



PERM NATIONAL RESEARCH POLYTECHNIC UNIVERSITY

The Chair of Construction Engineering and Materials Science

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An Intellectual Technology of Capital Market Modeling

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for the **Perm Winter School** 2013

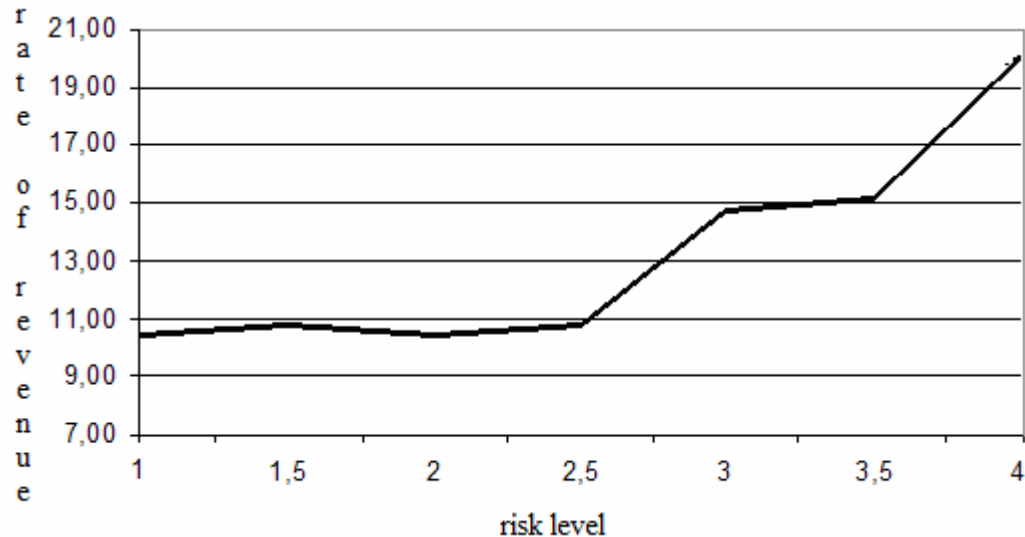
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Security Investor Boundary

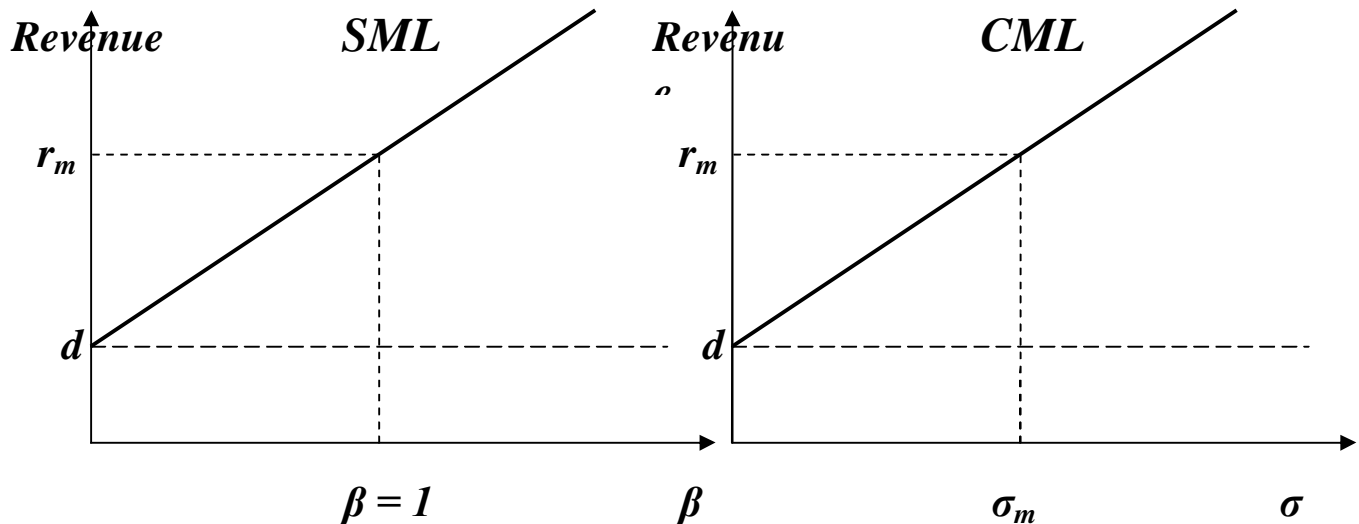
Revenue dependence on risks of investment objects





Revenue dependence on risk

Revenue dependence on risks of investment objects, for example, capital assets can be written by traditional *Security Market Line (SML)* or *Capital Market Line (CML)*:





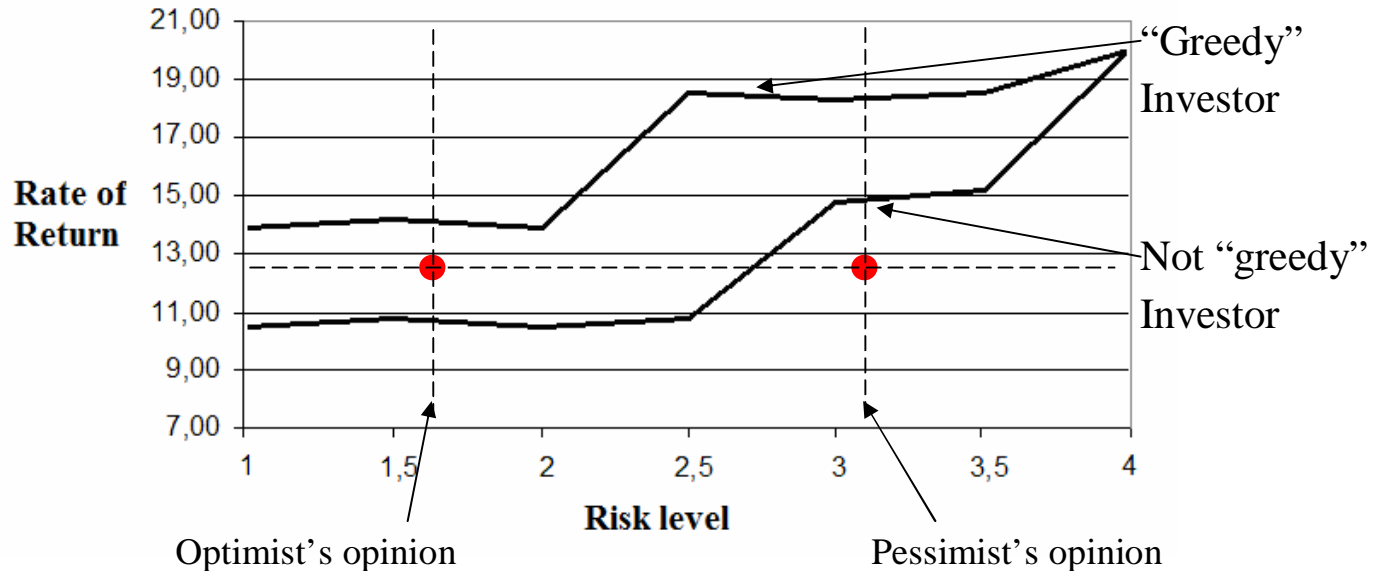
Classification of investors

Two bases for classification of Investors are **Fear** and **Greediness**

		Greediness	
		Greedy	Not greedy
Fear	Optimist	Greedy optimist	Not Greedy optimist
	Pessimist	Greedy pessimist	Not Greedy pessimist



Analysis of different Investor's decisions



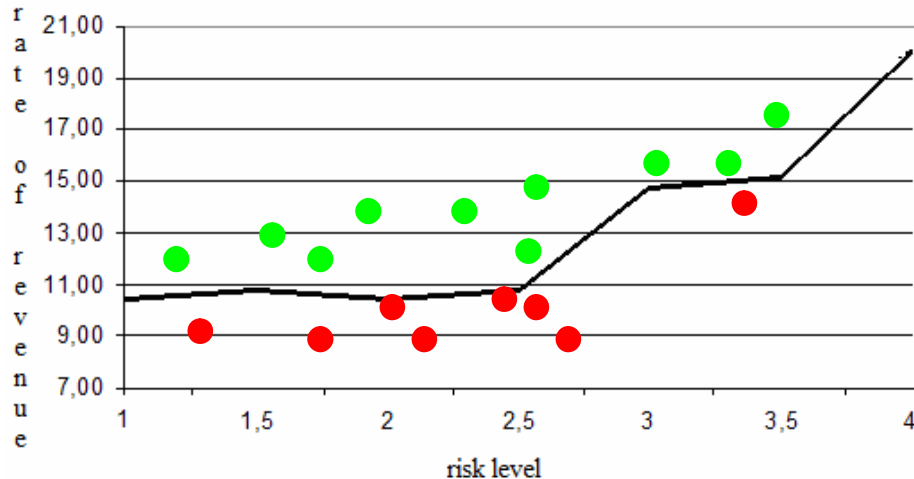


		Greediness	
		Greedy	Not greedy
Fear	Optimist	Don't agree	Agree
	Pessimist	Don't agree	Don't agree

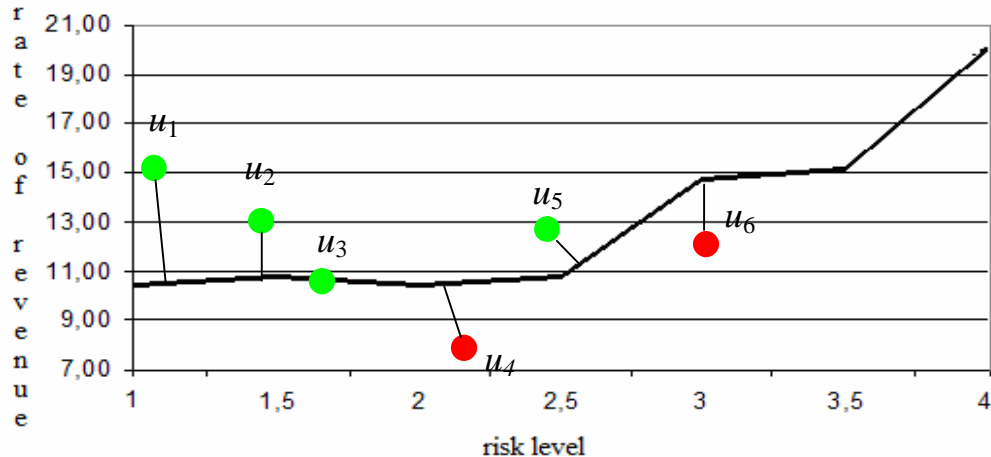


Proving of technology adequacy

Supervision of the real trading may help us for proving an adequacy of the intellectual technology of capital market modeling.



Security Investor Boundary is only a boundary of the set possible Investor actions. We need to determinate objective function for modeling Investor behaviors. Investor's interest may be written by minimal distance between Security Investor Boundary and point (risk; revenue):



$$u_1 > u_2 > u_5 > u_3 > u_6 > u_4$$



Utility function or Objective Function

Individual for i^{th} Investor utility function u of buying j^{th} investment object will be written by equation:

$$u_j^i = \min_R \left(\sqrt{(R - R_j)^2 + (SIB^i(R) - Rd_j)^2} \right), \quad i = \overline{1, n}, \quad j = \overline{1, m} \quad (1)$$

where R_j – risk level of investment object j , Rd_j – rate of revenue of investment object j , SIB^i – Security Investor Boundary individual for i^{th} investor, n – investors amount, m – amount of investment objects.

Criterion of optimization is maximum of utility function u_j^i :

$$u_{opt}^i = \max_j (u_j^i).$$



Risk factors

A risk is described by three parameters, which are called *risk factors*, according to International Project Management Association (IPMA):

- *risk event*;
- *risk probability*;
- *amount at stake*.

We call two last factors riskmaking parameters.



Human activity

Aggregation of riskmaking parameters by using matrix of convolution makes it possible to take into consideration human activity. Varsity of matrix elements makes it possible to value individual decision maker (Investor's) opinion to risk probability $X_P(P)$ and amount at stake $X_C(C)$.

Risk level R :

1 – small;

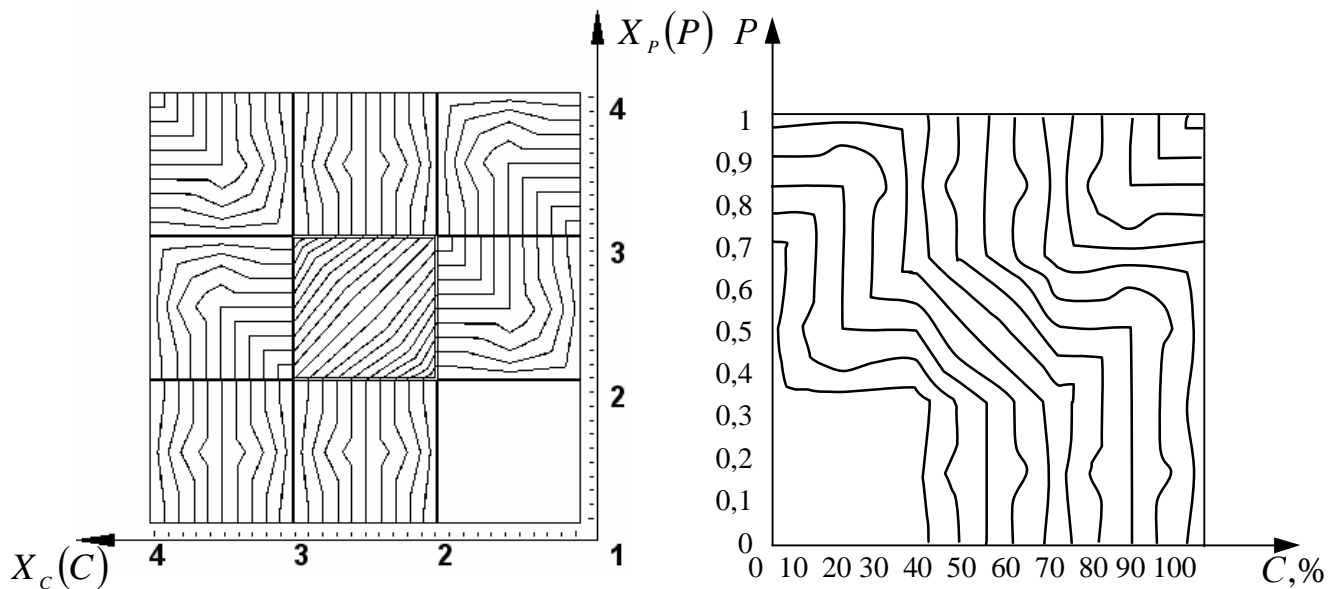
2 – medium;

3 – large;

4 – extra large.

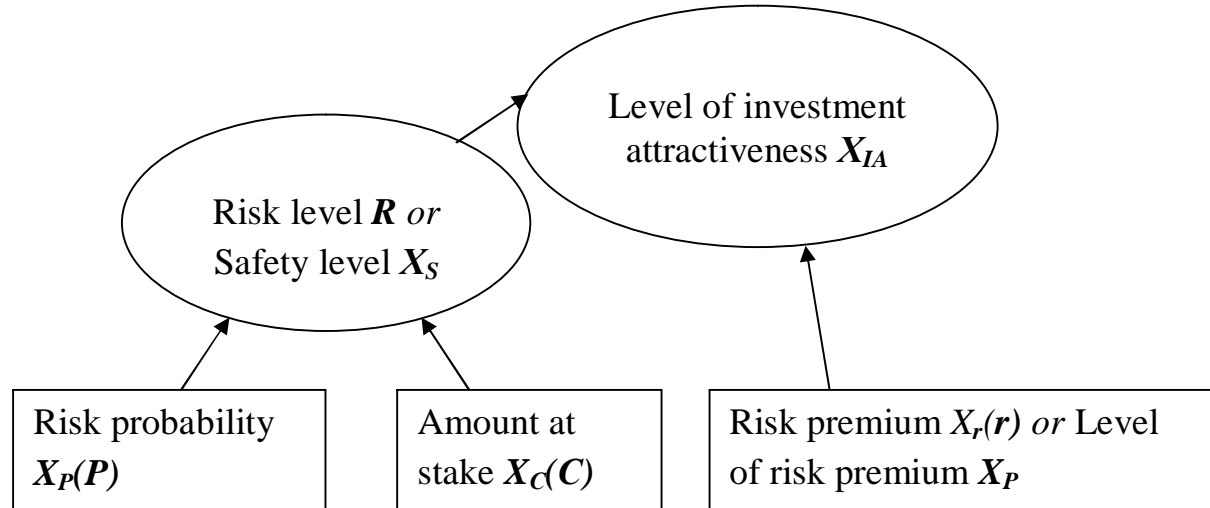
		$X_P(P)$				
	R					
		4	3	2	2	4 – large probability
		3	3	2	1	3 – medium probability
		3	2	1	1	2 – small probability
		3	2	1	1	1 – very small probability
	$X_C(C)$	4	3	2	1	
		4 – catastrophic, 3 – critical, 2 – acceptable, 1 – insignificant.				

Interpolation of discrete matrix of convolution is possible by using Zade's principle:



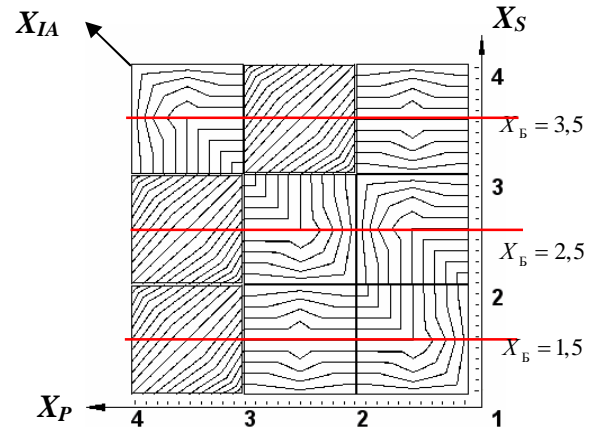
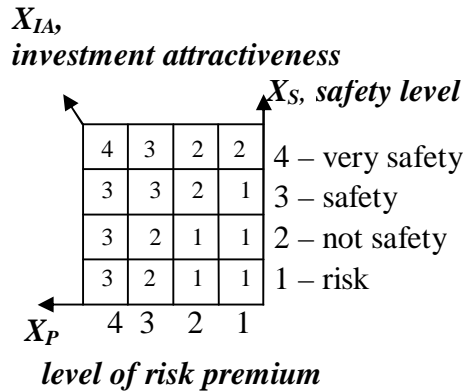


Model of investment attractiveness



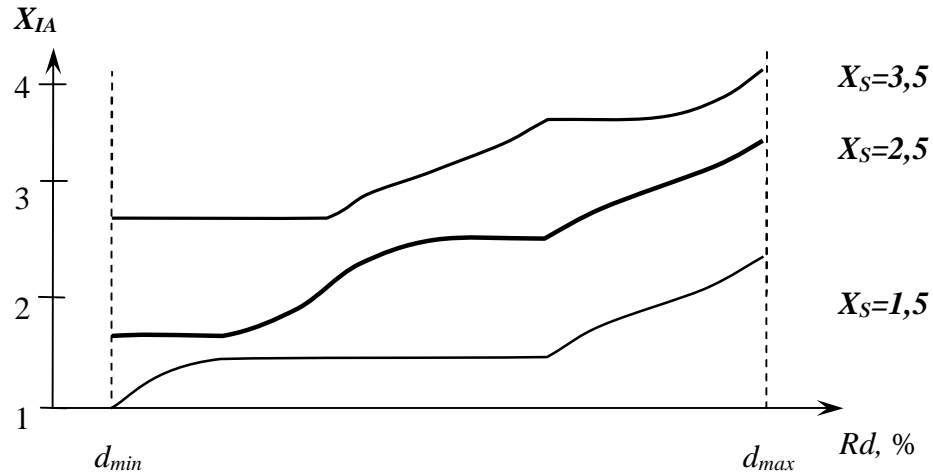


Sensitivity analysis of investment attractiveness



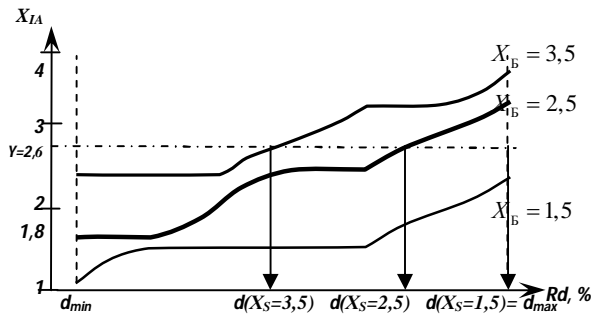


Sensitivity analysis of investment attractiveness

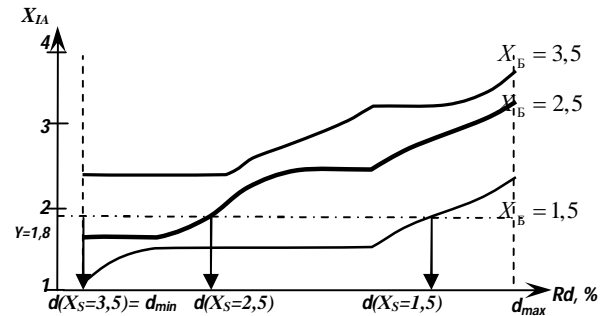




Investors with different level of claims



a)



b)

Determination of revenue rate for different levels of investment claims

$Y = 2,6$ (a) and $Y = 1,8$ (b)



Complex value in Model of investment attractiveness may be interpreted like “Investor’s interest about buying investment object” or “Investment object attractiveness for Investor”.

We can calculate value of his interest about j^{th} investment object (X_{IAj}^i) by using this Model.

If we know level of i^{th} Investor (X_{IC}^i) claims, we can subtract level of claims from interest:

$$Xu_j^i = X_{IAj}^i - X_{IC}^i \quad (2)$$

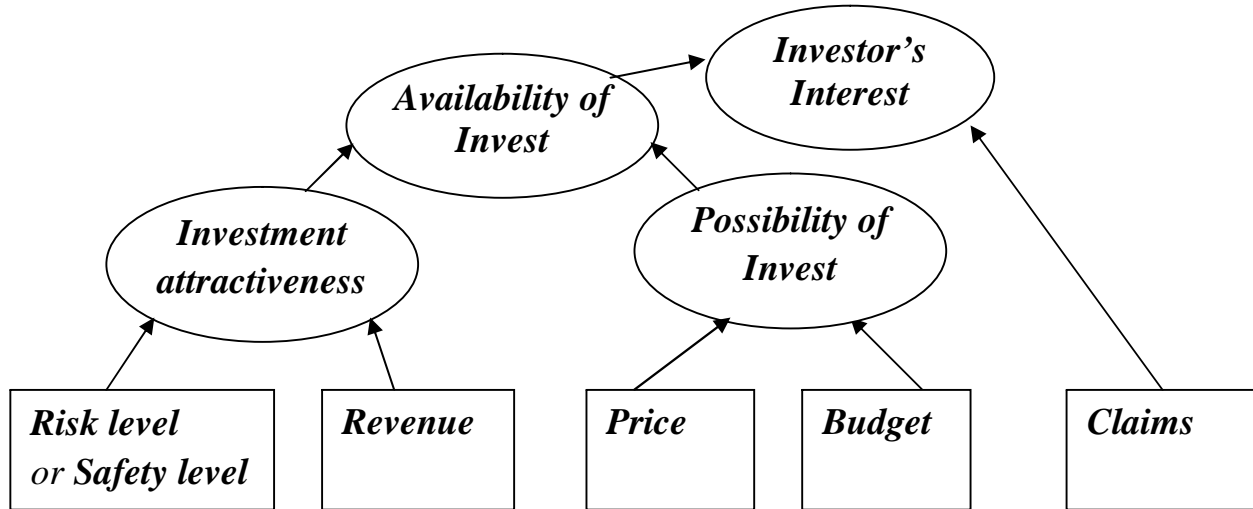
If result more than 0, so Investor may agree to invest,

If result less than 0, so Investor may not agree to invest.

Xu_j^i has same interpretation and substantial sense like utility function $u_j^i(1)$.



Full Model of Investor's preferences





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Thanks for Your attention!



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