TECHNICAL NOTE

The Weighted Average Cost of Capital: A Caveat

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INTRODUCTION

The debate between the proponents of the weighted average cost of capital (henceforth WACCists) and the proponents of sequential marginal costing (henceforth sequentialists) is one of the most fundamental debates in engineering economy. This debate is unresolved and would seem to be the subject of an academic truce. The purpose of this paper is to show that the WACC is subject to serious reservations if used as a capital budgeting discount rate. The determination of the discount rate for capital budgeting must be consistent with the principles underlying the determination of the net cash flows of capital projects.

THE WEIGHTED AVERAGE COST OF CAPITAL

The WACCists argue that the firm should be viewed as an ongoing concern, and the discount rate should be calculated as a weighted average of the various types of finance it uses, regardless of the specific financing used to fund a particular capital project (Brigham 1985: 250), (Weston & Copeland 1986: 612), (Ben-Horim 1987: 144-146), (Van Horne 1980: 234), (Levy & Sarnat 1982: 408-409). WACCists assert that even though a specific source of finance with a known cost is used to fund a project, this cost of capital should not be used as the discount rate. They argue that the use of one source of finance affects the firm's ability to raise the same type of finance as well as other types of finance in terms of cost and risk, and that this effect, a "spill-over" effect, also occurs from the past to the present, and from the present to the future (Brigham, 1985: 250).

The weighted average cost of capital is calculated (Gitman 1988: 400):

$$WACC = \sum \Omega\mu, \text{ where}$$

Ω = percent of the total capital structure supplied by each source of finance;

μ = the cost of capital of each source of finance reflected on the firm's balance sheet.

Weighting, by its very nature, cannot be discussed without reference to financial structure, the individual finance components, and investor utility functions for risk and return. The importance of the inter-relationships between these issues was recognized in the first presentation of the WACC concept by Dean ((a) 1951: 44-48; (b) 1951: 574-575). Evidence of these inter-relationships to the implementation of a WACC concept is available from as early as 1927 (Solodofsky & Olive 1974: 152). Although a variety of weighting systems are available, such as book, historic, market, and target values, there is general consensus among WACCists that the WACC should be based on market values and target financial structure weights. This system finds much favour in the financial literature (Brigham & Gapenski 1985: 256), (Gitman 1988: 463), (Hunt, Williams & Donaldson 1971: 192-193), and it has some empirical support (Gitman & Mercurio 1981: 23).

Thus, according to WACCists, the capital budgeting discount rate is the WACC based on market values of all sources of finance (Lambrechts, Reynders & Scheurkogel 1986: 299).

The net cash flow for purposes of capital budgeting subscribes to four fundamental principles. Apart from conflicting with these principles, there are other reasons which bring into question the validity of the WACC as a discount rate.

Firstly, only marginal revenues and marginal costs are relevant to the determination of the net cash flow, consequently, average, fixed, sunk, historic, pro-rata, as well as overhead costs and revenues are ignored. Therefore, an approach to the determination of the discount rate which depends on weighted averaging of all the firm's sources of finance is in conflict with this first principle.

Secondly, finance charges do not feature in the computation of the net cash flow since they are taken into account in the discount rate. The discount rates of the firm's other projects, which reflect historic investment and financing decisions and which influence the WACC, play no role in the determination of the discount rate of the specific project under consideration. The discount rate relevant to the project under consideration is a concept based on an ex-ante evaluation of the merits of the project and the current situation in money and capital markets.

Thirdly, working capital which is needed to support the optimal level of functioning of fixed assets, frequently needs to be increased when a capital project is implemented. The item working capital features as an outflow in the period in which it occurs, and features as an inflow at the end of the life of the project since that original investment is no longer needed to support the fixed assets of the project. Thus, working capital, as a cash inflow

item at the end of the life of the project is discounted to the present so as to enable both the calculation of NPV and IRR. Working capital is discounted at the project's required rate of return and not the firm's WACC. Use of the WACC would lead to an incorrect valuation because factors specific to other projects and not necessarily relevant to the project under consideration would influence the discount rate.

Fourthly, WACCists have called for the exclusion of depreciation, a major source of internal equity finance, from the WACC (Weston & Copeland, 1986: 605).

Just as these principles are highly relevant to the calculation of the project's cash flows, so too are they highly relevant to the determination of the project's discount rate. To apply, at some effort, principles of marginalism, and, embody ex-ante concepts into the cash flows which form the numerator of the net present value and internal rate of return algorithms without applying them to the denominator of these algorithms, jeopardizes the rationality and logic which underlies financial valuations. This is tantamount to the intentional intro-duction of financial inconsistency into the valuation process, for marginalism is then negated by averaging, historicism, and fixed cost ex-post statism. What in essence is an ex-ante valuation is severely constrained by an ex-post anchor whose very nature conflicts with the principles of capital budgeting. Moreover, WACCists are unsure as to whether or not the cost of current liabilities, which invariably form part of the firm's permanent financing, should form part of the weighted average cost of capital.

Further, from a portfolio point of view, the WACC is not acceptable because each security has a specific internal rate of return and a specific required rate of return, and averaging is inadmissible. Assets in the form of projects or securities, as plotted on the security market line, do not have a WACC as the required rate of return. When portfolios are constructed, individual components are not evaluated according to the WACC.

There is yet another acid-text for the WACC as the discount rate. If projects are risky, and a certainty equivalent approach or risk adjusted discount rate approach is used for valuation purposes, questions related to the use of the WACC arise. For example, in the case of the certainty equivalent approach, the project's cash flow is discounted at the default free rate of return, which is not the WACC, and the certainty equivalents themselves are not a weighted average of all the firm's projects. At no stage in the evaluation is the WACC used to compare or interpret the analysis of the project.

In the case of the risk adjusted discount rate approach, the projects' cash flows are discounted at a rate which include elements for risk specific to the project. Again, the

WACC is not used. Where no risk attaches to the projects, the discount rate is the risk free rate and not the WACC.

Serious reservations exist regarding the validity of valuations performed on the basis of the WACC.

SEQUENTIAL MARGINAL COSTING

The sequential marginal costing approach to the capital budgeting discount rate was originated by Solomon (1963: 88), and refined by Lindsay and Sametz (1968: 324-329, 340-342). Lindsay and Sametz are of the opinion that the WACC is an unacceptable approach to the discount rate for capital budgeting because it rests on the assumption that each project is financed by additional increments raised from a pool of funds comprising the various components. They argue that in practice funds are not raised from a pool of the various capital components, rather, finance is raised from specific sources because capital investment is a discontinuous process which recognizes that the property of infinite divisibility does not apply. As a result, financing is more likely to take place in large chunks of a specific component and not in marginal increments of the weighted pool of all the components. This is particularly the case with long term sources of finance which are either raised in totality as an economic order quantity, or are not raised at all.

This line of argument enables Lindsay and Sametz to query the validity of "averaging" (Lindsay & Sametz 1968: 341), and the aggregated marginalism of the weighted average cost of capital (Weston & Brigham 1969: 348).

Based on the assumption that low cost finance, say debt, is followed by higher cost finance, say equity, Lindsay and Sametz (1968: 324-329, 340-342) propose that the marginal cost curve for finance should take the form of a sequential marginal cost curve of the various capital components. Projects are then screened individually, qualifying for approval when the marginal return exceeds the marginal cost of the finance component used.

The sequential marginal costing approach has been criticized by WACCists (Brigham & Gapenski 1985: 250). As already mentioned, WACCists argue that financing needs to be considered as a whole because of "spill-over" effects. However, sequentialism does not conflict with the principles underlying the determination of the net cash flow and more accurately describes the process of raising project finance.

CONCLUSION

WACCists have skillfully argued their cause. Sequentialists have not responded appropriately, but have retreated behind the argument of "financial process." An appropriate response should include the fact that, unlike WACCism which conflicts with the principles of capital budgeting, sequentialism does not conflict with these principles, especially that of ex-ante marginalism. Consequently, a discount rate based on sequential marginal costing will provide superior valuations to those based on the WACC.

REFERENCES

1. Ben-Horim, M., (1987), *Essentials of Corporate Finance*, Allyn and Bacon, Boston.

2. Brigham, E.F., (1985),*Financial Management: Theory and Practice*, 4 ed., Dryden, Chicago.

3. Brigham, E.F. and Gapenski, L.C., (1985), *Intermediate Financial Management*, Dryden, Chicago.

4. Dean, J., (1951), (a) *Capital Budgeting*, Columbia Universtiy Press, New York. (1951), (b) *Managerial Economics*, Prentice Hall, New York.

5. Gitman, L.J., (1988, *Principles of Managerial Finance*, 5 4d., Harper and Row, New York.

6. Gitman, L.J. and Mercurio, V.A., "Cost of Capital Techniques Used By Major U.S. Firms: Survey and Analysis for Fortune's 1000", *Financial Management*, Vol. 11, No. 2.

7. Hunt, P., Williams, C.M., and Donaldson, G., (1971), *Basic Business Finance*, 4 ed., Irwin, Homewood.

8. Lambrechts, I.J., Reynders, J.J.J. and Scheurkogel, A.E., (1986), *Die Ivesteringsbesluit*, Haum, Pretoria.

9. Levy, H. and Sarnat, M., (1982), *Capital Investment and Financial Decisions*, 2 ed., Prentice Hall, Englewood, Cliffs.

10. Lindsay, R.L. and Sametz, A.W., (1968), *Financial Management: An Analytical Approach*, Irwin, Homewood.

11. Solodofsky, R.M. and Olive, G.D., (1974), *Financial Management*, South Western, Cincinnati.

12. Solomon, E., (1963), *The Theory of Financial Management*, Columbia University Press, New York.

13. Van Horne, J.C. (1980), *Financial Management and Policy*, 7 ed., Prentice Hall, Englewood Cliffs.

14. Weston, J.F. and Brigham, E.F., (1969), *Managerial Finance*, 3 ed., Holt Rinehart, Hinsdale.

15. Weston, J.F. and Copelane, T.E., (1986), *Managerial Finance*, 8 ed., Dryden, Chicago.

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