POSSIBLE MODEL FOR THE PORTOFOLIO RISK EVALUATION

Piciu Gabriela-Cornelia

Centrul de Cercetări Financiare şi Monetare "Victor Slăvescu", Calea 13 Septembrie nr. 13, Corp B, gabriela_piciu@yahoo.com, 0722287888

Possible model for the portfolio risk, is the novelty element brought data necessary for the constitution, correction and systemic processing of risk information by the bank's specialists, such that at their basis they could appreciate the relevant values of the variables associated to the risks and determinant activities.

Cuvinte cheie: matrix instrument,modeling, portofolio risk

The financial-banking system knew, in the last decades a complex expansion process, an institutional, instrumental, and procedure diversification and differentiation. The banking products and services were multiplied and adjusted to the conditions generated by an economy oriented towards globalization, informatization and liberalization. Within this context it was registered the relative rupture of the financial-banking flows and operations from the real economy's processuality, the functional and behavioural autonomization of the financial-banking entities, as well as the induction of a volatility and un-predictibility in the evolution of the parameters and monetary and financial characteristics of the real economy. It was evidenced, in the dynamics of the financial-banking system, the extension and intensification of uncertainties and risks associated to them, which became defining characteristics of the financial-banking environment, the risks having a determination exogeneous to the financial system. The expansion of the activites of the banking institutions on the internationalized financial markets have generated and amplified and maintained, a complex network of risks, of different intensities' nature, individualized or generalized on the financial-banking markets, induced and propagated in the economic and social systems of different dimensions.

Operating with innovating and volatile products, in a strongly informatized and de-materialized environment of services, the banking and financial institutions are oftenly using instruments and procedures oriented towards high banking efficiencies and towards the constitution of a financial-banking configuration-strongly polarized, forming and directing the demand of the clients for banking products and services towards investitional combinations and „puzzles" bearers of uncertainties and risks.

The protection against risks, their effect diminution, effects measured by the losses generated, the coverage and the insurance for the financial institutions, confronted with the risks' diversity has led to the continuous improvement of the risk management, to the innovation and diversification of the management instruments.

The banking regulations, the derivative instruments, the techniques for portfolios' diversification, the norms and modalities for resource, deposits and capital protection, are ways through which these institutions are trying to control the effects, often devastating, of the financial risks impact.

The global and formal approach of the impact of risks on the banking activities, particularly on the quality, the value of the assets managed by the bank—these being the primary source of gains—and, why not, on the losses of the bank, can be achieved by applying the matrix instrument.

The matrix offers the possibility of underlining, determining, and interpreting the causal interdependencies, determinative among the risks—which affect the banking assets in an insecure economic-financial environment—and possible and expected profits from assets managed by the bank, the level of these profits being determined by the winnings or probable losses of the bank.

The matrix reveals the network configuration of these interdependencies between profits and risks, making possible the statistical presentation of the *matrix co-variations* between the assets managed by the bank and, through these, the determination of the correlation between the assets, depending on the risks simultaneously affecting them.

Establishing the Model

It is obvious that the matrix interprets the *assets portfolio* of the bank as a *unitary asset*, with a value, a profit, determined by the global and interactional impact of risks on the assets included in the portfolio, viewed as its integrative elements, their relationship with the portfolio being one of intrinsic codetermination.

The matrix model for global evaluation of the risks, with which the financial entity is being confronted, in our case the bank, takes into account the following *categories of variables*:

Factorial variables, F.V., which underline the factors generating the risks the bank is confronted with; they fall into two categories:

Exogenous variables, G.V., environmental, they are related to the quality of the economic, financial, social and political environment of *being favorable or not* to the banking activity in question, and it reflects the external factors, which are not generated and cannot be controlled by the bank;

The States, S, of these variables are dual:

P = favorable, permissive (1)

A = unfavorable, aggressive (0)

Endogenous variables, D.V., active, they underline the qualities and abilities of the bank in disposing or not of the possibilities of properly accomplishing the banking activity in question.

The States, S, of these variables are dual:

F = the bank disposes of the ability to complete the activity (1)

N = the bank encounters difficulties in completing the activity (0)

The combination of these four states results intro the following factorial states of the bank:

11 = the bank holds an excellent, permissive, and aggressive active and environmental state

10 = the bank shows a favorable environmental state, but it lacks the ability of capitalizing its environmental advantage, displaying liabilities;

01 = the bank disposes of an unfavorable environmental situation, being confronted with a hostile environment, provided that it disposes of the necessary capacity of performing its activity, displaying an adequate action situation;

00 = the bank has an adverse environmental situation and a contractive action situation. (Table 1).

Environmental variables Action variables	1	0
1	11	10
0	01	00

Table 1: The combination of two factorial variables of Matrix Model for the Portfolio Risk Evaluation:

The four factorial states form the *factorial states vector, FSV, made up by factorial coefficients, CF*, with values between 0 and 1, their total being 1:

Action variables, A.V., which reveal the *banking activities* taken into account by the model, these activities being materialized into banking products managed by the bank, as its *assets*, characterized by differential *profitability*, with its levels affected by risks. The suggested simplified model has taken into consideration the following *categories of assets, C.A.: credits, C; titles, T; derivatives, D; currencies, V; cards, R.*

The assets are characterized by two defining attributes in relation to the bank:

- *the asset importance, A.I.*, which depends on the bank's specialization, on the clientele's traits, on the available technology etc, the importance being the *intensity attribute, IA*, of the asset. The values of this attribute oscillates between 1 and 5;

- *the asset profitableness, A.P.*, depends on the conjecture, the life cycle, the economic and social environment, representing the income or loss expected by the bank after making a transaction with the asset, forming the *extensional attribute, EA*, of the asset, its values depending on the banks characteristics, being both positive and negative.

- the risk variables, R.V., underline the specific risks with which the given banking activities are being differentially confronted, the suggested model taking into consideration the following *categories of risks: C.R.*:

1. *non-payment risk, N.R.*, represents the possibility of actually not cashing in the fluxes of income expected by the bank at the time limit, also being a credit risk;
2. *rate of interest risk, I.R.*, represents the possibility of unfavorable variations in the rate of interest with an impact on the bank's performances;
3. *currency risk, C.R.*, represents the possibility that the volatility of the financial assets prices be able to affect the currency transfers and therefore the bank's profit;
4. *portfolio risk, F.R.*, represents the possibility of registering losses by the bank due to an unfavorable composition of the portfolio of owned assets;
5. *price risk, P.R.*, represents the possibility that the volatility of the financial assets of the bank be able to negatively affect the bank's profit, through induced losses.

The risk variable, as the action variable, is defined by two attributes:

- *the risk intensity, R.I.*, reveals the level of impact the risk has on the bank, on its importance for the bank, the very intensive risks having a determinant contribution in diminishing the bank's interest in that particular asset. This attribute's values will oscillate between 1 and 5;
- *the risk probability, R.P.*, underlines the possibility, the eventuality of the risk manifesting itself in the case of the given asset, the percentage values oscillating between 0% and 100%.

Determining the profitability of the assets and the probabilities of the risks involves the bank specialists' systematic, correct, and operational integration, gathering, and processing of the information on income and risks, so as to be able to appreciate the expected and relevant values of the two attributes associated with assets and risks.

Based on the six variables, states, and attributes presented, the matrix model for risks evaluation (MMRE), synthetically presented in the (table 2) chart, can be elaborated

V.A.			V.R.			V.F.
C.A.	I.A.	R.A.	C.R.	I.R.	P.R.	
C			R.N.			
T			R.D.			
D			R.V.			
V			R.P.			
R			R.F.			
$\sum$			$\sum$			

Table 2: The matrix model for risks evaluation (MMRE)

The Methodology and Manipulation of the Model

The essence of the matrix model lies in the global and punctual liaison of assets categories, A.C., with risks categories, R.C., and, based on the values of each of their attributes, as well as on the binary values of the factorial variables, the determination of an aggregated risk of the portfolio of the five assets in question is attempted.

In what follows, the methodological stages of building the matrix model, as well as the hypothetical practicality of the model, are presented.

1). The evaluation of the *factorial coefficients, F.C.*, used to determine the *vector for the factorial coefficients, VFC,* which are hypothetical in the case of the proposed model; the states vector, which applies to the ensemble of the bank's portfolio, is presented in the table 3.

factorial states	11	10	01	00
factorial coefficients	0,10	0,30	0,40	0,20

Table 3: The states vector (factorial states, factorial coefficients), which addresses the ensemble of the bank portfolio

2). The evaluation of **the *profits matrix, PM*,** of the 5 assets of the portfolio in the 4 factorial states (Table 4).

State Asset	11	10	01	00
C	X1	X2	X3	X4
T	X5	X6	X7	X8
D	X9	X10	X11	X12
V	X13	X14	X15	X16
R	X17	X18	X19	X20

Table 4: Profits matrix PM

3). The evaluation of the assets *importance vector, AIV,* meaning the importance of every asset, evaluated on a scale from 1 to 5, for the bank: *AIV =(i5 i2 i3 i4 i1)*

4). The *assets value matrix, AVM*, in its 4 states, is determined by the multiplication of AIV by PM, the matrix cell, AVC, underlining the value of each asset in each factorial state: AVM = AIV x PM

5). The risks-assets interaction allows us to develop a first matrix, the *identification matrix, IDM,* which underlines the existence, represented by *, or the non-existence of the impact of risk on the asset, this matrix selecting, identifying, and enumerating the individual risks which affect the assets portfolio, the matrix presenting itself as follows: Table 5.

VA VR	C	T	D	V	R	$\sum$
RN	*	*	*		*	4
RD	*	*	*	*	*	5
RV		*	*		*	3
RP		*	*		*	3
RF		*	*	*		3
$\sum$	2	5	5	2	4	18

Table 5: Identification matrix IDM

The matrix underlines the fact that, from a total of 25 possible individual risks, PIR, the portfolio is affected by 18 risks, IFR, the intensity of the impact being measured with the aid of the *infliction rate, IR.*

$$rf = \frac{RAF}{RIP} \times 100$$

The analysis shows that the most frequent risks are the rate and the currency risks, with 5 *points of infliction* each, and the most affected actives are the credits, with 4, and the titles, with 5 points of infliction.

6). The matrix of probabilities in risks associated with assets, MPA, is drawn with j representing the assets in columns, and, on the rows, is stands for the probabilities of associated risks. The filling in of the matrix cells starts from the matrix of identification, the numbers in the matrix cell, N.P., representing the difference between the 100% certain situation, and the possibility of risk occurrence, R.P., according to the

identification, the evaluation of probability being either subjective, based on experience, flair or expert consulting, or empirical, objective, based on the history of probabilities proper to other banks, the banking system etc. In order to obtain the risk probability, R.P., a subtraction is done as follows: P.R. = 100 – N.P.

For example, in the case of credits, C, the probability of risk for the rate of interest, RI, is 65%, the corresponding cell in the matrix having the value of 35% = 100% - 65%. In the table 6, an hypothetical situation of this matrix is presented.

Risc / Activ	C	T	D	V	R
P(RN)	Y1%	Y2%	Y3%	Y4%	Y5%
P(RD)	Y6%	Y7%	Y8%	Y9%	Y10%
P(RV)	Y11%	Y12%	Y13%	Y14%	Y15%
P(RP)	Y16%	Y170 %	Y18%	Y19%	Y20%
P(RF)	Y21%	Y22%	Y23%	Y24%	Y250 %

Table 6: The matrix of probabilities of the risks associated with the actives

$$\sum_{i=1}^{5} k_i = 1$$

i = risk

7) The *vector of risks intensity, VRI,* is evaluated; the elements of the VRI vector represent the *intensity coefficients, k*, with values ranging from 0 to 1, according to the bank's perception of risks, these coefficients being specific to each bank, with the definition rapport being:

8) The *matrix of the risks impact, MRI*, is determined, in association with the portfolio assets, by multiplying VRI by MPA:

9) The *matrix of the risks portfolio, MRP*, is determined by multiplying AVM by MRI.

The cell of the MRP matrix underlines the conventional value of each of the 5 portfolio risks, in each of the 4 factorial states, which we call the *value of the state risk, VSR*.

10) The portfolio's expected values of risk are determined, being called the *expected value of risk, EVR*, as an average of the values of state risks, according to the following formula:

$$\overline{EVR} = \frac{\sum_{s=1}^{4} VSR_s}{4}$$

Apply the formula to the 5 categories of risks.

11) Determining the deviation of each VSR from EVR, thus obtaining the *median deviation of risks, MDR*, for all risks and states, according to the MRP matrix, deviations which form the *median deviations matrix, MDM*, presented below: $MDRis = VSR_{is} - EVR_i$

Where I = the risk, s = the factorial state.

12) The *squares of median deviations of risks, SMD*, are determined by elaborating the *matrix of squares of median deviations, MSD*.

$$SMD = (MDR)^2$$

13) The *variation* of each category of risks which affect the portfolio, $\sigma^2(R)$, is determined by adding up the SMD of every risk according to the following formula:

$$\sigma^2(R_i) = \sum_{s=1}^{4} SMD_{is}$$

14) The intensive variation of the portfolio, IVP, is determined by adding up the results form multiplying the risks variations, $\sigma^2(R)$ by the risk intensity coefficients, k(R), according to the formula below:

$$IVP = \sum_{i=1}^{5} \sigma^2(R_i) \times k_i$$

15) The *standard portfolio deviation*, $\sigma(PF)$, is determined.

16) The *portfolio risk, PFR*, is determined by dividing the portfolio deviation by the number of the risks.

$$RPF = \frac{\sigma(PF)}{5}$$

The models for the selection of efficient portfolios have the crucial benefit of objectively assessing the curve of investment opportunities (the efficient frontier) in risky assets. This is the «production» curve which the financial market can offer to the capital investors.

It can even be stated that this curve is objectively characterized by decreasing efficiency. The marginal ratability rate decreases as the risks assumed are higher and higher until they reach the maximum limit, when the rate becomes equal to zero. Beyond this «saturation point» of the risk, the marginal profit rate becomes negative and makes the continuation of the investment irrational.

Bibliografy

1. Dinescu, C. , Atanasiu, V., *Matematici pentru economişti*, Bucureşti, Editura Didactică şi Pedagogică, 1995;
2. Ghosh, Sukesh, *Econometrics, Theory and Application,* New Jersey, Prentice Hall, 1991;
3. Kolb, R. W., Rodriquez, R. J., *Financial Management*, Cambridge, Blackwell, 1996.