MODEL OF INVESTMENT ANALYSIS IN AN UNCERTAIN ENVIRONMENT

Prof. Constantin ANGHELACHE PhD.
„ARTIFEX" University of Bucharest, Bucharest University of Economic Studies
Prof. Alexandru MANOLE PhD.
„ARTIFEX" University of Bucharest
Andreea MARINESCU PhD. Student
Bucharest University of Economic Studies

Abstract

In this study, we have proposed to analyze the situation in which an investment project is developed within an uncertainty environment. In fact, no matter how many data we have available during an investment process, uncertain issues occur. An economic environment, deterministic, even if it assumes the anticipation of costs, risk elements can occur. The definition of risk itself, as uncertain element, leads to the setup of a model on whose basis all the variables should be identified, together with the correlation between those. There are cases when the economic environment is non-saturated from the monetary-financial viewpoint, and thus these moments must be identified, measured and controlled. On this topic, we have identified the indicators used for the substantiation of the investment decision in an uncertain environment. We shall define the concept of uncertain environment and the perspective of cash-flow and risks forecasts will be analyzed. We granted proper attention to the update rate of investment projects, subsequent to the occurrence of risky random variables. The study is completed with practical analysis models.

Key words: *economic environment, interest rate, uncertain environment, capital market, monetary flow, operational risk, inflation.*

Introduction

A certain or determinist economic environment implies, in the first place, that the interest rate and the future monetary flows of the investment project are known doubtless and with anticipation, meaning that the variations of interest rate, inflation rate and the exploitation risk are ignored.

Another hypothesis consists of the fact that the capital market on which the investor is operating is a perfect market, namely perfectly competitive and without taxation; no transaction costs are perceived while the interest rate is unique (the passive interest rate equals the active one). Hence, the financing decision does not influence the investment decision since all the capital resources are offered at their price of equilibrium between demand and

offer, homogenously anticipated. The hypothesis of the unique price arises from here, associating only one price with each item.

The selection of the investing variants may be done on the basis of an objective criterion, respectively maximizing the present net value. This criterion is substantiated on the down-warding yields of the opportunities of investing in the economy, irrespectively the subjective preferences of the consumer.

Under certain circumstances, the opportunities of investments of yields higher or equal to the interest rate would be privileged.

The plus of profitableness arising from the exploitation of the investments projects superior to the investment on the monetary market, would contribute to the increase of the company value. The contribution of each investment project to this supplement of value of the company is called the up-dated net value (VAN)

As noticeable out of the above arguments, the existence of a certain environment is impossible to achieve in the economic practice. The substantiation of the investments decision in a certain environment has merely a theoretic character, helping us to understand the main instruments of analysis for the investments projects.

Literature review

Anghelache, Manole and Dumitrescu (2015) study the influences of specific indicators of consumption, investments and income on the Gross Domestic Product, Anghelache and Manole (2012) focus on the investment factor. Anghelache and Anghel (2015) focus on the use of econometric models in financial assets analysis. Anghelache et.al. (2016) analyze a set of macroeconomic financial indicators. Itzhak et.al (2013) analyze the management perspective. Bloom et.al. (2007) study the impact of uncertainty on investment dynamics, Miles (2009) focuses on irreversibility and uncertainty. Gennaioli et al. (2015) develop on the investments from the viewpoint of expectations. Lambrecht and Myers (2007) research takeovers and disinvestments. Opreana (2015) approaches the investment modeling in the European Union. Stepaniak analyzes the usefulness of interactive maps in investments management.

Indicators utilized for substantiating the investments decision in a certain environment

In the frame of a company with normal functioning, there is a multitude of proposals for projects, some good, some not good; this is why it is necessary to elaborate methods allowing us making the distinction between these two categories.

Some of the projects are eliminated because of the fact that they might exclude other projects. These projects excluding each other are called concurrent projects and represent alternative possibilities of investment; if one of the possibilities is accepted, the other one must be rejected. The independent projects are those projects which costs and incomes are independent for a projects, as against another one.

There are several financial criteria (indicators) for evaluating the investments projects in a certain environment, the most significant being shortly submitted below (as this analysis does not make the subject of the present work):

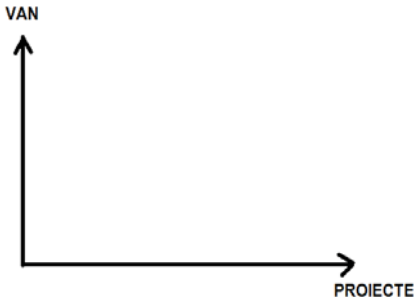
• The VAN criterion is by definition the plus of real value which the investment project promises to bring to the company accepting it:

$VAN = \sum CFDt(1+k) - t + VRn(1+k) - n - I0 = V0-I0$

The general condition of acceptance is VAN >= 0.

The graphical representation of n projects in a down-warding order of VAN

Figure 1



For the project n VAN = 0; beyond this threshold no other investment project is accepted.

Out of several projects with positive VAN the one having the bigger VAN is chosen.

• The RIR criterion (the internal rate of profitableness) – is representing the up-dating rate of the future cash-flows which might make the present value equal to the initial investment or that minimum profitableness rate which the project must bring so that it covers at least the investment.

$\sum CFDt(1+RIR) - t + VRn(1+RIR) - n = I0$

The condition of acceptance, on the basis of this criterion, is RIR >=k, where k is the profitableness rate required by the investors for the respective project.

The internal profitableness rate modified is defined as that profitableness rate which takes into account the fact that the re-investment of the future cash-flows is not achieved in fact at the project profitableness rate but at a specific rate of the company:

$I0(1+RIRM)n = \sum CFDt(1+ri)n - t + VR\ n$

In the process of selecting he projects, it is advisable to combine the criteria VAN and RIR in order to eliminate the imperfections typical for each one.

• The criterion of the recovery term (TR); this one represents the time interval out of the exploitation of the investment project when the future cash-flows would cover the initial investment:

$TR = I0/(V0/n)$

The acceptance condition is TR > n, where n represents the life duration of the investment or TR >= the "target" term, chosen by the company management.

• The criterion of the profitableness index (IP); this is calculating the efficiency of the investment of a project as against the achieved investment; there are two formulas of calculation:

$IP = V0/I0$ and, deriving from this one:

$IP = 1+VAN/I0$

The second variant is utilized for investments projects relieving cash-flows over more years (is generating the relative plus of real value).

The acceptance condition is IP > 1 and, simultaneously, maximum IP for more projects with over-unitary profitableness index.

In conclusion, we remark the fact that for one and same project, the optimum decision depends not only on the available information (the problem data) but also on the applied criterion. The decisional difficulty consists of the helplessness to make a doubtful choice of the best criterion. Generally, the criterion VAN is utilized since it is the most complete and has the most advantages.

The uncertain environment concept

The system of hypotheses governing the models developed in a certain environment makes the outcomes obtained on their basis to contain a high level of error, due to the character of theoretic optimum which they hold. In the frame of the analysis in an uncertain environment, the analysis of the investments decision is made in the frame of the same system of hypotheses (efficient market, information symmetry, neutrality against the risk, constant rate of the inflation) but eliminating the hypothesis as to the existence of the determinist, certain environment.

Being characterized by uncertainty (we cannot say exactly which will be the future value as this one is determined by more parameters valid in time

and uncertain), when evaluating the project we shall introduce the concept of risk of un-accomplishment of the theoretically calculated value (the risk that the future treasury flows are valid, of sizes and frequencies of known occurrence). Thus, a probabilistic, alleatory environment is built up, with a known variability of the conjuncture situations.

The associated probabilities have a profoundly subjective character, being generated by the behaviour at risk of the analyst, by the ratio optimism – pessimism etc., in setting up the values.

The economic situation is most of the times hard to quantify exactly; in general, it is not possible to identify all the influence factors which generate modifications in the present value of the investments project. Due to this cause, even if the values beach is a large one, it is possible that the estimation does not comprise exactly the real dimension of the value.

The forecast of the cash-flows and risk

If in a certain environment, the available cash-flows and the residual value were doubtless and VAN followed the formula:

$VAN = \sum CFDt(1+k) - t + VRn(1+k) - n - I0$

Now, we cannot talk about this certainty: the annual CFD are alleatory as well as the residual value; k is no more represented by the riskless rate only but a risk premium is considered as well (risk related to the non-achievement of the theoretically calculated value); the initial investment value is the only certain element.

In an alleatory environment, the investments decision is analysed depending on the expectation E(CFD) to obtain one or another treasury flow:

$E(CFDt) = \sum CFDit * pit$, where:

it – the number of estimated situations of the treasury flows (i), in the exploitation year (t) pit – probabilities of occurrence of the flows i in the year t.

The flow with the biggest probability of occurrence is exactly the weighted average of these flows, calculated in each year of exploitation (t). According to the normal distribution law, the expectation of the treasury flows, E(CFD), has the biggest probability to take values around the average. Thus, the probability of a square average deviation σ, as plus or minus, as against the average, counts for 68.3%, while the probability of placing the average within the interval $+/- 2\sigma$ counts for 95.44%.

The criterion for selecting the investments projects in an alleatory environment is the expectation for the up-dated net value:

$E(VAN) = \sum E(CFD)t(1+k) - t + E(VR)n(1+k) - n - I0$

The investor having an aversion at risk is interested to know whether the risk of assuming these deviations is well returned by the average profitableness of the project.

In order to identify the most adequate up-dating rate, we measure the risk and its size is given by the dimension of the dispersion, but mainly by the square average deviation: $\sigma = \sum(CFDit - E(CFDt)2 * pit)$

To the extent that the square average deviation or the standard gap of a project is lower, the project is less risky.

If two investments are submitting the same standard gap, we resort to the calculation of the variation coefficient in order to set up the risk of the projects; this is the ratio between the square average deviation and the mathematical expectation. The investment having a lower coefficient of variation is less risky.

The up-dating rate of the investments projects

In practice, one attempts to compensate the risk by choosing an up-dating rate including it: k = K=Rf + risk premium

However, there are two major disadvantages :

1. There is no coherent basis for associating a corresponding up-dating rate to each class of risk (including it objectively). A company must not utilize the same up-dating rate for projects of different risks since the risk premium which intervenes in such situations is increasing together with the risk.
2. The supplement of rate related to the risk is often erroneously added, during the investing period, the value concerning the dimension of costs related to this period is super-dimensioned. Thus, the risk associated too the project will be higher and thus the discounting rate as well will increase more than necessary; the forthcoming cash-flows up-dated to this rate will be sub-dimensioned while the investments decision may be erroneous; VAN will have a more reduced dimension as comparatively with the normal one, maybe even negative and thus it is possible that the project is abandoned, even if it is viable in real terms.

Another method to integrate the risk is that of the certain equivalences. The equivalent cash-flow is the volume corresponding to the risking one (CF') and which, in a certain environment, has the same present value (the same price = V0).

V0 = CF'/(1+k) = Cfechiv/(1+Rf), from where:

Cfechiv = CF'*(1+Rf)/(1+k)

Similarly, the equivalent size of the cash-flows from the years subsequent to the first year is calculated, which reduction is even obvious since the risk increases as the time passes. These certain equivalent cash-

flows are doubtless future incomes which an investment of risk zero would relieve (for instance, purchasing the government bonds).

Although more rational than the previous method, the certain equivalences method is by far more difficult to apply in practice.

Conclusions

Out of the study, a series of theoretical and practical conclusions were drawn, which must be taken into account in the analysis of investment achievement in uncertain environment.

The financial market is efficient: the transparency of the market and the transactions liquidation secure a very quick integration of any information on the company or the sector of activity to which it belongs in the equities market price.

Assuming that there are a certain economic environment and a non-saturated monetary market, the up-dating rate of the future incomes out of the investment is the average interest rate on this market.

The projects may be contingent or interdependent. For these projects, the choice of one of them implies the choice of the other one as well. The projects may be linked to one another in time, or through their goal. The projects of this type may be combined and evaluated as a single one project.

The condition of acceptance, on the basis of RIR criterion, is RIR >=k.

Depending on the future economic conjunctures taken into account, the values corresponding to the occurrence probabilities related to the respective conjuncture are associated.

The model thus generated is the result of combining a number of economic conjunctures, weighted with the corresponding probabilities of occurrence which may be generated either at the level of the previously recorded frequencies (the previous historical experience) or by computerizing simulation, utilizing theoretical situations possible to occur in the future.

We have seen that in a certain environment the riskless interest rate Rf was used as up-dating rate. The implicit hypothesis of an investment in an uncertain environment (more precisely, a probabilistic one) is that the up-dating rate is integrating the risk as well.

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