

# **The limits and the application of Internal Rate of Return (IRR) in the Concessions and Public-Private Partnerships (PPPs) in Brazil**

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## **Summary:**

There are a series of theoretical and practical questions about regulation of concessions and PPPs in Brazil, when the Internal Rate of Return (IRR) is used as an instrument of adjustment and measurement of profitability, as well as an instrument of marking of the economic-financial balance of contracts. In this way, adjusted concessions by the IRR can be inappropriate for that instrument, although it is easy to understand, cannot capture all the nuances of the cash flow of the projects. Moreover, if the cash flows are multiples, there are more than one IRR, which makes its use impractical. Alternative arrangements as the "Marginal Internal Rate of Return", whose goal is to isolate the flows of funds not originally provided in contract, can be used as a technical output, but it is still far from a proposal for regulation of the appropriate contracts. It is expected that, in the next years, other mechanisms are used to prevent the immense distortions made by regulation of the IRR.

Keywords: Internal Rate of Return (IRR) – Concession – Contracts - Cash flow - Regulation.

## **1 - Introduction.**

Regulation and control of public service concessions present theoretical and practical limits. We have seen in recent years a politicization of the debate and important decisions promoted by control bodies and, above all, by the Judiciary that

cause immense impact on profitability of these concessions and it has as reference the adequacy (or inadequacy) of using the Internal Rate of Return on these contracts.

The *leitmotiv* of deciding the Courts draws a link between the use of the IRR and the principle of Economic-Financial Rebalancing – EFR – of the contract. It means that, often, the imbalance would be a contractual remedy resulting to the maintenance and/or re-definition of IRR, in order to place it in levels that are able to rebalance the accordance. So it has been done.

It is true, as we will see, when tracing the decision about the EFR in the maintenance of IRR often have fragile economic base. The judiciary and the organs of control, when they detect the "smoke of the imbalance" (sorry for the neologism!), they point out immediately to the recalculation of the rate. This invariably brings a lot of problems for concessions, users and the Government itself.

There are measures that can be used to alleviate these deficiencies and some of them are useful as the Marginal Cash Flow and the Modified Internal Rate of Return.

Thus, it is common that investment decisions (or even judicial decisions) are taken without a clear understanding of the limits and the consequences of the application of the IRR. Insomuch that the problem arises at the root when the preparation of public notices and the definition of the referred Return Rate. Therefore, the authorities should clearly understand the definition, calculation methodology and alternatives to use of the IRR in contracts. Thus, the IRR is only used as a datum of contract, as cabalistic number and then they develop theses to justify the economic and financial recovery.

Take the well documented Judgment of TCU (*Court of Audit of the Union* - the Brazilian federal accountability office), number: TC 026.335/2007-4 that, provoked by the Supervisory and Privatization Secretariat of the Court of Auditors, examined the occurrence of financial imbalances in the concession contracts of federal highways, arising from overvalued tariffs, allegedly operating in disfavor of the users. In this case, there was an IRR originally set when its concession was granted in 90s, amounting from 17% to 24%. Years later, with the economic boom and the decrease of the "Brazil risk", the State argued that the contract was unbalanced in favor of the dealer, and it demanded a readjustment for less amount of IRR, under the penalty of allowing that the hired dealer earns extraordinary gains.

Similarly, the concessions, which have been celebrated in recent years, showed lower IRR, reflecting the positive economic position. With the deep economic crisis of 2015-16, the profitability of those dealerships will suffer concussions and certainly the readjustment of contracts via IRR will be charged administratively and judicially.

The questions are: if the Internal Rate of Return is the best instrument to obtain the return of these investments, and If the IRR can serve as a parameter for this rebalancing. It can be asked if it would fit to the Government define *ex ante* the timing of the release of the auction notice, the value of the IRR. Finally, innovations (or inventions) as the modified IRR and the marginal cash flow would be able to resolve these imperfections.

As we see, there are many doubts. Many questions still don't have a proper research on doctrine. Something has been discussed in the economic engineering area and the investment analysis, but in the field of Law, nothing further than the reproduction of old manuals.

## **2 – The Internal Rate of Return as a tool for the evaluation of profitability.**

The most popular indicator of the profitability of a project is, without doubt, the Internal Rate of Return. However, for decades, according to Kelleher and McCormack<sup>1</sup>, the books of Finance has issued warnings regarding the use of the IRR and the possibility of reinvestment of the cash flow performed by this rate, pointing out that its use may make a bad design seems good and a good project seems very good.

The authors report that a survey, which was conducted in the United States in 1999, shows that of  $\frac{3}{4}$  of CFOs tend to use IRR as they evaluate projects. Kelleher and McCormack also made an informal survey with 30 executives of corporations, Hedge Funds and Venture capital firms that showed that only 6 executives were aware of the shortcomings and problems to define profitability of projects using the IRR. Then, why do those responsible for investments of companies continue to use indiscriminately the IRR when it known its failure?

It is known that some deficiencies in the IRR are extremely technical, but the indiscriminate use of this rate can bring serious implications to the company. When the CFOs perform a contract based on the IRR, it is possible that they are doing it in very distorted calculations. A clear effect is a decrease in shareholder wealth because the project, after all, will not present the expected return. The hypothesis that the flows of intermediate cashes contained in the IRR will be reinvested at the same rate, is the major explanation for it. It's unreal.

<sup>1</sup> Kelleher, John e MacCormack, Justin. Internal Rate of Return: A Cautionary Tale. The McKinsey Quarterly. October 20, 2004. Disponível no endereço eletrônico: <http://ww2.cfo.com/strategy/2004/10/internal-rate-of-return-a-cautionary-tale/>

According to the authors, when the calculated IRR is greater than the effective rate of reinvestment of intermediate cash flow, may be unrealistic expectations regarding the annual return on investment. The implicit rule is that the company should have additional projects, also attractive and could invest the intermediate cash flows. It is seen that the assumption behind the use of the IRR is the idea of opportunity cost. It occurs, however, in most of the time, the concession projects are so specific and unique that we cannot talk about alternative projects. Therefore, the use of IRR simply doesn't make sense.

It's known, though it goes beyond the scope of this work, which is also behind the adoption of the IRR as guided by profitability control element of the concession, investment evaluation based on WACC model that embeds the possibility of the company, on the change of the opportunity cost of capital, it realign its investment portfolio to achieve its profitability. To make<sup>2</sup> that correlation doesn't make sense, because there is no alternative use to the project that is generally specific, as a general rule. Hence, because to establish an IRR control and make it static, it can enable monopolistic gains of the concessionaire.

The authors conclude that the best way to avoid the problem is simply not to use IRR as a form of decision, maybe replacing it by the modified IRR.

Anyway, 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.

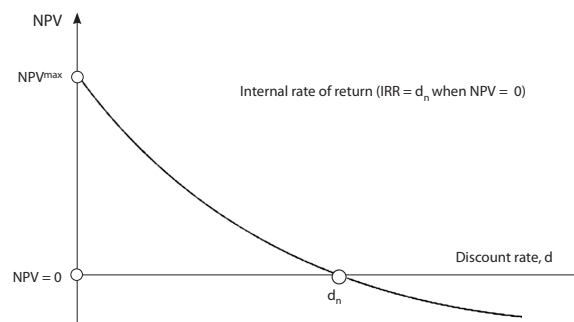
The degree of reliability of the two methods is equal. However, in general, only one of them is used to evaluate a particular investment. Typically, it is the IRR method. Because it seems to be more understandable and obvious to investors as an indicator that shows the limit of profitability of the project. In many cases, Tomasevic and Mackevicius<sup>3</sup> remind us the result both the NPV and the IRR converge to the same origin. However, the results can differ significantly in the case of non-typical investments, generating opposite results.

<sup>2</sup> BELLUZO, Luiz Gonzaga. Decisão de Investimentos, CMPC E Revisão Tarifária no Setor de Transportes Rodoviários. In CARVALHO, André Castro (Org.) – Teoria e Prática do Equilíbrio Econômico-Financeiro dos Contratos de Concessão de Rodovias: O Caso do Anel de Integração do Paraná – São Paulo: Quartier Latin, 2010. Pag 17.

<sup>3</sup>MACKEVICIUS, Jonas e TOMASEVIC, Vladislav. Evaluation of Investment Projects in Case of Conflict Between the Internal Rate of Return and the Net Present Value Methods. *Ekonomika* 2010, vol. 89(4).

Both methods are based on the cash flow of a project, and it is important to determine the outputs and inputs of resources. The NPV is based on the concept of Net Present Value and it shows the amount of income that is added to the project, in relation to payments. Thus, the NPV is equal to the aggregate cash flow for a determined period, and discounted at a given rate.

Let's see at the chart, copied from Mackevicius and Tomasevic:



In this case, the following rules are applied:

- a)  $VPL > 0$ , in this case, the investment is considered effective, in other words, the value of the project will increase during its implementation.
- b)  $NPV < 0$ , the investment will not be effective and the investor will have losses in the amount equal to the NPV.

$NPV = 0$ , this project does not generate profit or loss to the investor.

These assumptions are presented in the chart above, which shows the NPV for various discount rates. This curve has typically the downslope format. Two curve points deserve attention: the  $d_n$  point and the VPLmax one ( $NPV_{max}$  in the chart). In  $d_n$  point, point the curve intersects the x-axis and the VPLmax one when the y-axis is crossed.

$d_n$  point is the most that interests us and it means the rate at which the investor will not have gains or losses. After this point, the VPL liquid will be negative and the investor should not accept this project. This point of intersection is called Internal Rate of Return.

The intuitive idea is: If a particular investor puts money intended for an investment in a bank whose rate is higher than that of the enterprise, there would be no reason to make the investment. When the interest rate coincides with the IRR of the project, so it makes investing in the project or leaves the money applied to the Bank. They are equivalents. In other words, it would generate the same profit.

It is important to note that the IRR depends only on intrinsic factors to the project; it makes no sense use it beyond the limits of the project.

To calculate the IRR, we must match the equation of NPV to zero and it makes us find its value. Of course, the simplest way is to use the electronic calculator or an Excel spreadsheet. Mechanically, it can represent an exercise in mathematical interpolation we find a suitable number.

From the mathematical point of view, it is important to realize that the formula that calculates the NPV is a linear transformation. This means by adding one or more periods for the analysis of investments, this increases or decreases the NPV outcome without changing the results of prior periods. In the case of IRR, adding other periods could lead to changes in the direction of the curve and compromise the final result.

In the case of IRR, there is an intrinsic hypothesis that cash flow revenues can be reinvested by the value of it. This condition, however, is infrequent and the reinvestment rate varies.

Anyway, there are advantages and disadvantages of using the Internal Rate of Return for investment evaluation.

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.

Similarly, when the Government publishes a public note granting setting of a given IRR, the companies that are interested, the press, the control bodies, the society may (especially comparing with other similar projects) have a broad idea of the attractiveness of the project.

The IRR allows the comparison of projects with different levels of risk, so that a more risky project should have a higher Internal Rate of Return so that it can be accepted. The IRR also allows listing and staggering projects according to its economic viability, as well as the limit cost to borrow resources shows and it still keeps the project viable.

Despite the advantages of IRR, there are several disadvantages that can determine its adoption difficult and, in many cases, not desirable.

Firstly, it is not an absolute criterion of profitability, because it only observes the internal aspects of the project. In addition, it is highly sensitive the reliability of predictions about the entire cash flow of the project. Here I open a parenthesis: how to agree with the cash flow forecasts that were made for concessions in Brazil at the term of two or three decades. It seems illogical to anchor any decision of economic and financial balance in the IRR, when it is known that the premises on which it is based are fragile. There is no way to ensure a stable cash flow in a concession in the country, by which to regulate and to control them by IRR loses any sense.

The Internal Rate of Return can only be used when we are in front of a conventional cash flow, which means there will be only one output of funds followed by only capital inflows. In other words, there will be no change in the sign of the cash flow during the execution of the project. It is easy to understand observing again the expression that calculates the IRR:

$$TIR = \sum_{T=0}^n \frac{Fn}{(1+i)^n} = 0$$

I = Discount rate (IRR)

Fn = Cash flows during the period n

n = Number of periods

A conventional<sup>4</sup> cash flow would be one that benefitted these two aspects:

I) Disbursements (net cash outflows) that have occurred in the early years and receipts (net cash inputs) that will occur in subsequent years, featuring just a reversal of the cash flow.

II) The sum of the receipts overcomes disbursements.

<sup>4</sup>BARBIERI, José Carlos; ÁLVARES, Antonio Carlos Teixeira e MACHINE, Claude. Taxa Interna de Retorno: Controvérsias e Interpretações. GEPROS. Gestão da Produção, Operações e Sistemas – Ano 2, vol. 5, out-dez/07, p. 131-142

In the case of a conventional flow, according to Descartes' Theorem, there is only one positive root ( $x^* = 1 + i^*$ ) for the IRR equation, with attention to the condition I. The condition II demonstrates that  $X^*$  exceeds ' the unit, in other words,  $i^* > 0$ , soon there will be only an Internal Rate of Return.

In the end, the use of IRR assumes that cash flow will always be reinvested for the same fee. That doesn't happen, what makes it illogical use the IRR under these circumstances. The model of the IRR, as it was conceived and interpreted, allows inferring that the intermediate cash flows when they are positives (incomes), they are remunerated at a rate of interest equal to the IRR, whereas negative cash flows (disbursements) are funded by the same rate. As this premise is untrue, the IRR may differ substantially from the market rate and compromise all the analysis of the feasibility of the project.

Most of the times, however, we are facing unconventional cash flows, those in which alternate inflow and outflow during the time, mischaracterizing the linearity of the cash flow. As we know, the IRR calculation means in solving a polynomial equation of degree  $n$ . So, the more cash flow changes sign, the more we will have roots in the equation.

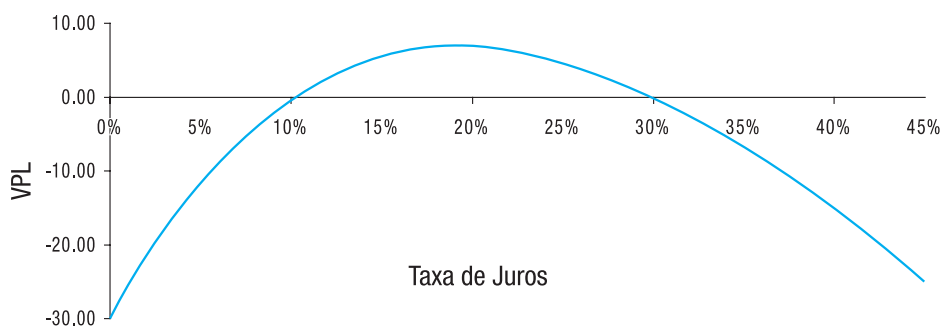
BARBIERI presents an interesting example, formulated in the following terms: *“A company has invested in a large event \$1,000,000 temporary Convention Center, by celebrating the passage of the Millennium. She profits, as a liquid result a year later, \$2,400,000. However, at the end of the following year, it suffers a condemnation that makes it compensate the Municipality \$430,000, for the cost of removing the facilities, in addition a fine of 1 million. The minimum rate set by the company attractiveness is 20% per year.”*

The NPV calculation in line with the rate of interest is given by the following formula:

$$VPL = -1.000 + \frac{2.400}{(1+i)} - \frac{1.430}{(1+i)^2}$$

$$VPL = NPV$$

If we match the equation to zero, we will find the Internal Rate of Return on investment. It can easily be seen in the case of a resolution of 2<sup>nd</sup> degree equation that will have two answers: 10% and 30%. If we adopt an interest rate of 20%, we will have an NPV of 6.94%. So, if the IRR is 30%, we should accept the project because  $IRR > NPV$ . If we chose 10% IRR, the project could not be viable because  $IRR < NPV$  (20%). How can we solve it? The chart below represents this function:



Source: Barbieri e ali

The NPV is negative for a Minimum Acceptable Rate of Return (MARR) less than 10% or above 30%, what determines that the investment should not be done under such circumstances. The investment would only be feasible if the MARR is between 10% and 30%. This seems odd! For a project with 20% MARR would be feasible, the same project would not be practicable with 5%. It makes BARBIERI conclude that: “The IRR set with the interest rate that nullifies the Net Present Value of cash flow does not represent the measure of return on investment.

From a financial point of view and according to the mathematical model of the IRR, intermediate positive flows should be applied by the IRR and the negative ones should be also funded by the same rate. If there is an abrupt reversal of sign for cash flow, all the investment (cash outflow) could be rescued by the IRR at any time during the execution of cash flow. In this case, the investor would be getting all paid by IRR and he'd be borrowing, the same project, surplus resources to the same value of IRR. It makes no sense, because, from the point of view of the company, the logic is reversed; i.e. in the case of a loan, the less interest rate is the ideal. In the case of investment logic, it occurs the opposite exactly.

In these cases, there is no way to use the IRR as a method of gauging the profitability of the Project. In addition, if there isn't a clear idea of how the cash flow of the business has been behaving over time; how to propose (and to approve) a Financial Economic Recovery based on the IRR? It just doesn't make sense and it can increase distortions.

In this case, the appropriate hypothesis is not to use the IRR for regulating and controlling the concessions. In the case of legalization of a concession contract, claiming IRR imbalance and the need to rebalance the contract, the most appropriate is, before all, to perform thorough expertise to find out the actual cash flow behavior during the analysis period.

As a result, we can observe that the IRR cannot have a static character because it is influenced by exogenous and endogenous factors. If the Financial Economic Rebalancing is done, considering the immutability of the IRR, the dealer will have

heavy losses (in case of worsening of the economic scenario) or he will receive monopolistic gains and profits above the agreed values on the market.

The decisions of the controlling bodies, and especially the Judiciary Branch, they are often taken – I repeat – misguided bases because the IRR, when treated in a static way, could not greatly reflect the real profitability of the project.

Accordingly, alternative methods are possible as the modified IRR, having as consequence the marginal cash flow. However, the major problem remains: the misunderstanding of the limits and scope of IRR and alternative methods to evaluate the return on investments. Decisions, both Court of Audit of the Union as the Judiciary based on the IRR, feature strong distortion in relation to reality, causing wrong decisions. Most of the time, it makes no sense to be regulated by IRR, even judging based on it. Also, it is absurd to politicize the issue.

Consequently, it is necessary a deeper analysis of the Economic Financial Recovery Institute in the administrative contract, by placing the debate on real bases, scientifically solid and simply not to repeat institutes that only affect the actual proposed problems. Such understanding is urgent, because one of the ways for the resumption of economic development is the recovery of infrastructure projects in the country.

### **3 – Conclusion:**

The regulation of public service concessions in Brazil by Internal Rate of Return presents a series of problems, both the use of the IRR, as an instrument of adjustment and measurement of profitability of concessions, as well as benchmarking instrument of economic-financial balance of the contract.

In this way, to regulate the IRR concessions can be unsuitable, by this instrument, although easy to understand, it cannot capture all the nuances of the cash flow of the project. Furthermore, if the cash flows are multiple ones, we have seen that there are more than one IRR, what makes its use impractical.

Finally, we have seen that mechanisms such as "marginal internal rate of return", whose goal is to isolate the flows of funds that have not been provided in contract, can be used as a technical output, but still far from an adequate regulation of the contracts.

Finally, it is expected that other mechanisms are used to prevent the immense distortions made by adjusting the IRR.

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