IRR BASED DECISION CRITERIA FOR CAPITAL BUDGETING

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Abstract: *In order that a project is considered acceptable for implementation, it has to satisfy the twin requirements of technical feasibility and financial viability. Financial viability of projects is evaluated by employing methods known as capital budgeting techniques. Internal rate of return (IRR) is one of the most popular capital budgeting techniques explored extensively by both practicing managers and academicians. IRR is thus a topic of paramount importance in the area of corporate finance.*
It appears that academicians apply the same set of decision criteria for evaluation of the financial viability of both investment projects and borrowing projects. Our analysis in this article, however, proves that a uniform set of decision criteria for both investment and borrowing projects is not at all a self-consistent requirement.
The set of self-consistent IRR based decision criteria for borrowing projects can be formulated as under:
1. For any single/independent borrowing project, IRR > 0 but ≤ a suitable positive benchmark rate.
2. For mutually exclusive borrowing projects, among the projects with IRRs ≤ the positive benchmark rate, select the one with the lowest IRR.

Keywords: *Internal Rate of Return (IRR), Investment and Borrowing Projects; Parity for IRR and NPV; Self-Consistent IRR based Decision Criteria.*
IRR based Decision Criteria for Capital Budgeting.

1. Introduction

A pre-eminent position in the field of corporate finance is held by the theory of project appraisal and finance. Every project needs to fulfil the twin criteria of technical feasibility and financial viability in order that it is taken up for implementation and funding by prospective investors. The methods to be employed for evaluation of financial viability of a project are termed as capital budgeting techniques. Capital budgeting techniques

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therefore occupy an extremely significant position in the domain of corporate finance.

Among the capital budgeting techniques, IRR happens to be one of the most frequently used ones. However, the IRR based decision criteria for borrowing projects do not appear to fulfil the basic test for self-consistency. A fresh set of criteria has been formulated in this article with a view to ensuring the much needed self-consistency for the overall analytical process.

If the final goal we are aiming at is better decisions, a very important starting point for this purpose would certainly be the formulation of a set of logically consistent decision criteria.

2. Internal Rate of Return (IRR)

IRR is basically a discounted cash flow (DCF) method for evaluating the financial viability of a project. IRR of a project is defined as that value of the discount rate i.e. the rate of return for which the net present value of the project works out to zero. In other words, if IRR of a project is set as the corresponding discount rate, aggregate of the present values of all outflows associated with the project would equal the aggregate of the present values of all inflows related to the same project.

We observe that IRR of a project is quite akin to the YTM of a bond. If the discount rate is equated to the YTM of a bond, the bond quotes at its intrinsic value. In other words, a bond is neither overvalued nor undervalued if the discount rate for the bond equals its YTM. Similarly, a project is neither overvalued nor undervalued (i.e. NPV of the project = 0) if the discount rate for the project equals its IRR.

3. Investment and Borrowing Projects

An investment project is characterized by an initial outflow i.e. at $t = 0$, when counting of time for the project commences. This initial investment in a project is followed by a stream of project related future cash flows that, in order to make the project viable, are dominated by inflows. This would ensure a positive rate of return for the initial investment.

A borrowing project, on the other hand, is characterized by an initial inflow i.e. at $t = 0$. In the wake of this initial inflow comes a stream of project related future cash flows that, to make the project viable, are dominated by outflows. This would ensure a positive cost of borrowing/ cost of capital.

4. IRR based Decision Criteria for Selection of Projects

Prior to the modification proposed in this article, the IRR based decision criteria for both investment and borrowing projects are [1]:

(a) If IRR of a single/independent project exceeds a positive hurdle rate set for it, only then accept the project. Otherwise, do not accept it.

(b) For mutually exclusive projects, among the projects with IRR exceeding the hurdle rate, select the one with the highest IRR.

However, for borrowing projects, these criteria face some fundamental problems and, as we shall observe shortly, it is essential that we modify the decision criteria in order to incorporate basic self-consistency in the overall scheme of analysis.

5. Parity of IRR and NPV [2]

If we start with any project and reverse the signs of all the cash flows associated with it (this will transform an investment project to a borrowing project and vice versa), then NPV of the project too changes sign without any change of the magnitude of NPV. In other words, we can state that NPV has an odd parity with reference to such a transformation.

However, unlike NPV, IRR remains unchanged in the face of such a transformation. In other words, IRR can be said to have an even parity because it remains unchanged when the signs of all the cash flows attached to a given project are reversed.

NPV and IRR thus have opposite parities. Accordingly, it is possible that while some issues come to the fore for one of these parameters, the same may not surface for the other.

In order to explore the IRR related position further, let us consider the following 2 simple projects [1]:

	CF at $t = 0$	CF at $t = 1$ year	Project Type
Project 1	– 100 units	120 units	Investment
Project 2	100 units	– 120 units	Borrowing

The required rate of return/discount rate is 10% p.a.

From the foregoing, we observe that:

(a) Project 1 is an investment project while project 2 is a borrowing project.

(b) If we reverse the signs of all the cash flows for project 1 we get project 2 and vice versa.

(c) Project 1, i.e. the investment project, has an initial outlay of 100 units (at $t = 0$) on account of investment in the project. This is followed by an inflow of 120 units at the end of year 1, which also includes the return on the amount of initial investment. The rate of return i.e. IRR on the amount of initial investment of 100 units thus works out to be 20% p.a. [$100\ (1+r) = 120$].

As against this, project 2 has an initial inflow of 100 units (at $t = 0$) due to disbursement of borrowed fund. This is followed by an outflow on account of repayment of 120 units at the end of year1, which also includes the interest payable on borrowed fund. The cost of borrowing i.e. IRR on the borrowed amount of 100 units therefore turns out to be 20% p.a. [$100\ (1 + r) = 120$].

(d) In this example, project 1 and project 2 have identical IRRs not because of any chance or fortuitous coincidence. This is guaranteed ab-initio because of the even parity of IRR towards reversal of signs of all project-related cash flows. However, the IRRs for the two projects represent completely different physical attributes. While IRR for project 1 i.e. the investment project represents the rate of return on investment, IRR for project 2 i.e. the borrowing project represents the cost of borrowing.

(e) Obviously, it may not be proper to mechanically apply an identical set of IRR based decision criteria for both kinds of projects. If we try to do so, there will be serious problems of consistency and compatibility. Two separate sets of self-consistent IRR based decision criteria for investment projects and borrowing projects have to be formulated in order that each set has a clear one-to-one correspondence with the physical attribute its IRR represents.

(f) Cash flows for the two projects considered above are rather simple in nature. However, our findings based on these can be easily extended for any generalized sequence of cash flows, and are thus valid for all kinds of projects. In other words, under all circumstances, an investment project and its corresponding borrowing project will have identical IRRs. However, their physical interpretations would be quite different. Therefore, as we shall see, to stipulate a uniform IRR based criterion like IRR>a benchmark rate for both an investment project and the corresponding borrowing project is an absurd requirement.

6. Fundamental Problem confronting IRR based Decision Criteria

(a) It has been clearly demonstrated in the previous paragraph that IRR has an even parity. It means that a reversal in the signs of all project related cash flows (thereby transforming an investment project into a borrowing project and vice versa) does not lead to any change of IRR for the project. However, the IRRs, though identical in numerical values, represent completely different kinds of physical quantities. While IRR for project 1 represents the rate of return for an investment project, IRR for project 2 represents the cost of borrowing for the corresponding borrowing project.

(b) Thus, although the quantitative value of IRR remains unchanged under the reversal of signs of all project related cash flows, the decision criteria for IRR need not remain unchanged under the same transformation. As a matter of fact, as we shall show below, the set of self-consistent IRR based decision criteria have to be markedly different for investment and borrowing projects.

(c) Let us consider two banks A and B belonging to the same risk category. Suppose bank A lends fund of 100 units, in the call money market or the repo market, to bank B. Assuming their opportunity cost to be 10%, we find as under:

	Investment by Bank A	$r = 10\%$ Borrowing by Bank B
At t = 0	(–) 100 units	(+) 100 units
i. At t = 1 yr	(+) 90 units [IRR = (–)10%]	(–) 90 units [IRR = (–)10%]
ii. At t = 1 yr	(+) 95 units [IRR = (–)5%]	(–) 95 units [IRR = (–) 5%]
iii. At t = 1 yr	(+) 100 units [IRR = 0]	(–) 100 units [IRR = 0]
iv. At t = 1yr	(+) 110 units [IRR = (+)10%]	(–) 110 units [IRR = (+)10%]
v. At t = 1 yr	(+) 111 units [IRR = (+)11%]	(–) 111 units [IRR = (+)11%]
vi. At t = 1 yr	(+) 120 units [IRR = (+)20%]	(–) 120 units [IRR = (+)20%]
vii. At t = 1 yr	(+) 125 units [IRR = (+)25%]	(–) 125 units [IRR = (+)25%]

It is clear from the above table that:

(i) Investor/lender A and borrower B have always numerically identical IRRs, although such IRRs physically represent completely different types of attributes.

(ii) IRR is negative if the magnitude of the cash flow at the end of year 1 is less than the magnitude of the initial cash flow. If we designate the initial cash flow by A0 and the cash flow at the end of year 1 by A1, then IRR < 0 for both kinds of projects if IA1I < IA0I.

(iii) A negative IRR is absolutely unacceptable for investment projects because it means a direct loss from the investment itself. In addition, the investor has also to bear the cost of funds deployed for such an investment.

(iv) A negative IRR would be a dream proposition for a borrower for he can make money merely by borrowing (100 units, say) and then repaying a lesser amount (only 90 units, say). This would provide an opportunity to a company to augment its value at will merely by addition to its debt burden. But, such deals where the borrower would make money at the cost of the lender/investor with the latter losing money heavily would obviously not be acceptable to the latter. Such proposals whereby borrowing will add value to a company and investment will strip it of its value are clearly absurd and not realizable in practice.

(v) IRR = 0 for both kinds of projects if IA1I = IA0I. This would imply zero return on investment and zero cost for borrowing. Zero IRR for an investment project would imply a net loss for the investor at the rate of his cost of capital multiplied by the project cost. As for zero IRR for a borrowing project, the borrower may be quite eager to avail of such a facility. But the lender/investor will not be agreeable to such a proposal because an investment not recovering even the cost of funds would mean a direct loss for him. So, this option is also not practically realizable.

(vi) In other words, IRR should be positive (IRR > 0) for both investment projects and borrowing projects – meaning that both return on investment and cost of borrowing should be > 0.

(vii) Positive value of IRR provides only a necessary condition, which is not sufficient for acceptance of an investment project. For an investment project to be acceptable, IRR must exceed or at least equal the cost of capital for the project (IRR ≥ cost of capital). In other words, IRR must exceed or at least equal a hurdle rate that depends on risk profile of the project and the current scenario for interest rate movements (IRR ≥ a positive hurdle rate).

(viii) For a borrowing project, however, the goal obviously cannot be to ensure that the cost of borrowing exceeds or at least equals a minimum benchmark rate. On the contrary, the goal here is tokeepa lid on the borrowing cost. Thus, the IRR for a borrowing project should be less than or equal to a positive benchmark rate that is set with due reference to the borrower's current cost of capital and the current trend for interest rate movements (IRR ≤ a positive benchmark rate).

If we now have a relook at the simple example incorporated in paragraph 5 above, we observe that:

Project 1, an investment project, has IRR of 20%, while the cost of capital is only 10%. So, it is financially viable and acceptable.

Project 2, a borrowing project, has also IRR of 20%. Since the current cost of capital is 10%, borrowing at a cost of 20%, which is way above 10%, is not an acceptable proposal.

Both the above findings for project 1 and project 2 are as expected, and there is thus no anomaly or incompatibility whatsoever about the IRR based analysis once we adopt the consistent decision criteria for borrowing projects formulated in this article.

(ix).For a given value of IA0I, higher values of IA1I (IA1I > IA0I) would mean higher values of IRRs for both types of projects.

A higher IRR for an investment project would mean a higher rate of return on investment and is thus most welcome by the investor/lender. So, among various mutually exclusive projects with IRR ≥ a positive hurdle rate, the investor would select the one with the highest IRR.

(h) For borrowing projects, however, the situation is just opposite. A higher IRR would imply a higher cost of borrowing. This is clearly against the interest of the borrower, whose primarily goal is to keep a lid on the cost of borrowing. Thus, among various mutually exclusive projects with IRR ≤ a positive benchmark rate, the borrower would select the one with the lowest IRR.

7. Formulation of Self-Consistent IRR based Decision Criteria for Capital Budgeting

As we have seen above, a uniform set of IRR based decision criteria cannot be applied mechanically for both kinds of projects viz. investment projects and borrowing projects.

Our analysis reveals that the self-consistent set of IRR based decision criteria for borrowing projects can be formulated as under:

(a) For a single/independent borrowing project, IRR > 0

(b) For a single/independent project, IRR ≤ a positive benchmark rate that is to be set with due reference to the current cost of capital as well as recent trend for movements of interest rates.

(c) Among a number of mutually exclusive borrowing projects satisfying conditions at (a) and (b) above, select the one with the lowest IRR.

As we have demonstrated, the above IRR based decision criteria formulated by us for borrowing projects incorporate the much-needed self-consistency for the overall analysis, and there is no anomalous or inconsistent outcome from the same.

Had the earlier set of decision criteria for borrowing projects been used, we could end up with absurd results of various kinds. For instance, borrowing at quite high costs would have been freely allowed in that case and borrowing at costs below a certain threshold level would have been strictly rejected. Moreover, borrowing at a higher cost would have been preferred to borrowing at a lower cost. Such failures/ shortcomings arise from the use of a set of faulty decision criteria lacking in consistency rather than from any intrinsic inadequacy of IRR as a capital budgeting technique.

However, for investment projects, the existing set of IRR based decision criteria listed below would continue to suffice.

(a) If IRR of a single/independent project ≥ a positive hurdle rate set for it, then only accept the project.

(b) For mutually exclusive projects, among the projects with IRR ≥ the hurdle rate, select the one with the highest IRR.

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