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Decision Support

Investment, financing and the role of ROA and WACC in value creation

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ABSTRACT

Evaluating an industrial opportunity often means to engage in financial modeling which results in estimation of a large amount of economic and accounting data, which are then gathered in an economically rational framework: the pro forma financial statements. While the standard net present value (NPV) condenses all the available pieces of information into a single metric, we make full use of the crucial information supplied in the pro forma financial statements and give a more detailed account of how economic value is created. In particular, we construct a general model, allowing for varying interest rates, which decomposes the project into investment side and financing side and quantifies the value created by either side; an equity/debt decomposition is also accomplished, which enables to appreciate the role of debt in adding or subtracting value to equityholders. Further, the major role of accounting rates of return as value drivers is highlighted, and new relative measures of worth are introduced: the project ROA and the project WACC, which aggregate information deriving from the period rates of return. To achieve these results, we make use of the Average-Internal-Rate-of-Return (AIRR) approach, recently introduced, which rests on capital-weighted arithmetic means and sets a direct relation between holding period rates and NPV.

1. Introduction

The analysis of economic performance of capital asset investments is a matter of central importance in corporate finance, engineering economy and, in general, managerial science. The valuation of new industrial opportunities is often associated with estimation of economic data which are used to draw up pro forma financial statements which aim at assembling, in an economically rational way, a massive amount of information. Pro forma financial statements consist of (i) income statements, where incremental revenues and costs associated with the project are collected, (ii) balance sheets, where sources of funds (equity, debt) are recorded as well as uses of funds (fixed assets and working capital), (iii) cash flow statements, which convert the estimated accounting and economic data into a stream of free cash flows (Titman & Martin, 2011). The use of such financial modeling is rather common in corporate projects and in private equity investments, and it is an indispensable tool in project finance transactions. Project finance is a no-recourse form of financing, whereby a new legal entity is created, named Special Purpose Vehicle (SPV), with the explicit aim of undertaking a project with limited life (Gatti, 2012). Originated in the energy generation sector, project finance is now widely used for several kinds of engineering projects, such as oil and gas, power and telecom projects, and, more recently, Internet and e-commerce projects (Borgonovo, Gatti, & Peccati, 2010)

The abundant quantity of economic, accounting, and financial data which are recorded in the pro forma financial statements is usually condensed into one single metric, expressing the project's economic profitability, which is either an absolute measure of economic profitability, such as the Net Present Value (NPV), or a relative measure of worth, such as a rate of return (most notably, the Internal Rate of Return, IRR).

As for the NPV, its use in industry for project valuation is commonplace (Borgonovo & Peccati, 2004, 2006; Gallo & Peccati, 1993; Giri & Dohi, 2004; Herroelen & Leus, 2005; Herroelen, Van Dommelen, & Demeulemeester, 1997; Wiesemann, Kuhn, & Rustem, 2010) and it is endorsed as a theoretically correct decision criterion in corporate financial theory (see Berk & DeMarzo, 2011; Brealey, Myers, & Allen, 2011). The IRR, albeit subject to several drawbacks (see Magni, 2013, for a compendium of eighteen flaws) is often used in place or even in conjunction with the NPV for investment evaluation, as well as other criteria such as payback or residual income (Lindblom & Sjögren, 2009; Magni, 2009; Remer, Stokdyk, & Van Driel, 1993; Sandahl & Sjögren, 2003).

While the standard NPV does detect value creation, it does not identify the projects' value drivers and is not capable of explaining, in a detailed way, how the economic referents underlying the project contribute to generating (or subtracting) value. In other words, the NPV

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alone cannot disentangle the constituents of a project: for example, given that the NPV does not distinguish investment from borrowing, it does not tell us whether value is created because funds are invested at a return rate greater than the minimum required rate of return or value is created because funds are borrowed at a borrowing rate which is smaller than the maximum acceptable borrowing rate. Also, the standard NPV cannot separate the contribution of equityholders from the contributions of debtholders in value creation or value destruction. Nor is it available, in the literature, a sufficiently general model able to establish a direct link between the accounting data estimated in the pro forma financial statements and the project's NPV. Paradoxically, while cash flows necessarily arise from (pro forma) accounting data, it is usually believed that accounting rates of return such as Return On Equity (ROE) or Return On Assets (ROA) have no financial meaning and are not reliable for economic analysis (Kay, 1976; Peasnell, 1982a, 1982b; Stark, 2004; Whittington, 1988).

The aim of this paper is just to provide a methodological framework capable of exploiting, to a full extent, the information provided by the financial modeling underlying a capital asset investment. In particular, it aims at detecting the value drivers of a project and investigating their formal and conceptual relations; it aims at showing how value is created and, in particular, (i) whether such a value is made out of investment or out of financing (ii) what the role of equityholders and debtholders is in generating value, (iii) how accounting variables can be aggregated in metrics that are economically significant and that enable one to establish a direct link between the project's ROE and ROA and the project's NPV.

To achieve the required results, we build upon Magni's (2010; 2013) approach, which uncovers the existing relations between a project NPV and its period rates of return. This approach, named Average Internal Rate of Return (AIRR), also enables to compute, from the financial statements, a unique NPV-consistent project rate of return which is devoid of the flaws which mar the IRR. Owing to the flexibility of the AIRR approach, we also allow for varying rates, and define a new return metric, named the *project ROA*, which aggregates all the estimated ROAs, and a new cost of capital, named the *project WACC* (Weighted Average Cost of Capital), which aggregates all the project's period WACCs.

A twofold decomposition will be finally supplied, which decomposes the value created by source of funds (debt vs. equity) and by the nature of capital (investment vs. financing).

The remainder of the paper is summarized as follows.

- Section 2 summarizes the results of Teichroew, Robichek, and Montalbano (1965a, 1965b) (TRM) which allow for a project to have financing periods as well as investment periods. Investment periods generate returns for the firm at a (constant) investment rate, financing periods generate borrowing costs at a (constant) financing rate. TRM devised two NPV-consistent decisions rules that assume that the cost of capital is constant and equal to either the investment rate or the financing rate.
- Section 3 supplies the missing link among investment rate, financing rate, cost of capital and Net Present Value (NPV). The AIRR approach is used for dividing the economic value created into investment NPV and financing NPV and for combining investment rate and financing rate into an economically significant project rate of return.
- Section 4 generalizes the results of the previous section removing the restrictive assumptions of constant rates: varying investment rates and varying financing rates are allowed, as well as varying costs of capital. Using again the AIRR approach, the project investment rate and project financing rate are obtained and combined into a project rate of return. Also, a project cost of capital is obtained, which is splitted up into an investment cost of capital and a financing cost of capital, which act as benchmark return rate and benchmark financing rate in the investment and financing periods, respectively.
- Section 5 takes into consideration the role of equity and debt in value creation and shows the relations among the various rates (ROE, ROD, ROA) and the various project-specific costs of capital (cost of equity, cost of debt, WACC). The NPV is decomposed into equity and value component and, using the results of the previous sections, each component is in turn decomposed in investment NPV and financing NPV and a project ROA is obtained, which, compared with the project WACC, signals value creation or destruction.
- Section 6 illustrates a simple example of a levered project, that is, a project which is partly financed with debt, where it is assumed that some periods are financing periods.

Some concluding remarks end the paper. An Appendix is devoted to highlighting the differences with the well-known modified internal rate of return.

2. Investment side and financing side of a project

While many industrial opportunities are pure projects (i.e., either investment or financing), some other opportunities are *mixed* projects. It may occur, in some periods, that the invested capital is negative: this means that the project acts as a financing rather than as an investment; more specifically, in these periods, the assets used by the firm for undertaking the project serve the scope of *financing* the stakeholders (equityholders and debtholders), who take on the unusual role of capital *borrowers*, instead of being capital *providers*. In mixed projects, the identification of a period as an investment period or a financing period is essential to better disentangle the way value is created or destroyed by the project: in an investment period, the return on capital is a rate of return, and the cost of capital is the minimum return rate required by the capital providers. However, in a financing period, the capital is a borrowed amount, so the "return" on capital is not a rate of *return* at all: it is to be interpreted as a borrowing rate, and the cost of capital expresses the maximum financing rate acceptable by the stakeholders.

Whether a project is pure or mixed depends on whether the capital committed is positive or negative. For example, consider a bank account whose interest rate is 5 percent if the account balance is positive and 10 percent if the account balance is negative. Suppose a client of the bank deposits €100 in the account, then withdraws €215 at the end of the period, then deposits €110 at the end of the second period and closes off the account. The cash-flow vector of this transaction is $(-100, 215, -121)$: in the first period, the customer invests €100 in the account. At the end of the period, before the withdrawal, the account balance is positive and equal to $100(1 + 0.05) = 105$; by withdrawing €205, the account balance turns negative and equal to €-110, which means that, at the beginning of the second period, the client borrows €110 from the bank. At the end of the second period, the customer repays debt plus interest and closes off the account with a payment of €121: $-110(1 + 0.1) + 121 = 0$. This simple transaction is a mixed project: the first period is an investment period (a €100 account balance represents invested capital), the second period is a financing period (a €-110 account balance represents borrowed capital).[1]

Therefore, in general, a project can be described as having two sides: an investment side, consisting of periods where capital is invested, and a financing side, consisting of periods where capital is borrowed. A pure project can be seen as a particular case of mixed project where all periods are either investment periods or financing periods.

[1] From the bank's perspective, it is the other way around: investment in the second period, financing in the first period.