or imprisoned not more than 25 years, or both (§1348).

Theories, models, criteria and decision rules that are misspecified, lack empirical validity, that are not epistemologically rigorous, defy sound research methodology, are an abstraction form reality and cannot be satisfactorily operationalised, may be construed as an attempt to commit a false or fraudulent pretence, particularly in the case of an expert professing specialised knowledge, skills, and competence.

Sound research methodology

Sound research methodology requires performance metrics and financial yardsticks ethically report, describe and explain the phenomena being researched (Cooper and Emory, 1995, p. 9; Sekaran, 2000, p. 19-34; Cavana *et al.*, 2000, pp. 27-44), and that these metrics be valid, reliable and interpretable (Cooper and Emory, 1995, pp. 148-56; Ghauri *et al.*, 1995, pp. 46-51; Davis, 1996, pp. 172-80; Sekaran, 2000, pp. 204-10; Cavana *et al.*, 2000, pp. 210-15). Thus, an operational performance metric that is used by managers, analysts, bankers, consultants and other professionals, whether it be for appraisals, valuations, asset pricing or asset allocation, must satisfy the minimum requirements of sound research methodology and sound ethics (SOX Sections 103, 406, and 407).

Methodologically, reliability is concerned with estimates of the extent to which a measuring criterion is free from random or unstable error (Cooper and Emory, 1995, p. 153). Reliable criteria are those that can be used with confidence and are robust in the sense that they deliver consistent results through different time periods under different conditions (Cooper and Emory, 1995, p. 153). Reliability contributes to validity and although it is necessary for validity, it is not a sufficient condition for validity. Consider

as an illustrative example a temperature gauge (thermometer) that correctly indicates temperature. This thermometer is both reliable and valid. However, if this thermometer consistently over-indicated the temperature then it would be reliable, but would not be valid. If this thermometer sometimes over-indicated, and at other times under-indicated temperature, then it is neither reliable nor valid, would not be practical (Cooper and Emory, 1995, p. 148) and meaningful interpretation of the readings would not be possible. If the performance criterion did not measure the phenomena it purported to measure, the criterion would be an inappropriate criterion.

The absence of reliable, valid, and interpretable criteria that fail to measure what they purport to measure, confound sound and ethical research. When deficient criteria are combined with theories, models and decision rules that lack epistemological rigour, the main objective as well as specific sections of SOX will be frustrated as will the prescriptive requirements of Rule 702.

Fisherian analysis and capital budgeting

Capital budgeting forms an important part of financial management. By its very nature it involves large sums of money, allocated over long periods of time, and typically capital budgeting allocations are irreversible excepting at high cost. A variety of criteria are used to determine the financial acceptability of capital projects, such as the net present value criterion (henceforth NPV), internal rate of return criterion (henceforth IRR), and profitability index.

The cost of capital plays an important role in many financial valuations and decision, either as a discount rate as for example in the calculation of NPV, or as a yardstick in terms of which rates of return are compared, as in the case of IRR and the return on equity.

In the case of Fisherian analysis, the cost of capital is used to calculate the NPV and IRR of the mutually exclusive projects, and furthermore is used to analyse and interpret the "rate of return over costs" or "switch-point" from one project to another project, which is discussed below. The cost of capital is defined in the literature as the minimum rate of return necessary to maintain an investor's current wealth position intact (Reilly and Brown, 2006, p. 18). Accordingly, any factor that can jeopardize an investor's current wealth should be taken into account in the cost of capital. The cost of capital comprises two major and distinct components, first, a risk-free rate of return, and second, components that accommodate a diverse range of risks such as business, financial, inflation, term structure, expectations and tax risk. In other words, the second group of components are characterised by a variety of probabilities attaching to a variety of outcomes, whereas the first group is not described by means of a probability distribution, and accommodates only time preference and fully anticipated inflation (Reilly and Brown, 2006, pp. 18-20). Since the risk free rate of return and time preference are common to all investors, differences in the cost of capital must be accommodated in the second group of components, the risk premia components. A notable implication of the definition and resultant composition of the cost of capital is that projects that differ in terms of characteristics such as risk, return, size of investment, life of project, and time shape of cash flows, are unlikely to have the same or constant costs of capital. Fisherian analysis however, is based on one and the same cost of capital regardless of non-trivial differences in project characteristics and is thus misspecified and consequently an invalid criterion.

When there is a conflict in project rankings in terms of the decision rules of the NPV and IRR criteria, a non-trivial matter, Fisherian analysis (1907, pp. 150-6; 1930, pp. 155-61, 168-74) is used to resolve these conflicts in rankings. The Cambridge-UK

School of economists also devoted considerable attention to this phenomenon of conflicts in rankings and classified much of the discussion as the capital switching – reswitching controversy (Robinson, 1970; Solow, 1963; Ferguson, 1969; Samuelson, 1962, 1966; Blaug, 1983, pp. 552-7). The phenomenon of switching-reswitching describes situations where at a lower range of costs of capital, one project is preferred to another project; at an intermediate range of cost of capital an alternative project or technique is preferred; and then at a higher range of costs of capital the initial project is yet again preferred in terms of economic value. In such circumstances, management would switch from one project or technique to another project or technique, and then back to the original project or technique at the higher discount rates. Thus, the relative rankings of multiple projects in terms of economic contribution change more than once. The cost of capital at which these changes take place are switch points for they indicate when a project ranking changes from acceptable to unacceptable back to acceptable.

Fisher's intersection (Clark *et al.*, 1984, pp. 65-9, 70, 74, 87-8) is the switch point from one ranking to another ranking, is also known as the 'rate of return over costs' (henceforth ROROC), and is the incremental internal rate of return (henceforth IIRR). The existence of ROROC was identified by Fisher who then proposed it for capital budgeting purposes (Fisher, 1907, pp. 150-6; 1930, pp. 155-61, 168-74). ROROC functioning as the IIRR is an important "switch-point" when evaluating two or more mutually exclusive projects whose rankings in terms of the NPV and IRR criteria are in conflict.

Consider for example the net present value profiles of two mutually exclusive capital budgeting projects, A and B, shown in Figure 1.

Figure 1 shows that for two mutually exclusive projects, A and B, at costs of capital less than Fisher's intersection (ROROC), A is preferred to B because NPV(A) is greater than NPV(B). At Fisher's intersection (ROROC), both A and B have the same NPV in which case indifference prevails between these two projects. At costs of capital greater than Fisher's intersection (ROROC), project B is preferred to A because NPV(B) is greater than NPV(A). The cost of capital that reduces NPV to zero is the project's IRR. Since IRR(B) is greater than IRR(A), in terms of the IRR criterion B is preferred to A. To resolve the question of which project to select, an incremental analysis is performed in terms of which a hypothetical project "A-B" is created by subtracting the net cash flow of B from A. The IRR of this hypothetical project "A-B" is defined as ROROC, and is the IIRR.

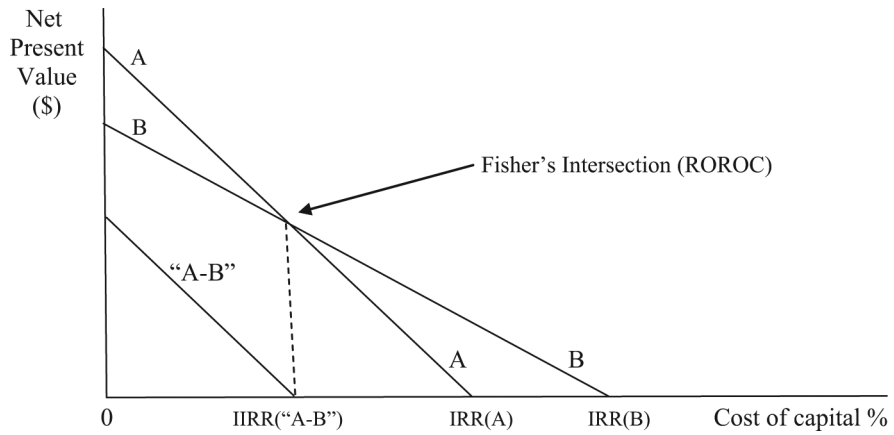

Figure 1.
Fisher's intersection

Fisher's decision rule

The decision- rule for project selection under circumstances where a difference in rankings occurs in terms of the NPV and IRR criteria, states that for project A to be acceptable the IIRR of the hypothetical project "A-B", which is the difference between A and B, must exceed the cost of capital of A, which throughout the literature is shown to also be the cost of capital of B. Thus, this decision rule says that the IIRR must exceed the costs of capital of both A and B. If this is not the case, then project A is rejected because the IIRR of the hypothetical project "A-B" is less than the cost of capital of A and B.

Epistemological problem

An epistemological problem arises in circumstances where projects A and B, or in fact any number of projects with convoluted rankings in terms of NPV and IRR criteria, do not have the same cost of capital in terms of numerical value. Fisher's approach is based on constant costs of capital across all projects regardless of differences in their characteristics or risks. This is a serious and non-trivial deficiency, given the circumstances for which Fisherian analysis is prescribed, namely mutually exclusive projects with substantial differences in characteristics and risks, as revealed in Tables I-III, and, as a consequence operationally notable differences in the costs of capital.

Mutually exclusive projects in essence refer to the selection of either one or another project where there is some common resource, for example the use of a piece of land for either an office block or multi-level parking garage. In terms of NPV the office block may be preferred to the multi-level parking garage, but in terms of the IRR the multi-level parking garage may be preferred to the office block. If the projects are not mutually exclusive, this type of ranking problem does not arise.

The literature on the topic of conflicts in rankings of mutually exclusive projects identifies circumstances where such conflicts can arise, for example, where there are:

- differences in the magnitude of initial investment;
- disparities in the timing of cash flows;
- differences in the lives of projects;

Author	Initial investment Project A $	Initial investment Project B $	Size differential
Clark *et al.* (1984, p. 87)	180,000	240,000	1.33
Brigham and Gapenski (1990, p. 275-6)	1,000,000	5,000,000	5.0
Bierman and Smidt (1993, pp. 90-1)	10,000	15,000	1.5
Levy and Sarnat (1994, p. 69)	100	1,500	15.0
Seitz and Ellison (1995)	10,000	20,000	2.0
Seitz and Ellison (1995, pp. 184-6)	500	1,500	3.0
Van Horne (2002)	300	500	1.67
Van Horne (2002, p. 144)	100	500	5.0
Keown *et al.* (2005, p. 347)	200	1,500	7.5
Ross *et al.* (2005, p. 159)	1	10	10.0
Berk *et al.* (2009, p. 217)	200,000	500,000	2.5

Table I.
Examples of differences in magnitude of initial investment from the literature

	Cash flow Project A				Cash flow Project B			
	Yr1	Yr2	Yr3	Yr4	Yr1	Yr2	Yr3	Yr4
Clark *et al.* (1984, p. 67)	0	40,000	0	0	20,000	10,000	0	0
Brigham and Gapenski (1990, p. 178)	0	4,046	0	0	1,280	0	0	0
Levy and Sarnat (1994)	20	120	0	0	100	31.25	0	0
Levy and Sarnat (1994, p. 69)	20	120	0	0	100	31.25	0	0
Seitz and Ellison (1995)								
Van Horne (2002)	750	500	0	0	350	350	350	350
Van Horne (2002, p. 144)	10,000	10,000	10,000	10,000	0	5,000	10,000	32,675
Keown *et al.* (2005, p. 348)		100	200	2,000	650	650	650	0
Ross *et al.* (2005, p. 159)	10,000	1,000	1,000	0	1,000	1,000	12,000	0
Berk *et al.* (2009, p. 217)	40,000	0	0	0	75,000	0	0	0

Table II.
Examples of differences in the timing of cash flows from the literature

- the matter of the reinvestment rate (Clark *et al.*, 1984, p. 89; Herbst, 1982, p. 95; Kroncke *et al.*, 1978, pp. 200-5; Levy and Sarnat, 1994, pp. 64-6); and,
- computational difficulties in the calculation of the IRR, such as multiple roots and no unique roots (Levy and Sarnat, 1994, pp. 81-5).

In these circumstances, the literature recommends a Fisherian analysis be undertaken to resolve conflicts in project rankings. The matter of the reinvestment rate as well as situations where computational difficulties can arise with the IRR will not be considered in this article, however, the other circumstances as enunciated in the literature will be considered.

(i) Differences in the magnitude of initial investment

According to the literature a conflict in the rankings of mutually exclusive projects in terms of the NPV and IRR criteria may arise as a result of differences in initial investment (for example, Clark *et al.*, 1984, pp. 69, 71-2; Brigham and Gapenski, 1990, pp. 275-6; Bierman and Smidt, 1993, pp. 89-90, 189; Levy and Sarnat, 1994, p. 69; Brealey *et al.*, 1995, p. 147; Seitz and Ellison, 1995, pp. 184-6; Bierman and Smidt, 1993, pp. 89-90, 189; Damodaran, 2001, pp. 352-8; Van Horne, 2002, pp. 144-5; Keown *et al.*, 2005, pp. 346-50; Ross *et al.*, 2005, p. 159; Berk *et al.*, 2009, p. 217). In Table I the illustrative examples provided by the aforementioned authors are presented.

From Table I it is apparent that the differences in the scale of the initial investments of the competing projects used for illustrative purposes in the literature are substantial, ranging from 1.33 to 15 times. If size matters as a characteristic, as it surely must, differences in the scale of the initial investment may be indicative of different types and levels of risk both with regard to the investment, its financing, and impact on a firm's liquidity and solvency. These differences in risk will have an impact on the cost of capital of projects with such notable differences in initial investment. Where such notable differences in the magnitude of initial investment exist, how legitimate is it to make a comparison among the "unequals" on valuations based on one and the same cost of capital ? If firms were to implement the larger of the projects show in Table I, and if these larger projects were to fail, would the implications for the firm be the same had the smaller project been implemented and also failed ? How would the financing in terms of equity, debt and derivatives of the larger projects differ from the financing of the smaller projects, and would the impact be on earnings per share, dividends per share, and return on shareholders' funds ? In the event of substantial amounts of debt finance being used, it is inconceivable that the same restrictive and standard loan covenants would apply when the scale of investment exhibited such notable differences.

Table III.
Examples of differences in the lives of projects from the literature

Author	Life of Project A (years)	Life of Project B (years)	Increase in life (%)
Clark *et al.* (1984, p. 94)	2	4	100
Levy and Sarnat (1994, p. 74)	1	4	400
Seitz and Ellison (1995)	1	A perpetuity	Infinite
Seitz and Ellison (1995, pp. 189-90)	2	4	100
Damodaran (2001, pp. 357-9)	5	10	100
Keown *et al.* (2005, p. 349)	3	6	100
Berk *et al.* (2009, pp. 224-5)	2	3	50

As a result of the differences in the initial investment and consequent impact on risk and hence cost of capital, it is extremely unlikely that the same cost of capital, in the sense of compositional structure and numerical value, can be legitimately used to value the smaller and larger mutually exclusive projects. Once the issues cited receive recognition, the validity of one and the same cost of capital for all mutually exclusive projects is brought into question. This in turn reveals a fundamental flaw in Fisherian analysis.

(ii) Disparities in the timing of cash flows

Another reason proposed in the literature of capital budgeting for a conflict in the rankings of mutually exclusive projects is that of disparities in the timing of cash flows (for example, Clark *et al.*, 1984, pp. 69, 71-2; Brigham and Gapenski, 1990, pp. 275-6; Bierman and Smidt, 1993, pp. 89-90, 189; Levy and Sarnat, 1994, p. 69; Brealey *et al.*, 1995, p. 147; Seitz and Ellison, 1995, pp. 184-6; Bierman and Smidt, 1993, pp. 89-90, 189; Damodaran, 2001, pp. 352-8; Van Horne, 2002, pp. 144-5; Keown *et al.*, 2005, pp. 346-50; Ross *et al.*, 2005, p. 159; Berk *et al.*, 2009, p. 217). In Table II the illustrative examples provided by the aforementioned authors are presented.

From Table II it is apparent that the differences in the timing and size of the cash flows are not trivial, and have a notable impact on the time value of the projects being evaluated. The differences in time value mean that there are differences in the type and magnitude of risks, and will have a bearing on firms' cash and treasury management. Regardless of these differences in risks, which surely are indicative of these projects having different costs of capital, in the literature such projects are discounted at the same cost of capital to calculate NPV and screen IRR (Clark *et al.*, 1984, p. 67; Brigham and Gapenski, 1990, p. 178; Bierman and Smidt, 1993, pp. 90-1; Levy and Sarnat, 1994, p. 69; Brealey *et al.*, 1995, p.147; Seitz and Ellison, 1995, pp. 184-6; Van Horne, 2002, p. 144; Keown *et al.*, 2005, p. 348; Ross *et al.*, 2005, p. 159; Berk *et al.*, 2009, p. 217). Some of the examples cited by the aforementioned authors have accelerating cash flows, for example Van Horne's project B, Keown *et al.*'s, project A, Levy and Sarnat's project A; other have decelerating cash flows, for example Clark *et al.*', project B, Levy's project B, Berk *et al.*, project B; and other projects have cash flow annuities, for example Keown *et al.*, project B, Seitz and Ellison project B.

Accelerating and decelerating cash flows constitute an import characteristic form a portfolio perspective, especially where the rates of change in acceleration or decelerating are substantial. Since money has time value, then even if all the characteristics of projects A and B are the same excepting for the disparities in the timing and size of the cash flows, how reasonable is it to discount these competing projects at the same cost of capital ? Capital market conditions change form year to year, as do interest rates and risk premia as evidence by the fluidity of the term structure of interest rate curve and yield spread differentials. Periods of an abundance of credit give way to periods of tight credit, and yield spreads are hardly stable. The credit crunch in global financial markets since July 2007 provides testimony in support of this line of argument that the cost of capital can be independent of the timing and size of cash flows and can be a constant numerical quantum. If the projects A and B whose cash flows are shown in Table II were presented to a financial institution for funding, it is implausible that the cost of funding could reasonably be the same with the same standard and restrictive loan covenants in the case of debt, or at the same prospective yields in the case of equity. In the event of the first and second years being recessionary, and the third and fourth years being expansionary, how reasonable would it be to use the same cost of capital for all four years, let alone using the same

cost of capital for all pairs of projects A and B ? Yet, Fisherian analysis prescribes using the same cost of capital regardless of the timing of the cash flows.

(iii) Differences in the lives of projects

The literature asserts that differences in the project lives can be the cause of conflicts in the rankings of mutually exclusive projects (for example, Clark *et al.*, 1984, pp. 69, 71-2; Brigham and Gapenski, 1990, pp. 275-6; Bierman and Smidt, 1993, pp. 89-90, 189; Levy and Sarnat, 1994, p. 69; Brealey *et al.*, 1995, p. 147; Seitz and Ellison, 1995, p. 184-6; Bierman and Smidt, 1993, pp. 89-90, 189; Damodaran, 2001, pp. 352-8; Van Horne, 2002, pp.144-5; Keown *et al.*, 2005, pp. 346-50; Ross *et al.*, 2005, p. 159; Berk *et al.*, 2009, p. 217). In Table III the illustrative examples provided by these authors are presented.

The differences in lives of projects are used by prominent authors to illustrate where Fisherian analysis should be used to resolve ranking conflicts of mutually exclusive projects vary from an increase of 50 per cent to infinity. It does not requires much of an imagination to appreciate that these differences are rather substantial, and border on an appeal to sophistry to persuade analysts of the necessity of Fisherian analysis, with the same cost of capital being used irrespective of these differences in project life. Financial theory makes use of the term structure of interest rates (Reilly and Brown, 2006, pp. 699, 711-15) to explain why rates of return differ for assets of different life durations. Conceptually the term structure of interest rates is not a recent device, and was discussed by Sir William Petty in the seventeenth century in *A Treatise of Taxes and Contributions* (cited and discussed in Cassel, 1903, p. 12). To a notable extent, the differences in rates of return for assets of different life durations can be attributed to the differences in risk which attach *inter alia* to cyclical behaviour (Polakoff and Durkin, 1981, p. 519), expectations (Van Horne, 1978, p. 116; Tinic and West, 1979, p. 342), and the call option (Copeland and Weston, 1988, pp. 232, 236). The difference in risk type and risk level for projects with different lives means that the cost of capital for each of these projects under consideration cannot remain the same. To argue otherwise would be to reject the concept of term structure of interest rates, and yet this is in effect what Fisherian analysis does. In so doing, Fisherian analysis describes circumstances that perhaps would be descriptive only in the land of Cockaigne.

Implications of using the invalid and misspecified fisherian criterion

The prime function of the cost of capital is to provide guidance in the acquisition and allocation of financial resources, and is thus a yardstick in terms of which capital investments are evaluated. If this yardstick is misspecified, such as with Fisherian analysis, the outcome will be incorrect valuations and misallocations of financial resources because incorrect choices will have been made. Where project characteristics are patently different, there must surely be implications for project risk, in which event the cost of capital must reflect such risks. To discount mutually exclusive projects that display different characteristics at the same cost of capital is tantamount to a rejection of the definition of the cost of capital, and in so doing financial managers are deprived of a pivotal criterion when undertaking valuations.

The nature of Fisherian analysis and its decision rule can hardly be described as valid or epistemologically rigorous, or capable of meaningful operationalisation, for it is based on an intellectual misconception, namely that of constant costs of capital across substantially dis-similar projects. As a model, it is misspecified, and therefore wrong. The process of Fisherian analysis prostrates the composition and function of

the cost of capital by imposing the rigor mortis of constant costs. To the extent that Fisherian analysis itself cannot satisfy the requirements of Rule 702, and moreover severely dislocates a valid, reliable and interpretable criterion, namely the cost of capital, its legitimacy for management in the era of SOX is suspect. In short, Fisherian analysis in its current form does not contribute to the resolution of the problems of valuation and choice, and therefore does not accomplish what it purports to accomplish. It does not achieve its objective function, is thus construct deficient, and as a consequence does not satisfy the requirements of sound research methodology with regard to performance metrics.

The illustrations presented in the literature, shown in Tables I-III, reveal the extreme differences in the competing projects. Illustrations based on sophistry can be a "popular" way of making a case, but they are unscientific, serve little academic or operational use, and are hardly likely to satisfy Rule 702 or SOX. Management that utilises invalid and unreliable valuation criteria not only endanger the financial wellbeing of corporations, but also expose themselves unnecessarily to risks of not complying with legal requirements. In this regard, infringements of SOX Section 807 §1348, that carries large fines and extensive periods of imprisonment, ought not to be ignored by management. The judiciary does not condone less than complete practice by those possessed of expert knowledge and skills, education, or seniority in corporate hierarchies, especially when the issues are clear cut.

References

Berk, J., DeMarzo, P. and Harford, J. (2009), *Fundamentals of Corporate Finance*, Pearson, Boston, MA.

Bierman, H. and Smidt, S. (1993), *The Capital Budgeting Decision*, 8th ed., Macmillan, New York, NY.

Blaug, M. (1983), *Economic Theory in Retrospect*, 3rd ed., Cambridge University Press, Cambridge.

Brealey, R.A., Myers, S.C. and Marcus, A.J. (1995), *Fundamentals of Corporate Finance*, McGraw-Hill, New York, NY.

Brigham, E.F. and Gapenski, L.C. (1990), *Intermediate Financial Management*, 3rd ed., Dryden, Chicago, IL.

Cassel, G. (1903), *The Nature and Necessity of Interest*, Macmillan, London.

Cavana, R.Y., Delahaye, B.L. and Sekaran, U. (2000), *Applied Business Research*, John Wiley, Milton.

Clark, J.J., Hindeland, T.J. and Pritchard, R.E. (1984), *Capital Budgeting*, Prentice Hall, Englewood Cliffs, NJ.

Cooper, D.R. and Emory, C.W. (1995), *Business Research Methods*, 5th ed., Irwin, Chicago, IL.

Copeland, T.E. and Weston, J.F. (1988), *Financial Theory and Corporate Policy*, 3rd ed., Addison Wesley, Reading, MA.

Damodaran, A. (2001), *Corporate Finance: Theory and Practice*, 2nd ed., John Wiley, New York, NY.

Davis, D. (1996), *Business Research for Decision Making*, 4th ed., Duxbury, Belmont, CA.

Ferguson, C.E. (1969), *The Neoclassical Theory of Production and Distribution*, Cambridge University Press, Cambridge.

Fisher, I. (1907), *The Rate of Interest*, Macmillan, New York, NY.

Fisher, I. (1930), *The Theory of Interest*, Kelley and Millman, New York, NY.

Ghauri, P., Gronhaug, K. and Kristianslund, I. (1995), *Research Methods in Business Studies*, Prentice Hall, New York, NY.

Herbst, A.F. (1982), *Capital Budgeting*, Harper Row, New York, NY.

Jevons, W.J. (1970) in Black, R.D.C. (Ed.), *The Theory of Political Economy*, Penguin, New York, NY (originally published in 1871).

Keown, A.J., Martin, J.D., Petty, W.J. and Scott, D.F. (2005), *Financial Management: Principles and Applications*, 10th ed., Pearson Prentice Hall, Englewood Cliffs, NJ.

Kroncke, C.O., Nemmers, E.E. and Grunewald, A.E. (1978), *Managerial Finance: Essentials*, 2nd ed., West, New York, NY.

Levy, H. and Sarnat, M. (1994), *Capital Investment and Financial Decisions*, 5th ed., Prentice Hall, New York, NY.

Polakoff, M.E. and Durkin, T.A. (1981), *Financial Institutions and Markets*, 2nd ed., Houghton Mifflin, Boston, MA.

Reilly, F.K. and Brown, K.C. (2006), *Investment Analysis and Portfolio Management*, 8th ed., Thompson South Western.

Robinson, J. (1970), "Capital theory up to date", *Canadian Journal of Economics*, Vol. 33 No. 3, pp. 309-17.

Ross, S.A., Westerfield, R.W. and Jaffe, J. (2005), *Corporate Finance*, McGraw-Hill, Boston, MA.

Samuelson, P.A. (1962), "Parable and realism in capital theory: the surrogate production function", *Review of Economic Studies*, Vol. 29 No. 1, pp. 193-206.

Samuelson, P.A. (1966), "'A summing up', in 'Paradoxes of Capital Theory: A Symposium'", *Quarterly Journal of Economics*, Vol. 80 No. 4, pp. 568-83.

Seitz, N. and Ellison, M. (1995), *Capital Budgeting and Long-Term Financing Decisions*, 2nd ed., Dryden, Fort Worth, TX.

Sekaran, U. (2000), *Research Methods for Business*, 3rd ed., John Wiley, New York, NY.

Solow, R.M. (1963), *Capital Theory and the Rate of Return*, North-Holland, London.

Tinic, S.M. and West, R.R. (1979), *Investing in Securities: An Efficient Markets Approach*, Addison Wesley, Reading, MA.

Van Horne, J.C. (2002), *Financial Management and Policy*, 12th ed., Prentice Hall, Englewood Cliffs, NJ.

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