A BUILD-UP ALGORITHM FOR SUSTAINABLE DISCOUNT RATES PROJECTIONS

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ABSTRACT
In the context of the sustainable development the investment efficiency and optimum receive new dimensions characterized by an increased complexity, which makes the quantification of a forecasted risk level more difficult, a level based on which a correct substantiation and evaluation might be realized that should denote the decision generating a maximum performance level. The key element of the efficiency indicators' correct planning and quantification is the discount rate. The respecting of the reporting tendencies to multiple dimensions highlighted the quantification need of new investment risk factors.
Our article proposes a model for calculating the discount rate of the investment projects. The algorithm is composed out of 6 variables that surprise both classical influence factors and the interest rate or the inflation rate, but also innovating aspects that underline the implementation's sustainability degree of an investment objective in a certain country of the European Union.

KEYWORDS: *CBA (cost-benefit analysis), discount rate, investment project, panel data, sustainability.*

JEL CLASSIFICATION: *C23, C51, D81*

1. INTRODUCTION

The investment projects represent a unique objectives ensemble, intercorrelated activities and resources for reaching a predefined purpose. The Project Management Institute proposes the following definitions for the projects: "A temporary effort realized for the creation of a product or of a unique service" (PMI, 2008).
Within this complex framework, a serious dialogue between all implied factors sharing different sets of information and political objectives should be leaded by solid stimulation mechanisms for the projects' stimulation with the purpose of exceeding the asymmetry of the structural information.
The investment projects represent in fact complex, resources consuming activities ensembles, which imply majore transformations at the level of the beneficiary organizations. Moreover, the sums implied in projects, regardless of their provenience are big and very big, and the processes for attracting, managing, using reporting, monitoring etc become increasingly more complex, which imposes inclusively the existence of the specialized human resources.
Due to the raise of the projects' elaboration and implementation methodologies complexity, respectively of the costs arising thereof, the projects pass more and more in the strong organisation's sphere, with significant resources availabilities, on short and medium term.
In the same context there must be highlighted the fact that the needs of the civile society are increasingly higher, respectively the natural and anthropical disasters, the international conflicts

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consume increasingly more financial resources, all being supplied from a common fond, which automatically attracts the diminution of the resources for other needs, a fact that imposes the adopting of new assignment and usage methods, based on sustainability and performance.

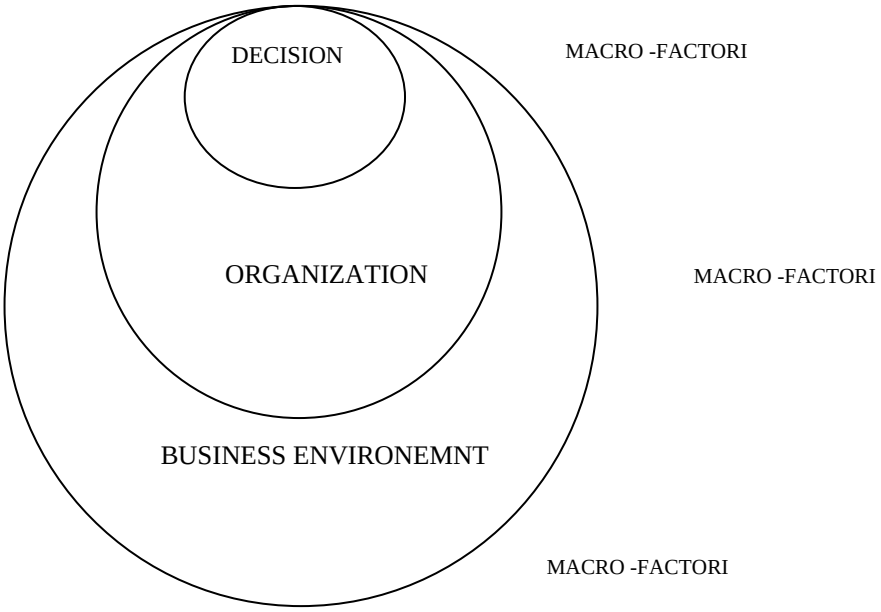

Figure 1. Influence environments of the managerial decision
Source: authors

The fast change of the global environment, the technological development and the competitive intensity are elements influencing the projects management in order to constantly redefine the establishing manner of the budget or the assigning manner of the response time, of the quality and of the projected products' characteristics.
In order to benefit of the investment opportunities offered by the national and especially international economic environment, for the obtainance of the competitive advantage in a certain context, there is imposed the study of the determinant characteristics of the respective context and of its evolution forecast.
The investment decision is strongly influenced by the specific of the business environment in which the activity of the beneficiary organization is being developed and implicitly by the arisen changes or by the upcoming ones on this level. The investment decision is significantly influenced by the provisions regarding the evolution of these factors, the projecting and evaluation being reported to a minimal rentability level imposed by the environment's conditions in which the project is being developed.
Therefore we intend to develop a model for the determination of an discount rate based on which the management might realize sustainable and realistic evaluations. The model of build-up type composed of 6 variables will be presented within this paper. Moreover we include within the article the determination of the statistic signification of each variable's influence over the discount rate, studied by means of some models with panel data.

2. BACKGROUND

The organizational performance and profitability are nowadays conditioned by permanent investments in consecutive and simultaneous projects that are mostly concurrent (Ghasemzadeh et al., 1999). Thus, the managers have to solve a decisional complex situation for the assignment of

limited resources to the projects amount with a superior contribution in the fulfillment of the organization's objectives (Cheng & Li, 2005, Medaglia et al., 2007). Making some wrong decisions in selecting the projects implies two negative consequences: on the one side the resources are consumed for the implementation of inappropriate projects and on the other side the organization loses the potential benefits of assigning the resources to the corresponding projects (Martino, 1995). Thus, the optimization of the investment decision and the correct project portfolio choice guarantee the efficient development, effectiveness and hence performance, profitability and capitalization of the implied stakeholders' efforts at the organization's level.

The evaluation and selection of the projects is a decisional problem of strategic importance underlying the studies of numerous researchers for more than 40 years. Characetised by multiple, contradictory criteria and oftenly tough to be measured (Liesio et al., 2007), the process imposes to the decider a special attention in establishing the most efficient alternative from the point of view of the different considered aspects (Mavrotas et al., 2008). The permanent interest for this subject is also reflected in the variety of models existing in the specialty literature (Heidenberger & Stummer, 1999). Hundreds of models and methodologies for the evaluation and selection of the projects are grouped in: scoring, classification, mathematical programming, fuzzy logic and AHP (Badri et al., 2001); non-numerical (the sacred cow, the operational/competitive necessity, potential benefits) and numerical (financial evaluation, financial options, opportunity costs, scoring) (Meredith & Mantel, 2010); scoring, ad-hoc, comparative, economical, portfolio, mathematical optimization and simulation (Tavana et al., 2013).

All evaluation and selection models are based on previsions. The realized previsions might be influenced both by factors depending on the one promoting the project (microeconomic level) and factors at regional, national or even international level (aggregate, macroeconomic level). These influence factors might be grouped in some major categories like this:

- economic factors
- social factors
- political factors
- institutional factors.

The potential data sources used in the estimating the costs and benefits of each project alternative might be base on information coming from:

- official statistic data
- scientific papers and studies
- market researchs
- data coming from firms (ensurance companies)
- data supplied by the market (commodities markets, firms)
- the analist's exoerience and judgement.

The institutions, authorities and organizations offering credible and useful data in realizing the cost-benfit analysis on Romania's case are firstly:

- The National Institute for Statitstics and Eurostate
- The National Prognosis Commission
- National Bank of Romania
- The International Monetary Fund
- The National Health Insurance House
- Statistics of the central and local public authorities
- Statistics of insurance-reinsurance societies
- Statistics of life insurance societies

The influence's aggregation of the micro and especially macroeconomic factors over the investment projects is highlighted in the established value for the discount rate.

The discount rate is that variable by means of which the financial flows (input or output) are expressed in the value ar the intial moment of the investment making, by taking into account the

preference for the time factors (value in time of money), respectively the assumed risk by realizing the analysed project. From this perspective, the financial discount rate is assimilated with the opportunity cost of the capital in time.

Although the discount concept is a simple one, the choice of an discount rate is a controversial subject and a real trial stone within the financial analysis in ACB. The discount rate used in the financial analysis should reflect *the capital's opportunity cost for the investor* (the state in case of the projects financed by public funds), which offers a quite subjective reference point. The establishment of the discount rate is a sensitive topic because a too high or too low level of it might modify the acceptance or rejection decision of a project. Assuming that only the projects with actualized new value should be accepted, a too high level of the discount rate might lead to the rejection of many projects (underinvestment phenomenon), thus generating opportunity costs (the "lost chane" costs). On the other side, a too low level of the discount rate would lead to the adoption of some projects that are less performant than others, probably rejected as a consequence of budgetary constraints (overinvestment phenomenon). These affirmations are certainly valid in case of the projects financed from private funds. Taking into account the characteristics specific for the public investments projects, we cannot neglect in this case the importance of the discount rate's rigorous estimation, as an essential entrance variable in the evaluation process.

Regarding the financial discount rate's evaluation, the solution accepted both in the specialty literature and in the financial practice is to consider the discount rate as being the opportunity cost of the financial resources. If the project's funding is realized by two or more sources, it is recommended to use the share of each source in the total value of the project, as an discount rate of the capital's balanced medium cost (CMPC), based on each financing source's cost. If there exist controversies in the specialty literature in estimating the proper capital's cost, the vision ragrding the evaluation of the borrowed capital's cost (performance at maturity, if it is regarding credit titles issued on long term), adjusted with the fiscal economies generated by the usage of the indebtedness as financing source.

There exist three possible approaches in the estimation process of the financial discount rate:

- the effective costs of the implied capital – for the investments financed from public funds, there might be used as a reference: the real rentability of the government obligations (the direct marginal cost of the public funds) or the real interest rate on long term afferent to the commercial loans (if the project need private fundings) or the weighted average of the two rates. This approach is very simple but might present a real disadvantage: the best alternative project might win more than the real interest rate afferent to the public or private loans;
- the estimation of a maximal limit for the discount rate value as it takes into account the profit lost from the best investment alternative. In other words, an alternative to the project's incomes is not the compensation of the public or private debt, but the profit from a proper financial portfolio;
- the estiation of a minimal acceptable rate, used as a reference: for example, a specific interest rate or a rentabilit rate from an recognized issuer of value titles in an international currency; the minimal reference is multiplied by a coefficient depending on the risk specific for the project.

For the projects financed from Structural Funds, the European Commission recommends a financial discount rate of 5% *in real terms*, as a reference parameter for the capital's opportunity cost on long term for the Member States that benefit from the Cohesion Policy – among which there is also Romania. The same financial discount rate's level is indicated in the "National Guide for the Cost-Benefit Analysis of the Investment Projects" in Romania (European Commission, 2008).

These levels of the discount rate, recommended by the European Commission do not take into account the social-economic realities in Romania. The EC recommendations regarding the usage of a unique reference value for the financial discount rate is based on the supposition that the funds

come from ordinary citizens and from the UE contributors. The different values from the reference value of 5% might be justified based on: the macroeconomic conditions specific for Romania; the investor's nature (for example, the discount rate might be higher in case of the project realized in public provate partnership, where the inclusion of the private funds might lead to the raise of the capital's opportunity costs); the sector in which the project will be realized (for example, the infrastructure projects in transports involves higher assumed risks than the investments in the rehabilitation of some buildings in the public patrimony). Thus, the usage of a single discount rate for all projects does not take into account the fact that the risks are different from a project to another. The European Commission encourages the Member States to supply their own value for the financial discount rate, that they should then constantly apply in the evaluation of their projects at national level, in order to ensure the coherence between the discount rates used for similar projects in the same region/country.

3. THE BUIL-UP ALGORITHM

3.1. Proposed model

For the determination of the discount rate there is being proposed within this paper a calculation model based on algorithms of Build-up type (Ibbotson, 2005).

The proposed model is described by the following formula:

$$a = \bar{R}_k + \pi^{+}_{R_i} + \pi^{-}_{e^*_i} + max(ri_i, rd_i) + Rm_z$$

where:

a – discount factor;

$\bar{R}_k$ - medium risk rate of the industry/activity area k registered at the European Union's level;

$\pi^{+}_{R_i}$- the country risk premium against the risk rate of the European Union;

$\pi^{-}_{e^*_i}$ - the risk premium against the sustainable efficiency e^* of the country i;

ri_i - inflation rate of the country i;

rd_i - interest rate in the country i;

Rm_z - size risk rate of the organization z.

In order to draw a clearer image of this model, the calculation algorithm is highlighted by the logic scheme presented in figure 2.

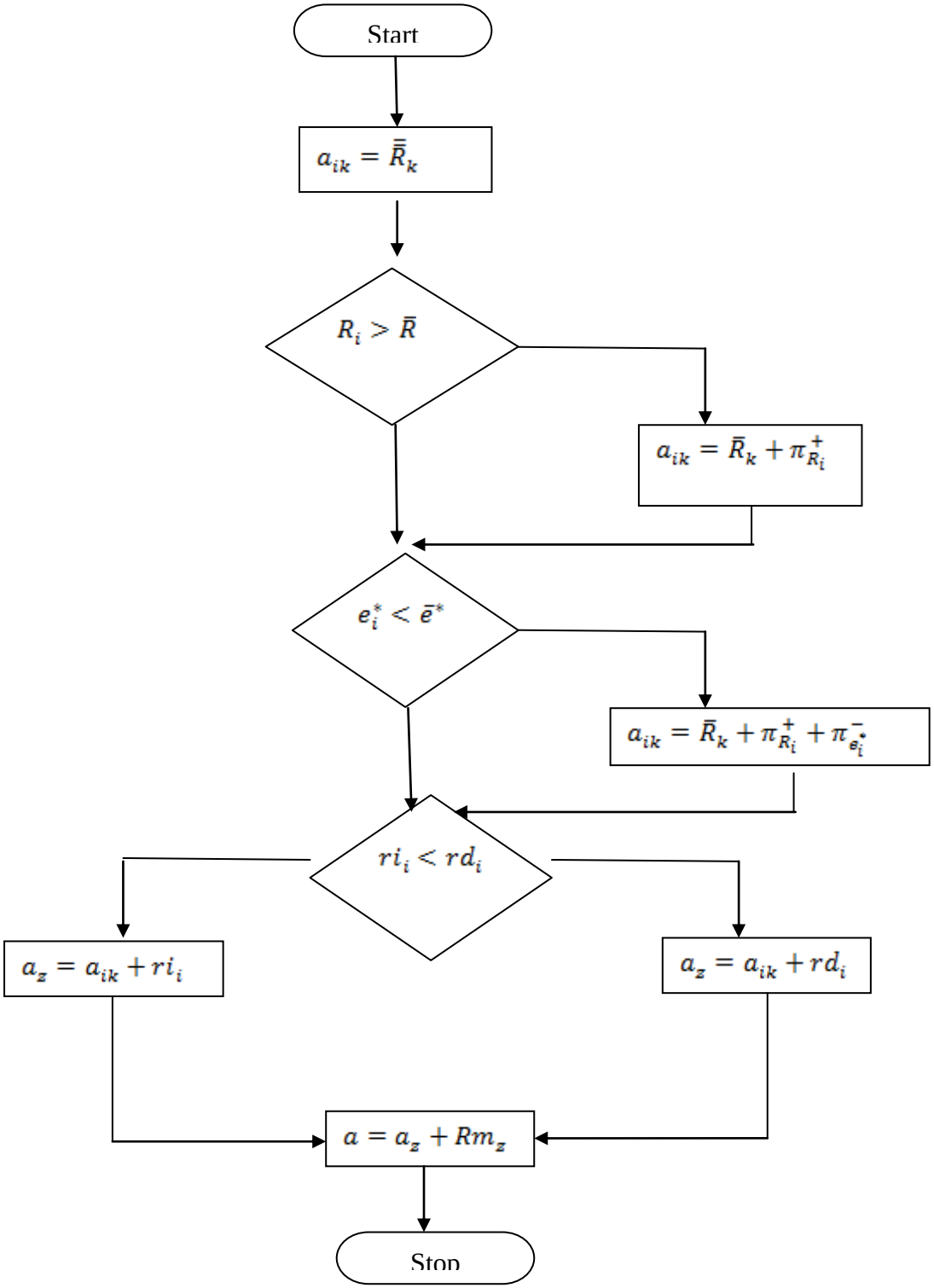

Figure 2. Logic scheme of the discount rate's calculation model
Source: authors

The risk is the alternative the individuals are most often confronting with, the idea that it represents a permanence of the human activity in general being unanimously accepted. Under these conditions it can be said that the activities with a high safety degree almost do not exist anymore, the risk notion becoming complementary with the activity one. Thus, we live in a risk's world, as Louis de Broglie (French physician, Nobel laureate in Physiks in 1929) was affirming, we have to chase the risk because it represents the key of all succeses. In this context, the risk received a very big

importance in all domains, its assuming becoming a common practice in the internal and international business environment. This is because no one risks knowing that they will lose, but they risk hoping that they will win (Iliescu, 2010).
Under these conditions, taking into account the path irreversible entered by the bond between the results of the economic activity and of the social and political environment, the analists but also the subjects directly implied in the international economic flows assign an increased importance to the concept of country risk. Under the conditions of the economic globalization, for the realization of some international investment flows under rentability conditions, there is imposed the identification and management of the risks that might appear in the receiving economied due to the particular political-economical and social conditions under which each national economy handles.
Any activity performed in the global economic environment is influenced by a basis risk, named riskless rate. If everybody runs with the same speed, we can say that we are all stand still. This safe risk rate id registered in USA under the titles of a mature capital market. The medium rate $\bar{R}_k$ has in its composition two risk categories: the general risk of the Euro zone and the medium risk of the k industry at the European Union's level. The general risk is determined as a risk premium to the global risk. According to the data bases built by teacher Damodaran (2013b), over time the risk premium of Euro in comparison with the basis rate is 0. It results thus that $\bar{R}_k$ has in its composition the risk rate of the titles in USA and the risk of the industry k in the UE. To this risk rate there will be added the country risk premium, namely the supplementary risk of the country to the risk of the Euro zone. Because the sustainable development plays an important role in the contemporary conditions, the model also has in its composition a risk rate of sustainable efficiency. Its determination is realized as a risk premium of the country's efficiency in the context of the sustainable development reported to the medium efficiency of EU-27 (Dinu, 2013).
For the complete definition of factor there will be also taken into account a discounting rate of the inflationary phenomenon. Although reference papers in the domain add up the values of the inflation rate and of the interest rate, the proposed model takes into account the maximum of the two ones. The interest rate should have the minimal value equal with the inflation rate for the justification of the deposit's benefits and thus the economical theory would indicate the inclusion in the model of the interest rate. The motivation regarding the choice of the maximum is based on the results obtained through the evolution's study and the correlation of the two rates at Romania's level, which highlight the registering of some inflation rates superior to the interest rate in certain periods.
At organizational level, the discount factor determined according to the proposed model relates to the company's size risk. Rm_z, also named size rating of the company z is being chosen by framing the indicator's value $interestcoverage = \frac{EBIT}{dobânzi}$ in the corresponding class (Damodaran, 2013c).
Thus determined, the discount rate value assigns the proper importance to the multiple risk classes implied in the development of an investment process within the actual economy's context.

3.2. Model hypothesis formulation

The model's validity is further proven by testing the hypotheses regarding the existing correlations between the proposed risk categories and the investments.

Ip.1. Framing a country in a superior risk class (reducing the risk) increases its attractiveness for supplementary direct investments.

Ip.2. Reducing the value of the registered inflation in a country sustains the growth of the direct implemented foreign investments.

Ip.3. The growth of the interest rate value in a country implies the reduction of the registered investments.

Ip.4. The efficiency of a country's investments within the context of the sustainable development influences directly proportional the directly attracted foreign investments.

Ip.5. The reduction of the industry's risk level increases the organizations' availability for realizing social responsible investments.

For the company's size risk there has not been realized the testing regarding the validity of its consideration in the model.

The proving of the formulated hypotheses has been realized by estimating the parameters of the regression model that defined the relationship described by each of them. The used data are disposed in panel matrixes whose characteristics are presented in table 1 and the afferent equations are built like this:

$$ISD_{it} = \alpha_1 + \beta_1 R_{i,t-1} + v_1$$

$$ISD_{it} = \alpha_2 + \beta_2 ri_{i,t-1} + v_2$$

$$INV_{it} = \alpha_3 + \beta_3 rd_{it} + v_3$$

$$ISD_{it} = \alpha_4 + \beta_4 e^*_{i,t-1} + v_4$$

$$ISR_{kt} = \alpha_5 + \beta_5 R_{kt} + v_5$$

Table 1. Specifications of the models with PANEL data

Tested hypothesis	Dependent variable	Independent variable	Cross-sections	Period
Ip.1.	ISD	Country risk (R_i)	27 EU countries	2001-2011
Ip.2.	ISD	Inflation rate (ri)	27 EU countries	2001-2011
Ip.3.	INV	Interest rate (rd)	27 EU countries	2003-2011
Ip.4.	ISD	Efficiency (e_i^*)	27 EU countries	2005-2011
Ip.5.	ISR	Industry risk (R_k)	8 domains	2006-2010

Source: authors

For the determination of the risk categories' influence included in the proposed model for the discount factor's calculation over the investment decision, there have been used, depending on the data availability, investment categories and direct foreign investments (% from BIP), total investments and responsible social investments (at the nominal value).

The direct foreign investments are defined as being investments realized on long term by the resident of a country in a resident enterprise of another country. The long term investments suppose the existence of some long-term relationships between the investor and the financed enterprise, which implies its considerable influence over the respective businesses leadership (OECD, 2011). The globalization, the technological transfer, the free circulation of the capitals and information obliged the organizations to assign a major importance to the attraction process of the direct foreign investments (ISD) from the perspective of their impact over the emergent economies' performances. The researches regarding the influence factors and the ISD effects are justified by the fact that they represent the main access and integration paths in the global economy and by the recognition of the reached competition level, through the reporting to the international systems. The choice of the foreign investments to the detriment of the total investments fund is justified by their

importance in highlighting a country's attractiveness that permits the estimation of the interdependences between the conditions/risks that are specific for the countries and the value of the attracted investments.
The necessary data bases for the estimation of the regression models' coefficients have been taken over for ISD, total investments, inflation rate and the interest rate from the documents published by Eurostate (2013). The social responsible investments, defined in detail in the previous chapters, highlight the implication of the world's big companies in such projects quantified in the annual reports Giving in Numbers, published by The Committee Encouraging Corporate Philanthropy (CECP, 2007-2011) for approximately 200 companies, grouped in 8 activity domains. The country risk and the industry risk are based on the evaluations of one of the most appreciated authors, who developed numerous financial analysis models of the investments (Damodaran, 2013a). And the efficiency within the context of the sustainable development refers to the indicator that was calculated and taken over from a previously realized study (Dinu, 2013).

3.3. Results of panel data models estimation

The parameter of the regression models have been estimated through the method of the smallest quadrates for panel data (GLS), with free term and explicative coefficient common for the entities included in the analysis. The models outlined based on the thus determined results are the following:

$$ISD_{it} = 65.67 - 3.22 \cdot R_{i,t-1} + v_1$$

$$ISD_{it} = 50.49 - 0.88 \cdot ri_{i,t-1} + v_2$$

$$INV_{it} = 78323.99 - 9994.807 \cdot rd_{it} + v_3$$

$$ISD_{it} = -134.42 + 1.99 \cdot e^*_{i,t-1} + v_4$$

$$ISR_{kt} = 72.54 - 4.89R_{kt} + v_5$$

Table 2. Testing of the statistic hypotheses

Statistic hypotheses	Equation validation	Errors' uncorrelation	Parameters' significance		Determination coefficient	**Model's validation**
Test / **Model**	Fisher Prob.	Durbin-Watson	t-Student Prob. α	β	R^2	
ISD vs. R_i	0.0	0.16	0.0	0.0	0.68	✓
ISD vs. ri	0.0	0.14	0.0	0.005	0.73	✓
INV vs. rd	0.0	0.1	0.0	0.0004	0.65	✓
ISD vs. e^*	0.0	0.22	0.0	0.0	0.8	✓
ISR vs. R_k	0.0	1.17	0.0	0.0019	0.63	✓

Source: authors, Stock & Watson (2003)

From the statistic point of view, the validation of the models describing the correlations specified through the formulated hypotheses do not permit the acceptance with maximal probability of inclusion of the elements considered in the proposed model for determining the discount rate. The investor's reticence for the implementation of some sustainable principles, but also the absence so far of such an evaluation model are the main explanations that constitute important limits of the application in practice.

4. CONCLUSIONS

The actual business environment imposes to the enterprises a high strictness in elaborating the strategies and a special complexity in substantiating the managerial decisions in all activity domains. Thus, the investments decision has an increased complexity degree due to the innovative models and technologies applicable in the new economic environment, to some resources with increased novelty degree and to the influence of some external insensitive factors up to the actual moment. The decisions include social, ecological and economical preoccupations and they are much more complex and interrelated than the ones in the past. The organizations and their decision support systems have to adopt procedures capable to interact with this complexity, exceeding the strict technological orientation (Courtney, 2001).
The complexity, risk and incertitude of the business environment are not totally surprised and quantified by means of the proposed model and they probably will not ever be.
If under the conditions of the complete and actualized data existence regarding the evolution of some macroeconomic indicators, the country risk might be quantified based on a multiple regression model or with PANEL data, the industry risk needs a complex and heavy to realize study that depends on the business environment through the component organizations and through their representatives, which often treat the research with indifference and they do not find the needed time for the implication in such a project. Therefore an element that should be included in the proposed model for the determination of the discount rate is the industry risk premium at the level of each country. Such an analysis might represent the scope of an entire research program that should particularize at the level of each country the risk of performing the activity in a certain domain in the context of the sustainable development.
Furthermore, the sustainable efficiency premium is determined by the country level. The model does not quantify the efficiency of realizing a sustainable investment at the level of the activity domain and it does not take into account the aspects specific for their importance and for the necessity of including elements of the sustainable development in the evaluation of projects belonging to different domains. The same previously proposed study for the particularization at the industry's level of the risk quantification models is proposed in order to continue the research.
The inclusion of supplementary risk categories, the addition of other countries and the choice of other analysis periods are also limits of the proposed model that might represent ideas for future researches.

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