The Engineering Economist

A Journal Devoted to the Problems of Capital Investment

ISSN: 0013-791X (Print) 1547-2701 (Online) Journal homepage: https://www.tandfonline.com/loi/utee20

Investment decisions and the logic of valuation. Linking finance, accounting, and engineering

by Carlo Alberto Magni, Cham, Switzerland, Springer Nature, 2020, 738 pp., $74.99 ISBN 978-3-030-26775-9 (hardback), $59.99 ISBN 978-3-030-27662-1 (eBook)

Joseph C. Hartman

To cite this article: Joseph C. Hartman (2020) Investment decisions and the logic of valuation. Linking finance, accounting, and engineering, The Engineering Economist, 65:3, 259-261, DOI: 10.1080/0013791X.2020.1784515

To link to this article: https://doi.org/10.1080/0013791X.2020.1784515

Published online: 25 Jun 2020.

THE ENGINEERING ECONOMIST
2020, VOL. 65, NO. 3, 259–261

Taylor & Francis
Taylor & Francis Group

BOOK REVIEW

Investment decisions and the logic of valuation. Linking finance, accounting, and engineering, by Carlo Alberto Magni, Cham, Switzerland, Springer Nature, 2020, 738 pp., $74.99 ISBN 978-3-030-26775-9 (hardback), $59.99 ISBN 978-3-030-27662-1 (eBook)

There are many textbooks that service the Engineering Economy field, with *Investment Decisions and the Logic of Valuation: Linking Finance, Accounting and Engineering*, by Carlo Alberto Magni of the University of Modena and Reggio Emilia in Italy, being a new entry to this list. This book would not be considered a "traditional" engineering economics text – there is no derivation of interest factors, development of cash flow diagrams, presentation of spreadsheet functions, or listing of interest rate tables. Rather, it builds upon the significant research in valuation by the author and builds a methodology for investment decisions. To summarize this text, we borrow directly from the author in Chapter 6: "We take market input data as given: This book aims at explaining how to reach rational and consistent valuations and decisions whatever the perspective adopted and whatever the input data."

Refreshingly, this text lays a foundation grounded in engineering and physics principles. Part I defines the mechanics of an engineering system, in accounting and financing terminology. Specifically, laws of conservation and motion are defined for economic activity. The law of conservation merely states that there is balance in economic activity. That is, capital invested is equal to capital raised; income generated is equal to income accrued; cash flow contributed to an economic activity is equal to cash flow contributed to the capital providers; and rate of return generated from capital is equal to rate of return accrued by the capital providers. The law of motion for an economic activity merely states that the capital position in one period is equal to the capital position from the previous period plus income generated minus any cash flow paid out, where income and cash flow can be positive or negative. These laws are referenced throughout the book when performing cash flow analysis.

Part II of the text presents Magni's method for performing analysis using "The Matrix." The matrix, which can be displayed in a spreadsheet, is defined by quadrants: operating assets, non-operating assets, debt and equity. Each quadrant can be further delineated in greater detail, resulting in an expanded matrix. The clever design, though, is that the quadrants are separated by "bars" which mathematically represent equality signs such that rows in the left quadrants sum to rows in the right quadrants, representing the motion laws, while columns in the top quadrants sum to columns in the bottom quadrants, representing the conservation laws. The matrix is then utilized in subsequent chapters for analysis, but it is in this section where the quadrants are tied to the balance sheet, income statement and cash flow statement from traditional accounting.

The remaining two parts of the textbook are devoted to valuation and project selection, with Part III dedicated to absolute measures such as net present value (NPV) and Part IV dedicated to relative measures, such as internal rate of return (IRR). Those that are familiar with Magni's research are well aware that he has written numerous papers to eliminate inconsistencies with the application of IRR to project analysis while also proving its equivalence to NPV. Perhaps with a bit of humor, he proposes an "alliance" of these measures of worth, stating "there is no point of choosing between NPV and a rate of return if you can compute both and harmonize them into a comprehensive, consistent approach."

Chapter 6 (Part III) starts the reader on a path of learning different evaluation techniques according to the three classifications of describing a project: (1) cash flow; (2) income; and (3) capital, clearly illustrating Magni's attention to detail. The cash flow method is tied to

the NPV criterion for decision-making; the income method is tied to the residual income (RI) criterion; and the capital method is tied to the net future value (NFV) criterion.

For the (1) cash flow approach, no less than 12 methods for project evaluation are presented using discounted cash flows analysis. These include five approaches for unlevered projects (i.e., no explicit financing provided to the project such that there are no explicit debt payments in the project definition and every cash flow generated by the project is distributed to investors and not retained as a liquid asset), including three approaches using the weighted-average-cost-of-capital (WACC), two using "adjusted" present value, and seven approaches for levered projects, including two analyzing capital cash flows, two analyzing cash flow to equity, two analyzing free cash flow to equity and one analyzing cash flow from assets. But Magni notes that he has presented a unified paradigm, in that "if the set of assumptions is the same, any one scheme provides correct values and rational recommendations for decision-making. This means that the choice of a valuation scheme is a practical issue, not a theoretical one." This issue is generally predicated on the information at hand and assumptions to be made, generally with regards to financing and the cost of capital.

For the (2) income approach, Magni illustrates the equivalency (i.e., economic rationality) of using residual income, often referred to as excess profit, in analysis. For the (3) capital approach, the concepts of value added and NFV are introduced. While most texts define NFV as merely a mathematically equivalent value of NPV at the end of the horizon, Magni illustrates that the "NFV measures the difference between the terminal capital of the project system and the terminal capital of the benchmark system," thus denoting the "value added" of the project system (if positive).

This last statement reiterates Magni's analysis framework for all of these valuation methods: a project matrix, representing the results of an investment, and a benchmark matrix, illustrating the status quo, are defined and the difference between these two systems defines whether the project creates value. The matrix provides a visualization of this analysis and the economic difference.

Chapter 7 opens with a discussion on the preference of relative measures of worth in analysis, and by practitioners, in that they provide a measure of efficiency and the return per unit of capital investment, which is information that cannot be gleaned from NPV analysis. That said, Magni does note that a relative measure of worth is not perfect, as it does not provide a measure, or amount, of value created or destroyed. This discussion leads the reader to Chapter 8 where, in my opinion, an elegant description and derivation of rate of return is presented. Precisely, the rate of return is defined as the ratio of total return to total capital. This is clearly illustrated for a one period problem and then generalized to multiple period problems.

After introducing the notion of a Chisini mean (if a function of n inputs returns the same value as the function of n mean values, the mean is a Chisini mean, and arithmetic, geometric, harmonic and power means are all special cases of the Chisini mean), Magni introduces the Average Internal Rate of Return (AIRR), which has been the subject of his prior research. The AIRR is actually a class of rates with the "traditional" internal rate of return being a special case of the AIRR. However, the AIRR can be computed straightforwardly with mixed investments, and, most importantly, its related decision criterion is consistent with NPV. Furthermore, four equivalent approaches are provided to compute the AIRR, using (1) total return over total capital invested; (2) weighted income rates; (3) a converted instantaneous return; or (4) cash flows. The work is further generalized to include time-varying costs of capital and mixed investments. Chapter 9 looks more closely at the classical internal rate of return and its traditional pitfalls which lead to its inconsistencies as a decision criterion. Chapter 10 closes the discussion on relative measures of worth by

clearly aligning AIRR with RI; defining the Internal Average Rate of Return (IARR) and aligning it with NPV; and finally defining the Aggregate Return on Investment and aligning it with NFV. Thus, consistent absolute and relative measures of worth are categorized with cash flow, income, or capital analyses. More importantly, absolute and relative measures of evaluation are completely reconciled. Chapters 11 and 12 provide deeper examples with the developed methods.

As this summary illustrates, this textbook is much more focused than traditional engineering economy texts. Specifically, it builds a project through the estimation of cash flows and provides an extremely thorough analysis of that project through both absolute and relative measures, depending on different assumptions of financing and available data. Its contribution to the literature is significant, as it unifies previously disparate views on project analysis with regards to absolute and relative worth analysis.

There is a "cost" to this detail, in that the text does not delve deeply into topics that are generally found in many engineering economy textbooks, such as dealing with multiple projects (Chapter 11 does address project ranking with both absolute and relative measures), capital rationing, and replacement analysis. However, any advanced course that deals with project selection and the controversy between absolute and relative measures must employ this text, as it puts the controversy between these methods to rest. The text does a marvelous job at not only developing the integrated theory, but explaining its relevance in decision-making, making the text more accessible than the underlying research literature. This contribution to the literature – namely reconciling the use of absolute and relative measures of worth in an accessible manner – cannot be understated.

Joseph C. Hartman
University of Massachusetts Lowell
Joseph_Hartman@uml.edu

https://doi.org/10.1080/0013791X.2020.1784515