ISSN-L: 2223-9553, ISSN: 2223-9944
Vol. 4 No. 4 July 2013

COUNTRY RISK PARAMETERS: INFORMATION FOR KNOWLEDGE BASE IN THE IMPLEMENTATION OF EXPERT SYSTEMS

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ABSTRACT

Since knowledge plays an important role in all economic organizations, one of the main purposes of expert systems and in general of artificial intelligence is capturing their expertise and converting them into accessible formats. The specific research problem, dealt with in a knowledge-based system is the recognition of country risk criteria and the establishment of classes of risk. This paper aims to summarize the main elements that lead to an expert system for country risk analysis. It should be noted that this approach is part of an expert system developed in the economy. The knowledge base of the expert system is presented addressing production rules developed in relation to political risk variables, economic performance, indebtedness indicators, access to capital markets, etc.

Keywords: Risk classes, knowledge, analysis models, variable, expertise, fiscal flexibility, rule-based

INTRODUCTION

First, the concept of expert systems (ES) was presented by Edward Feigenbaun showing that [2] expert systems are designed with the role of reasoning in order to solve certain problems which usually require some human expertise. Therefore, expert systems may function as viable training aid, but they should not be used as substitutes for actual instruction (practical) [7].

The literature offers other types of approach regarding the type of ES applied in economy; for example Luger discusses four areas of application of ES in the economy although, the proposed classification is somewhat confusing, since it is not clear the nature of the criteria used [6].

Later [8] believes that choosing random solutions, adopting greedy approaches, evolution of basic heuristics for finding a more advanced heuristics are just some of the approaches used in solving heuristics problems through ES.

Turban et al [13] considers expert systems as an engineering discipline in which knowledge is integrated in informatics systems to solve complex problems in various areas of economy, finance, banking, etc which normally require a high level of human expertise. Other researches made by Garcia Crespo et al. [3] have highlighted various ontology representations of knowledge in business.

Country risk analysis is an area of intense research concerns which led to highlighting the need to develop specific responses in terms of the technology sector. Achieving an expert system to analysis risk parameters implies not only research in the specific field, but also concrete needs of future beneficiaries. An expert system does not replace the specialist but it can make his work easier by directing intervention, by automating repetitive tasks and, last but not least, by allowing computerized management of all data, results and reports.

Typically, human activity is directed to achieve results, but most often these are influenced by a number of events which can affect the results expected. These events are known as risks and are uncertain in terms of place, time and time of appearance. According to the Romanian language explanatory dictionary [15] risk is defined as "possible danger, more or less predictable" but in an economic sense is defined as "likely event, losses generator, and possible danger." This shows that economically speaking, in a transaction there is the possibility that the expected wins are not gained as a result of losses due to factors influencing those transactions. Risks occur at any time of economic operations and influence both directly and indirectly. Most common classification schemes are [12]:

By predictability:

a. predictable – are generated by foreseen factors which can be removed through some measures;
b. Unpredictable – when they are generated by factors that can not be anticipated and whose limitation is difficult (earthquakes, floods, strikes).

By position:

a. intern – within an economic entity; they are related to its functions (production, logistics, human capacity;
b. extern – they are related to the extern environment of the economic entity (contractual, political, etc).

By their content and nature:

a. commercial – economic nature (price, rate of exchange interest rate, inflation rate, etc);
b. uncommercial –non-economic nature (economic blockades, natural diaters, etc).

To establish an analysis model for risk dimension it must be taken into consideration the following:

I. Variability - size of the damage, the seriousness of the consequences that may arise after the event causing the loss;
II. Cost – possible size damage that a trader incurs in financial terms;
III. Treatment - a set of techniques through which the economic entity can reduce the cost of risk.

SETTING THE PARAMETERS

Country risk arises in specialized language in 1956 with the nationalization of the Suez Canal and refers to the exposure of the losses that may occur in contractual relations with foreign partners, losses caused by events of whose production can be controlled wholly or partly by the authorities' government of the country of residence of the foreign partners [5].

Currently there are several models of analysis [9] of risk country; the most known are those proposed by BERI (Business Environmental Risk Intelligence), by the U.S. rating agencies (Standard & Poor's, Moody's, Fitch IBCA, Duff & Phelps) and by the The Economist and Euromoney magazine [1].

We will refer to the analysis model proposed by rating agency Standard & Poor's which is based on a set of variables. Classification is essential as it provides the correct orientation in knowing main issues, in establishing a fair risk class, absolutely necessary in shaping a

ISSN-L: 2223-9553, ISSN: 2223-9944
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program and in forecasting developments in every aspect analyzed. Starting from a set of criteria, there are distinguished eight categories of variables that may influence risk classes:

Table 1. Variable of the country risk model

Variables	*Analyzed aspects*
Political environment	Form of government
	Democratic participation
	Quality of succession power
	The consensus of economic policy objectives
	The degree of integration in international economic exchanges
	The security and the defense capacity of the country
Level of public debt	Public financial assets
	Indebtedness of the State
	State commitment regarding pension
Pricing	Inflation level
	Average economic interest rate
	Exchange policy
	The level of independence of central bank
The economic structure of incomes	The standard of living, income levels and access to health services
	Whether or not the existence of market economy
	Access to resources and their diversity
Flexibility balance of payments	Impact of monetary/fiscal policy on national accounts
	Structure of current account
	Structure of capital flows
Prospects for economic growth	The savings/investment project
	Rate/Structure of economic growth
Fiscal flexibility	Main budgetary constraints
	Fiscal policy discretion
	Pressure on public spending
External debt/liquidity level	The currency composition of external debt
	Importance of banking system
	History and payment incidents of extern service

Source: Standard &Poor's Rating Methodology-www.standardandpoors.com

After analyzing these variables, countries are classified into a risk class that provides an overview of financial capacity to fulfill the financial obligations according to Table 2.

Table 2. Risk classes according to Standard &Poor's

Risk class[*]	*Capacity to fulfill its financial obligations*
AAA	Extremely strong capacity to fulfill its financial obligations
AA	Very strong capacity to fulfill its financial obligations
A	Strong capacity to fulfill its financial obligations
BBB	Adequate capacity to fulfill its financial obligations: paying off debt may be influenced by certain economic factors
BB	Capacity of debtor to fulfill its financial obligations is subject to uncertainty
B	Capacity of debtor to fulfill its financial obligations is influenced by certain economic-financial factors
CCC	Capacity of debtor to fulfill its financial obligations is vulnerable, being significantly influenced by business context
CC	Capacity of debtor to fulfill its financial obligations is very vulnerable
C	Liabilities are at risk of default
D	The debtor is unable to fulfill its financial obligations on time

* Risk classes AAA-CCC may be modified by adding + or -.

Source: Voinea M. GH. – Mecanisme şi tehnici valutare şi financiare internaţionale, Ed. Sedcom Libris, Iaşi, 2003, http://www.standardandpoors.com

According to Euromoney magazine country risk uses nine criteria, each having a certain percentage in total score, as following:

Table 3. Risk country criteria after Euromoney

Criteria	*Share*	*Analyzed aspects*
Political risk	25%	- The risk of non-payment of goods/services purchased - The risk of default of loans - The risk of non-payment of amounts associated with commercial activities and of dividends - Risk of repatriated capital
Performance	25%	- VNB (GNI)/inhabitant - Results of economic projections made by Euromoney
Borrowing indicators	10%	- Total debts/PNB - Service of public debt/exports - Current account/PIB
Outstanding/rescheduled debt	10%	- The ratio of rescheduled debt and total debt
Credit rate	10%	- Nominal value are correlated with country ratings provided by Moody's, Standard and Poor's, Fitch IBCA and Capital Intelligence
Access to bank finance	5%	The share of long-term unsecured private loans, in PNB
Access to short term resources	5%	Information from OECD, US, EximBank and Atradius UK
Access to capital markets	5%	Accessibility to international markets titles
Lump	5%	For promissory notes and bills of exchange maximum period of time from issued time until maturity in primary market and from buying/selling time until maturity in secondary market

Source: Euromoney Magazine, Country Risk methodology, www.euromoney.com

ISSN-L: 2223-9553, ISSN: 2223-9944
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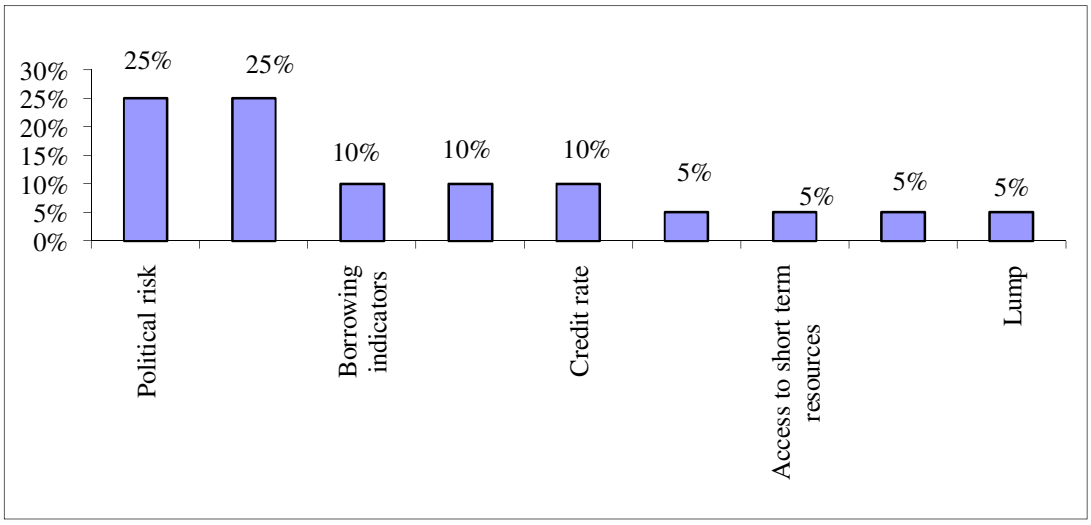
Total score is obtained by summing the 9 shares of the criteria analyzed.



Graph 1. The score of country risk

Analyzing the two analysis models it is noted that best lends the one conducted by Euromoney. The variables that are reported as percentages in establishing the score can be quantified in the knowledge base of the expert system. According to Pigford [11] knowledge acquisition is the transfer of knowledge into an appropriate computer representation.

Taking into account the 7 steps to be taken in implementing expert systems, problem description, the appeal to expertise, recourse to experts, knowledge acquisition, successive explanation between participants, definitions of inference rules, testing and validation of future expert system model to conduct an analysis of country risk is shown in figure 1.

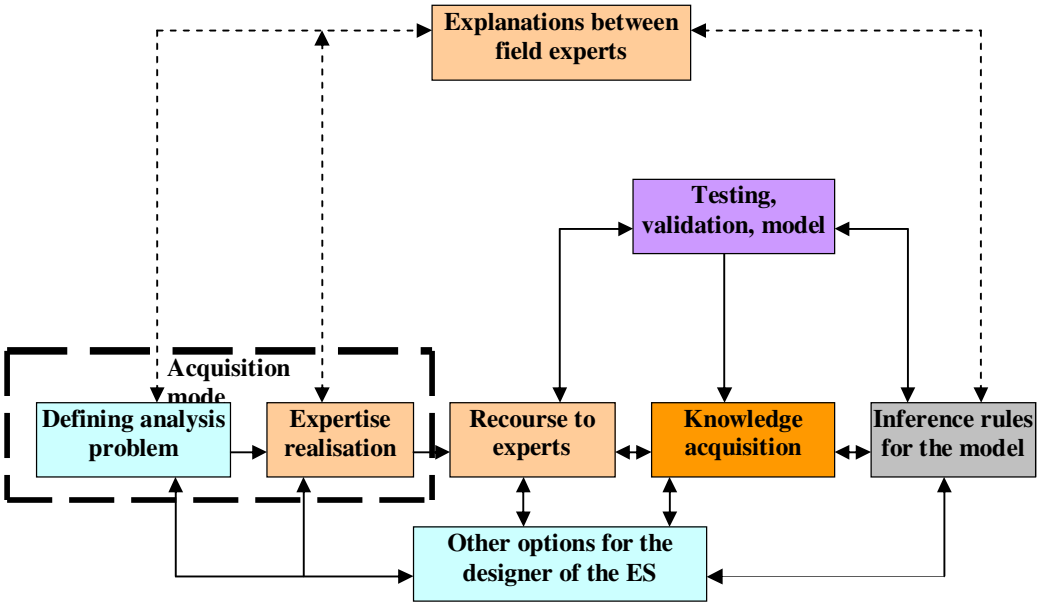


Figure 1. Steps in building an analysis ES of country risk

There are different methods of integration of information and knowledge in the knowledge base, but the main methods of representation are logical, semantic networks paintings, much knowledge representation, and the representation of uncertainty.

Formulation and composition of trees

Political risk	RP
Economic performance	PE
Borrowing indicators	IB
Outstanding/Rescheduled debt	DR
Credit rate	RC
Access to bank finance	FBA
Access to short-term resources	RSA
Access to capital markets	MCA
Lump	LP

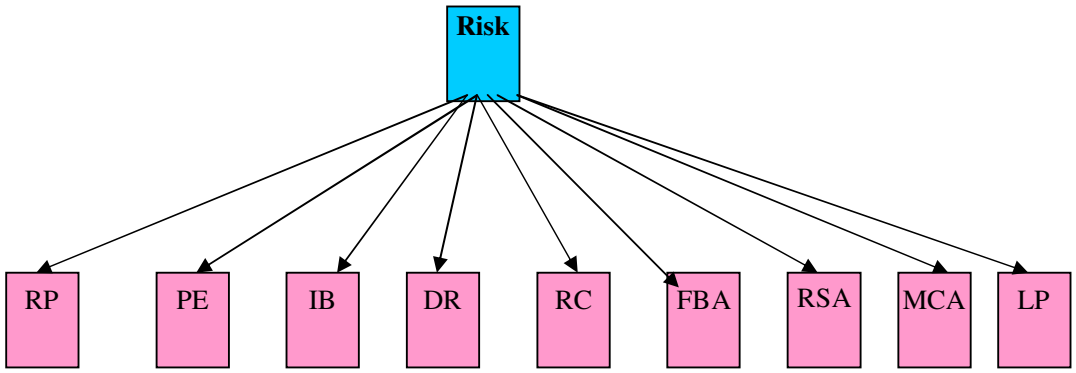


Figure 2. Risk graph on criteria

Working mechanism based on graphs that has been cited in the above figure can be assigned, as appropriate, with variables and defined expressions and with the type of rules to be defined for the proposed ES.

Any reference to any of the "2" possible analysis models to be included in the construction of an ES to estimate country risk, is the subject of the M_1, M_2 (as generic models to whom can report the designer), of a number of variables to be defined according to the specifics of each model, of the expressions that will define differently from one model to another and of production rules which will be the base of the inference engine. The generalization problem [4] set is presented suggestively in Figure 3.

As easily inferred from those shown in Figure 3, it is seen through intuitive senses that between two or more score functions advertised by two or more models of analysis there is *a relationship of major interdependence*, since all "n" models included in the analysis leaves and / or rely on the same *knowledge* base.

ISSN-L: 2223-9553, ISSN: 2223-9944
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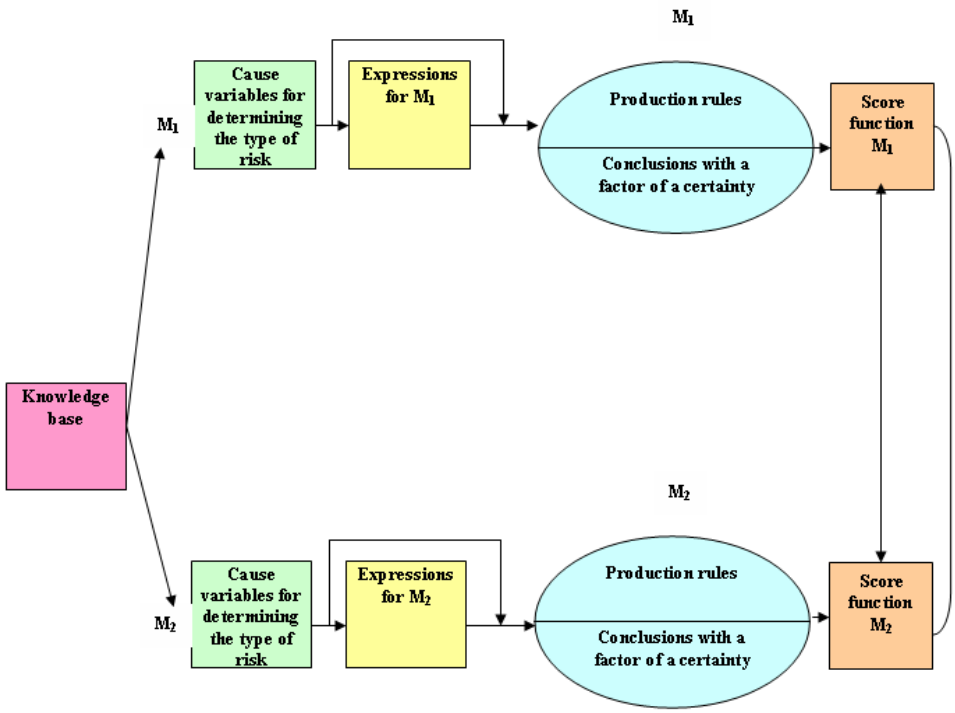

Figure 3. Tree structure of an ES based on analysis models

Inference processes are performed through a program that controls the process of reflection, which is an intelligent and cognitive part of the system. Then, it is concluded depending on the method through which knowledge has been represented in the knowledge-base, for example, by means of repeated execution of rule modus ponens called "*forward chaining*" or the repeated execution of the rule modus tollens called "*backward chaining* ".

The inference engine contains procedures for expressing reasoning processes, procedures organized as a set of instructions that involve inference rules [11]. In this case the rule-based inference engine performs the following functions: trigger rules; adds user's response in the knowledge base; infers a new fact of another rule; adds inferred fact on the basis of knowledge; compares the facts from the knowledge base to the corresponding components from rules; where there are matches, the rules are triggered; if there are other similarities, it controls whether the default order is reached; triggers the smallest number of rules necessary to solve the problem.

The inference engine works with the knowledge base until a fact from the facts base is set or until a partial fact is set if working with uncertainty [10]. Once the facts have been introduced into the facts base, the engine goes back to the knowledge base to infer other facts. This mechanism continues until the preset goal is reached or until all the rules have been triggered and it is recorded a failure.

Defining variables, expressions and production rules remain inevitably influenced by the knowledge of the system engineer; in a somewhat similar way, variables, expressions and production rules for such ES will appeal to temporary knowledge; use of temporary economic models can improve decisively functioning of an ES, by updating information, meaning score functions.

The predefined structure of the "2" models (a certain *frame* required by each model) will automatically induce certain conditionings, meaning certain advantages and disadvantages in designing an ES which aims to incorporate two or more such models. Several variables can

be embedded into a single model evaluation / quantification offering further insight on the "criteria" of the country risk.

CONCLUSIONS

This study showed the parameters to be taken into account in determining country risk in a knowledge base of an expert system. Knowledge base of the expert system can be designed based on variables causing risks. These variables ultimately lead to the establishment of classes of risk. It is reached the conclusion that *mixing between knowledge is chaotic* as it is difficult to quantify the amount in solving such problems; it is noted, however, that *the qualitative dimension of knowledge* is what distinguishes between success and failure in solving any problem.

ISSN-L: 2223-9553, ISSN: 2223-9944
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