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Consensus and Contrdiction between Internal Rate of Return and Net Present Value in comparing two Mutually Exclusive Projects

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Abstract: This paper is intended to study the similarities and differences between the methods of internal rate of return IRR and net present value NPV when comparing two mutually exclusive projects for investment under certainty, and selecting appropriate alternatives. The framework of this paper is based on a detailed literature review of net present value (NPV) approach and the internal rate of return analysis. Furthermore, the paper investigates the consensus between NPV and IRR in the normal situations where they both give similar results as well as discussing the cases of contraditions that may occur between the two parameter and the reason behind that, and suggests the solutions when this contradiction takes place.

Keywords: IRR, NPV, PI, EAA, MIRR, consensus of IRR and NPV. Contradiction of IRR and NPV.

التوافق والتعارض بين معياري معدل العائد الداخلي وصافي القيمة الحالية عند المفاضلة بين مشروعين مانعي التبادل

توفيق الطيب البشير عبدالرحمن

الملخص: تهدف هذه الورقة إلى دراسة أوجه التشابه والاختلاف بين معياري معدل العائد الداخلي IRR وصافي القيمة الحالية NPV عند مقارنة مشروعين مانعي التبادل في ظروف التأكد، واختيار البدائل المناسبة للوصول إلى جدوى المشروعين وأيهما أفضل. يستند إطار هذه الورقة إلى مراجعة أدبية تفصيلية لنهج القيمة الحالية الصافية (NPV) ومعدل العائد الداخلي. وعلاوة على ذلك، تبحث الورقة في التوافق بين NPV وIRR في الحالات العادية حيث تعطي كلاهما نتائج مماثلة، باعتبارهما أفضل المعايير المستخدمة في المفاضلة بين المشاريع مانعة التبادل، وكذلك مناقشة حالات التناقض التي قد تحدث بين المعيارين والسبب وراء ذلك، وتقترح الحلول عند حدوث التعارض ومناقشة آراء الخبراء الذين تناولوا هذه الظاهرة في دراسات الجدوى الاقتصادية.

الكلمات المفتاحية: معدل العائد الداخلي، صافي القيمة الحالية، أوجه التشابه والاختلاف بين صافي القيمة الحالية ومعدل العائد الداخلي، مؤشر الربحية، القيمة المكافئة السنوية، معدل العائد الداخلي المعدل.

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1. Introduction

The internal rate of return (IRR), and the net present value (NPV) are two of the most important and reliable criteria that lead to a positive or negative investment decision under certainty.

In most cases, investors are taking the NPV as value, and the IRR as ratio together when evaluating any project, because they both give the same impression to accept or reject the proposed project.

Generally, investors accept projects those show positive NPVs and IRRs higher than the rate of return used to discount the future cash flows expected during the project lifetime.

But not always the harmony between IRR and NPV goes steadily; some cases are making a trouble in the coincident relationship between these two parameters.

In this paper, I would like to highlight this issue and present some illustrations that differentiate between the consensus and contradiction between IRR and NPV.

2. NPV defined:

According to Ondrej Zizlavsky, (2014), "NPV approach is the most popular and most sophisticated economic valuation technique". It expresses the difference between all future in- and out- cash flows resulting from the innovation project with a given discount rate .

NPV is basically a result of subtracting all discounted cash outflows of the proposed project from all discounted cash inflows.

It can be shown as follws:

$$NPV = -I_0 + \sum_{t=1}^{T} \frac{CF_t}{(1+K)^t}$$

Where, I_o is the initial investment,

CF : is the cash inflow,

t : is the year in which cash flow is accrued.

k : is the discount rate

In other words "NPV is the net present value which is the sum of all the future cash flows to determine the present value. Cash flows include the both inflows and outflows that are discounted at a specific rate. It is calculated as: NPV = Cash inflows – Cash outflows, or expenditure of Investment. The net present value (NPV) of a project is the sum of the present value of all its cash flows, both inflows and outflows, discounted at a rate consistent with project’s risk" (Asma Arshad , 2012).

It should be clearly stated that the discounted cash outflows do not include initial capital as it can not be discounted, because it expresses the present time of the project, whereas all inflows and other outflows, if any, should be subject to discount because they occur in the future time, and therefore they will be affected by time value of money.

Ondrej Zizlavsky, (2014), explained that the first principle of NPV approach is that a risky Euro tomorrow is less valuable than a certain Euro today. Hence future cash flows are discounted each year. The discount rate reflects the opportunity cost of the capital mobilized, which increases with the estimated riskiness of the innovation opportunity.

The second principle of NPV to Ondrej (2014) is to take into account all the future net cash flows linked to the innovation opportunity. The importance of using NPV rule resulting from the need of investor to choose the project with positive NPV, and strictly rejects a project of a negative NPV.

NPV is not always appreciated, it is also disadvantageous in many ways, but the worst disadvantage of NPV is the way one could determine a discount rate that affects the NPV result, and so the investment decision. That if we consider a lower discount rate, we get a higher value of NPV whereas considering a higher rate of discount may result in rejecting a viable project. That is, the results of the decision made based on the absolute amount of NPV can differ according to the values of the calculative rate of interest. (Lajos Juhász, 2011).

In addition , NPV method suggests accepting the investment plan that shows positive NPV, but it doesn't provide an accurate answer at what period of time the investor will achieve positive NPV.

3. IRR defined:

The internal rate of return (IRR) is mostly defined as a discount rate that makes the net present value of all cash flows (in and out) from a particular project equal to zero.

From a mathematical point of view, the internal rate of return is defined as the discount rate (r) if it exists and is unique, that makes the NPV of all cash flows of an investment equal to zero (in summary (r) is the discount rate at which the NPV of positive cash flows is equal the NPV of negative cash flows. (Giuseppe Munda, 2015).

IRR should normally and logically be higher than a rate of return used to discount cash flows of a given project, then it represents the expected return that will be earned on a project or investment.

António Mota (2015), looked to the IRR as a good sign or a bad sign with reference to the required rate of return (r), adopted by the investor. He stated That IRR should be compared with the required rate of return used in the computation of the NPV. If the investor's required rate of return is higher than the IRR, then the project will have negative NPVand should be rejected. If the investor's required rate of return is lower than the IRR, the project will have a positive NPV and so it can be accepted (from a strictly financial perspective). Therefore, one can see the IRR as equal to the maximum rate of return that an investor may require for a given project.

Here is a simple example for this:

0	1	2	3
$-15000	$4500	$6500	$9500

If the r is 10%, then NPV equals $ 1600, and IRR is 15%. This shows that if (r) is 15% then NPV will be zero, but because (r) is lower than 15% NPV goes above zero, and on the other hand when (r) is exceeding 15% then NPV will go down beyond zero and show negative value. Also this can be interpreted in other words that the rate of 15% (15%-10%) is earning $ 1600 NPV.

Figue 1 shows this:

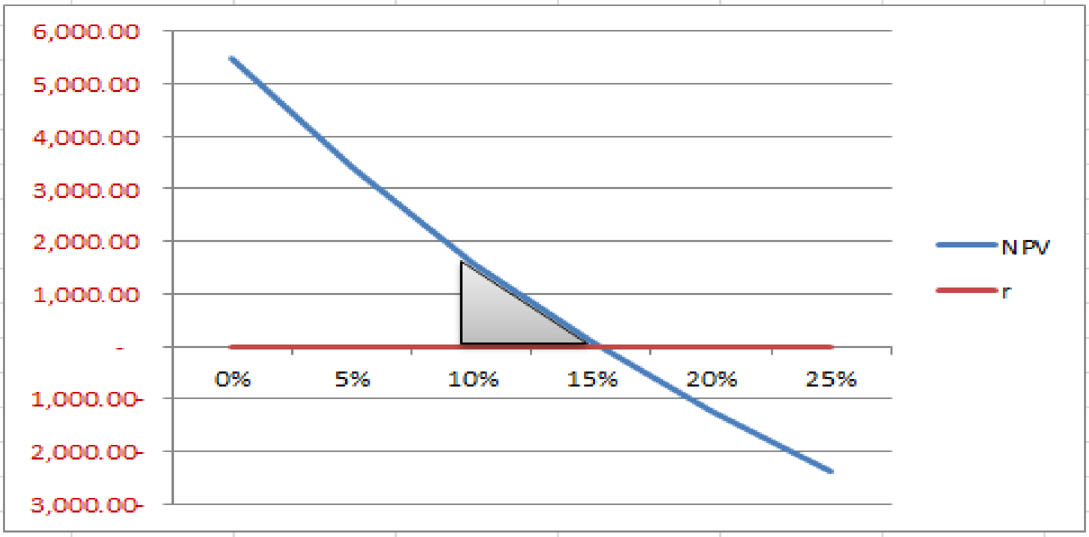


Figure 1: the relation between NPV and IRR

Marcos (2017) consider that The internal rate of return parameter estimates the actual interest rate which the investment generates and has the advantage that it does not pre-requires a knowledge of the discount rate, that is during its estimation no market's interest rate or time preference rate is taken into account.

That is, the internal rate of return represents the highest interest rate which an investor could pay without loosing money if he borrows the entire capital for the investment's funding and pays off the loan (initial amount and interests) with the revenues coming out from the investment paying at the moment they are made.

Anyway, there are many advantages and disadvantages of using IRR as a tool of evaluating the investment in two mutually exclusive projects "The first major advantage is that the IRR is informative, objective and independent of the size of any alternative investment, besides showing the limit of profitability of a particular project. Thus, the widespread use of IRR is given by the fact that it can communicate with only one number the basic characteristics of particular project profitability. The IRR represents as close as you can get to NPV, without that, in fact, we have a criterion as the NPV". (Marcos Nóbrega, 2017).

Also IRR is in some cases disadvantageous as Marcos Nóbrega (2017) pointed out. That IRR is not an absolute criterion of profitability, because it only observes the internal aspects of the project. In addition, it is highly sensitive to the reliability of predictions about the entire cash flow of the project.

Herbert Kierulff (2012) talked about a significant drawback of IRR when a series of numbers may have as many IRRs as the number of its sign changes. In the normal IRR problem, there is only one sign change— negative outflow to positive inflows. If there are more than one sign changes, however, multiple IRRs can occur.

4. Consensus of NPV and IRR:

It is widely agreed that NPV and IRR are used together, and they give same acceptable or non-acceptable results when comparing two mutually exclusive projects, and they give more confidence for the investor because they give same valuation, they go up together or drop together , one is giving a value, and the other is giving a ratio.

Marcos Rios Nobrega (2017) noted that the two most used methods for evaluation of investment is the Net Present Value (NPV) and the Internal Rate of Return (IRR), which are methods that have a universal character.

Some authors tried to differentiate between NPV and IRR preferring one over the other. Asma Arshed (2012), noted that NPV is better than IRR. As NPV is calculated on capital cost and IRR is determined on calculated IRR rate. For mutually exclusive projects NPV is preferable, and for individual projects IRR is preferable.

She continued: “After concluding the result it was find out from the sum and mean that 52.5% of authors are in favor the point, NPV is better than IRR. On the other hand 10% have the view that IRR is better than NPV. Remaining 37.5% have the view that in some cases IRR is better and in some cases NPV is better. IRR is better when projects are individual and NPV is better when projects are mutually exclusive” (Asma Arshed, 2012),.

“But there is an opposite idea as noted by (Dean Altshuler, and Carlo Alberto Magni, 2012) that all surveys indicate that lenders find it more appealing to analyze potential investments in terms of percentage rates of return than by comparing dollars of NPV.’’

Herbert Kierulff (2012) stated that (IRR) has become a major tool in investment evaluation. Many executives prefer it to net present value (NPV), presumably because they can more easily comprehend a percentage measure.

However, the investor cannot dispense with one of the two criteria for the other, because the two criteria together will give the investor more confidence in his investment decision.

Some authors believed that using IRR alone in making an investment decision is a biggest mistake . Amy Gallo (2016) said that “the biggest mistake, says Knight, is to use IRR exclusively. It’s much better to analyze a project using at least one of the other methods — NPV and/or payback. Using it alone could lead you to make a poor decision about where to invest your company’s hard-earned dollars, especially when comparing projects that have different durations.

Here we can see an example of compatibility of NPV and IRR at a discount rate of 12%;

Project	0	1	2	3	4	NPV	IRR
A	-15000	5000	6000	7000	9000	4950	25%
B ↑	-15000	7000	9000	11000	14000	15152	49%
C ↓	-15000	4000	5000	6000	8000	1912	17%

But not always this will be the case; the NPV and IRR do not go up or down together unless three conditions are fulfilled.

These three conditions are:

(i) The size of the two compared projects (mutually exclusive) should be almost the same.

(ii) The lifetime of the two compared projects (mutually exclusive) should be the same.

(iii) The cash flows earned from the two compared projects (mutually exclusive) should be positive and homogeneous in nature, showing no difference in the cash flow patterns or timings of the various proposals.

5. Conflict Between NPV and IRR:

As stated above, The NPV and IRR are used together and they give similar results, but this should happen strictly when the three conditions mentioned above are fulfilled, in some cases when one or more of the condtions are unapplicable, the situation may vary to the contrary, in the case of mutually exclusive projects when a company should try to select the best one among others. It can happen that one project has a higher NPV but lower IRR, and the other one has a higher IRR but lower NPV. Michael J.Osborne (2010) has stated that sometimes NPV and IRR provide inconsistent rankings. This inconsistency sparked a debate about which criterion is better. The debate has lasted more than 100 years.

This case arises when the size of investment differs, the lifetime of one project is longer, or the cash flows witness a case of instability.

Lajos Juhasz (2011) noted that this conflict has no significant effect in the following cases.

(i) Independent investment proposals which do not compete with one another and which may be either accepted or rejected on the basis of a minimum required rate of return.

(ii) Conventional investment proposals which involve cash outflows or outlays in the initial period followed by a series of cash inflows.

Lajos Juhasz (2011) also summerized the area of conflict in three resons:

a) The ranking of investment proposals of diverse sizes, excluding each other mutually;
b) The evaluation investments that have non-conventional cash-flows;
c) The adjudication of investments excluding each-other mutually and having time-differing structured cash-flows.

Moshe Ben-Horin and Yoram Kroll (2012) tried to explain and limit the deficiency of the IRR ranking relative to the NPV ranking stems in two resons as follows:

1. The NPV is an absolute measure of wealth, whereas IRR is a relative measure of wealth, and

2. The time value of money employed in calculating the NPV is the risk-adjusted cost of capital, which is a measure of the actual economic opportunity cost of the capital invested in the project. On the other hand, the time value of money employed in calculating the IRR is the IRR itself, which is an artifact of the project’s cash flow and does not represent an economic alternative cost.

Here are some examples for the conflict between NPV and IRR.

Example 1: The case of variety in the size of investment (at 10% discount rate) :

Project	0	1	2	3	NPV	IRR
A	-15000	7000	8000	9000	4737	26%
B	-40000	18000	19000	20000	7092	20%

Project A initial investment is \$15000 whereas Project B is \$40000, here we observe that:

1- According to the NPV analysis alone, Project B is the most appropriate to choose.

2- According to the IRR analysis alone, Project A is the most appropriate choice.

The NPV and IRR analysis for these two projects give us conflicting results. This is most likely due to the variety of initial capital for each project.

To solve this conflict we substitute IRR by Profitability index method (PI) , the formula is

$$PI = 1 + \frac{NPV}{I_0}$$

Using PI method we get ratio of 1.3 for project (A) and 1.2 for project (B). This means that the small size project (A) is more viable than the big size project (B). Now we prefer Project A according to NPV and PI irrespective of how much IRR is.

Example 2: The case of difference in the lifetime of each project (at 10% discount rate):

Project	0	1	2	3	4	NPV	IRR
A	-15000	7000	8000	9000	10000	11567	40%
B	-15000	9000	10000	11000	-	9711	43%

Project A lifetime is 4 years whereas Project B is 3 years, here we observe that:

1- According to the NPV analysis alone, Project A is the most appropriate to choose.

2- According to the IRR analysis alone, Project B is the most appropriate choice.

The NPV and IRR analysis for these two projects give us conflicting results. This is most likely due to the variety of lifetime for each project.

To solve this conflict we substitute IRR by Equivalent Annual annuity method (EAA) , the formula is

$$EAA = NPV \times \frac{k}{1-(1+k)^{-T}}$$

Using EAA method we get value of \$3649 for project (A) and \$3905 for project (B) . This means that the small size project (A) is more viable than the big size project (B). Now we prefer Project A according to NPV and EAA irrespective of how much IRR is. Note that here NPV of Project B is lower than that of Prject A.

Example 3: The difference in the nature of cash flows for each project (at 10% discount rate):

Project	0	1	2	3	4	NPV	IRR
A	-25000	10000	11000	12000	16000	13126	31%
B	-25000	15000	12000	10000	9000	12214	34%

Project A cash flows are increasing whereas Project B cash flows are decreasing, here we observe that:

1- According to the NPV analysis alone, Project A is the most appropriate to choose.

2- According to the IRR analysis alone, Project B is the most appropriate choice.

The NPV and IRR analysis for these two projects give us conflicting results. This is most likely due to the abnormal nature of the cash flows of each project.

To solve this conflict we substitute IRR by Modified internal rate of return method (MIRR) , the formula is

$$MIRR = \left[\frac{\sum_{t=1}^{T} CF_t (1+i)^{T-t}}{I_0} \right]^{1/T} - 1$$

Herbert Kierulff (2012) considered that MIRR differs from IRR in two important ways. First, MIRR assumes that the return to be calculated is on the cash flows, not the original investment. Second, the return on these cash flows is compounded over time. This dominent difference is making MIRR more accurate and attractive tool for an investor to make his investment decision.

There is an other issue that makes MIRR more effective than IRR , that the IRR is considering the reinvestment of cash flows at the same IRR rate. Jonas Mackevicius and Vladislav Tomasevic (2010) look to the MIRR as a realistic tool in this regard, they say: "According to the IRR method, it is assumed that any previously received cash flows are reinvested at the same internal rate of return. However, in practice this occurs quite infrequently and the internal reinvestment rates vary. In such cases, the method of modified internal rate of return (MIRR) is both more reliable and realistic." They added "when NPV is positive and IRR is higher than the applicable discount rate, the project is accepted; otherwise it is rejected. Conflicts are resolved on the basis of NPVs or MIRRs, ignoring the values of IRR."

Using MIRR method with reinvestment rate of 8%, we get a rate of 21% for project (A) and 20% for project (B) . This means that the rising cash flows project (A) is more viable than the regretting cash flows project (B). Now we prefer Project A according to NPV and MIRR irrespective of how much IRR is.

When facing such a situation, the project with a higher NPV should be chosen because there is an inherent reinvestment assumption. In our calculation, there is an assumption that the cash flows will be reinvested at the lower discount rate (8%). In IRR, the implicit reinvestment rate assumption is of 31% or 34%. The reinvestment rate of 31% or 34% in

IRR is quite unrealistic compared to NPV. This makes the NPV results superior to the IRR results. In this example, project A should be chosen.

Anyway, the only way that NPV and IRR may get conflicted is the case of mutually exclusive projects . In the cases of independent projects each and every project serves a different purpose and they do not compete with each other regarding their selections.(Sayan Banerjee, 2016).

6. Problems of IRR:

Although the IRR has occupied a prominent position over the years and become one of the overwhelming choices for the quantitative measurement of investment attractiveness in modern corporations, it suffers from a set of problems that sometimes make it unreliable.

Herbert Kierulff (2012) explained that IRR is not a measure of investment attractiveness until it is compared with the cost of capital. It depends only upon the size and timing of the free cash flow involved. Since the IRR is determined by its cash flow and active investors typically reinvest cash flows, IRR will be misleading if active investors cannot find opportunities that result in the same IRR.

Anyway, the IRR rule is facing a number of difficulties if the timing or size of the cash flows fluctuate between two mutually exclusive projects. Some of these problems may be summarized as follows:

a) Multiple IRRs:

When a project involves a non-conventional cash flows pattern, multiple IRRs will arise and then the investor could not make a right action because he will not know which one of IRRs to compare with the hurdle rate.

But in reality this case is somewhat rare . Moshe Ben-Horin1 and Yoram Kroll (2012) have declared that the popularity of IRR indicates that under reasonable practical assumptions the deficiencies of IRR relative to NPV are minor or extremely rare. they think that if the negative cash flows of an investment project are only at the initial and ending periods, the IRRs provide a simple decision rule.

They believe that if there are negative interim cash flows of investment projects, then in most practical cases these negative interim cash flows are due to the realization of real investment options and thus only the positive expected value of the option should be included in the cash flow of which the IRR and NPV are calculated. They also consider the case where interim negative cash flows nevertheless exist. They proved that if there are three consecutive sign variations in the cash flows, then if one assumes the very reasonable assumption that the undiscounted sum of all expected cash flows of the investment is positive, then multiple positive real IRRs may exist only when the cash flows exhibit extreme swings, changing from very high positive (negative) to very high negative (positive), to a degree that renders such ex ante cash flow expected fluctuations unrealistic.

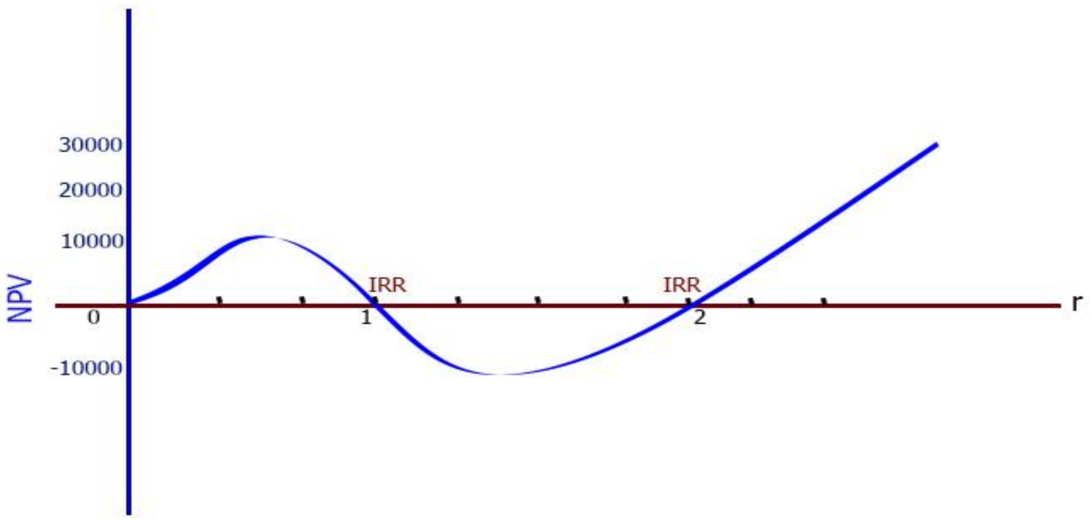
Herbert Kierulff sees that (2012) many cashflows inconsistence may bring multiple IRR into existence. He says “a series of numbers may have as many IRRs as the number of its sign changes. In the normal IRR problem, there is only one sign change negative outflow to positive inflows. If there are more than one sign changes, however, multiple IRRs can occur. He continues, there are business cases where several sign changes can occur. Brealey et. al. (2011) discussed the case of a strip mine where the initial outflow to start up the mine is followed by positive cash flows and then a negative cash flow when the land is returned to a condition equivalent to its original state".

If the cash-flows change signs several times during the useful life-span of the investment, more IRR values are created while the NPV is zero. This problem makes the work of the decision making financial expert more difficult since the known IRR values cannot be compared with the profit need of the company in many cases. Some experts suggest using the net present value principle to solve this problem (Lajos Juhász,2011) .

Here is an example for multiple IRR with net present value.

	0	1	2	3	4
Project	-25000	10000	-10000	20000	25000

These unconventional Cash flows will generate multiple IRRs as follwos:



IRR is not a sound parameter in this case because it would give many different readings at the point in which NPV equals zero, and NPV will not show positive signs between IRR at point 1 and IRR at point 2.

But Gordon B. Hazen (2003) looked to multiple IRR from an optemestic angle, he says: " The most commonly cited drawback to using the internal rate of return to evaluate deterministic cash flow streams is the possibility of multiple conflicting internal rates, or no internal rate at all. We claim, however, that contrary to current consensus, multiple or nonexistent internal rates are not contradictory, meaningless or invalid as rates of return. There is, oreover, no need to carefully examine a cash flow stream to rule out the possibility of multiple internal rates, or to throw out or ignore "unreasonable" rates. What we show is that when there are multiple (or even complex-valued) internal rates, each has a meaningful interpretation as a rate of return on its own underlying investment stream. It does not matter which rate is used to accept or reject the cash flow stream, as long as one identifies the underlying investment stream as a net investment or net borrowing.

When we say it does not matter which rate is used, we mean that regardless of which rate is chosen, the cash-flow acceptance or rejection decision will be the same, and consistent”

Negative cash flows can occur when an investment assets are introduced at different times during the lifetime of the project. This matter will cause IRR to have more than one rate.

b) The Cash flows timing problem:

If the cash flows of the two mutually exclusive projects are equal in value but differernt in timing, the NPV and IRR will give different results. Some of these results are unrealistic.

V. Karpov, and V. Shevchenko-Perepelkina (2015) had limited this problem of cash flows in the following:

- Decrease of the cash flow by the end of the life cycle of the project;
- Increase of the cash flow by the end of the life cycle of the project;
- Fluctuation of the cash flow during the life cycle of the project;

Forexample if we have five projects with the same initial investment of $ 30000 and and same total of net cash inflows of $45000 but these cash flows were generated in different timing. If the discount rate is the same for all project at 10% we will get different values of NPV and different ratios of IRR and here the investor could not make any desion.

The following table illustrates this

Prject	0	1	2	3	r	NPV	IRR
A	-30000	5000	5000	35000	10%	4974	17%
B	-30000	15000	15000	15000	10%	7303	23%
C	-30000	20000	20000	5000	10%	8467	29%
D	-30000	35000	5000	5000	10%	9707	38%

Here no contradiction between NPV and IRR will be seen, but it seems that Project A is the worst scenario whilest Project D is the best although same capital investment, same rate of discount, and same total of cash flows are applied. The reasoning behind this refers to time value of money.

c) The Fisher Intersection :

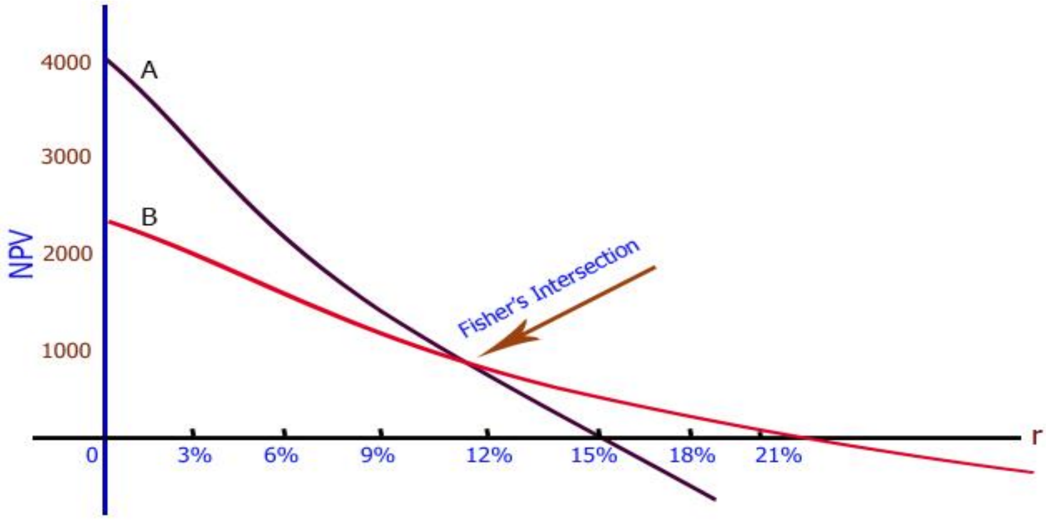
We stated earlier in this paper that there are three conditions that should be achieved if IRR is assumed to match with NPV up or down. If any of these three conditions is not fulfilled then IRR is giving contrary result to NPV. That means IRR may be high when NPV is low and vise versa.

The Fisher-intersection shows the discount rate in the frame of reference at which the two investment alternatives have a similar consideration based on the sum of the net present values. The Fischer-intersection shows that at a discount rate at the intersection of the two investments versions produce a nearly equal net present value. (Lajos Juhász, 2011) .

The following Example shows the crossover point called Fisher’s intersection:

Project	0	1	2	3	NPV	IRR
Project A	-10000	2000	3000	9000	4000	15%
Project B	-10000	4000	5000	6000	2276	22%

This can be illustrated as follows:



Investment B is better than A only if the cost of capital (assumed to be the same for both projects) is higher than the value of the discount rate at which the NPV profiles of B and A intersect (Fisher's intersection).

If the cost of capital is lower than the discount rate at the Fisher's intersection, choosing the project with the highest IRR means selecting the project which contributes the least to the firm's equity value.

7. The solution of the IRR problems:

We have stated previously that IRR is a domemant tool in comparing the two mutuaaly exclusive project and go a long with NPV without giving any problem in case that determinant conditions are achieved. Whenever any of these conditions is violant then PI , EAA, and MIRR will be suitable for applying the comparison.

PI is set to solve the problem of variety in capital of the two projects, EAA is to sole the problem of the difference in lifetime , and MIRR is to solve the problem of hetrogenious nature cashfolws.

It is very likely that most users of IRR do not fully appreciate the fact that, for an investment represented by a given sequence of cash flows, IRR is computed as a constant rate of return that has associated with it internally implied beginning-of-period capital values upon which its rate of return is earned. The recognition of implied interim values is a critical feature of IRR in proving that its use in an ICM-style analysis is illegitimate. (Dean Altshuler,and Carlo Alberto Magni,2015).

Dean Altshuler, and Carlo Alberto Magni (2012) were being talking about Average IRR (AIRR) as an effective tool for solving the problem that IRR assumes interim investment values that are mechanically generated by the IRR equation itself and will almost surely differ from the true interim values of the project under consideration.

They thought that (AIRR) produces a correct money-weighted rate of return (MWR) for a project. Furthermore, AIRR has none of the other problems that the IRR has (e.g., it always exists and is unique), and it appropriately accounts for the amounts actually invested over the course of the investment. They argued that “The Remedy for the IRR’s Ills We have argued that the interim values implied by the IRR are poor indicators of true value. So, the question arises as to whether there is any scenario where the IRR’s values, and hence, the IRR result itself, is adequate. Only two scenarios come to mind as potential candidates. The first scenario is when we simply have no decent estimates as to what our project’s actual interim valuations are, and so are willing to assume that they are equal to the IRR function’s implied values, simply due to lack of a viable alternative. The second scenario is when we have some comfort that the IRR result, while incorrect, is still probably ‘‘close enough’’ to the correct rate of return for our project”.

They also asummed that Aggregate Return on Investment (AROI) is an other active tool for giving a reliable result more that IRR.(2015), but these alternatives are not given the comprehensive exercises to substitute IRR in the studies of investment and most investors are still depending mostly on NPV and IRR .

8. Conclusion:

NPV and IRR are the most prevailing investment tools in compaing two mutually exclusive projects. They give comfort and confidence to the investors to take their investment decisions without hesitation.

But these two criteria are not always reliable, they are in some cases giving cotradictive results and accordingly they are controvertial.

Most authors think that these cases of contradiction are rare and when happen the criteria like PI, EAA, and MIRR will replace IRR and eliminate the contradiction.

Some authors saw that whenever there is a conflict between NPV and IRR the correct answer is provided by NPV alone.

Other authors presented some solutions like AIRR and AROI to solve IRR problem but most of the investors and consultants still believe in NPV and IRR as top measures to differentiate between two mutually exclusive projects considering that the cases of conrtadiction is rare and the traditional criteria like PI, EAA, and MIRR will give reliable solutions.

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