PRACE NAUKOWE
Uniwersytetu Ekonomicznego we Wrocławiu

RESEARCH PAPERS
of Wrocław University of Economics

Nr 371

Inwestycje finansowe i ubezpieczenia – tendencje światowe a rynek polski

Redaktorzy naukowi
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Summaries

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REDUCED FORM OF THE STANDARD APPROACH FOR OPERATIONAL RISK FOR ECONOMIC CAPITAL ASSESSMENT

Summary: The paper addresses the construction of the standard approach for calculation of the operational risk. We present procedure for the modification of the business lines charges and composition for operational risk assessment to be applied for economic capital assessment. The method is based on the identification of the scope of activities and their returns on equity together with grouping the activities to business lines. We propose the application of the factorial analysis for the business line identification. The empirical testing was performed on the Polish broker-dealers market. A sample consists of 34 entities and represents 62% of the market in terms of number of entities. The financial statements for periods ended 2010 and 2009 were taken into consideration. The total financial statements included in the sample were 84 yearly observations.

Keywords: brokerage houses, controlling, economic capital, capital requirements, business lines, factor analysis.

1. Introduction

While making revision of the Basel Accord the Basel Committee on Banking Supervision (hereafter the Basel Committee) enlarged the former applied credit and market risk with the recommendation on the operational risk[1] [Banking Committee 2004].

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[1] The operational risk defined as ''[...] risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. This definition includes legal risk, but excludes strategic and reputational risk.''

The Basel Committee proposed three approaches to the risk measurement: Basic Indicator Approach (BIA), the standardized approach (SA) and the advance measurement approach (AMA). The BIA and SA were the methods based on the fraction of the gross income, while the AMA allowed for the development of own model subject to the coverage of the yearly operational risk exposure with a confidence interval of 99.9%.

Among different risk exposure on the market, the investment companies in Poland are at most exposed to the operational risk. Operational risk represents the highest rate in term of the percentage of the total capital requirement [Urząd Komisji Nadzoru Finansowego 2013].

The aim of this paper is to present an alternative form of operational charge calculation to standard method for II pillar application. The analysis is based on the profitability of the activities. The activities are grouped into coherent business lines and the charge parameters are estimated. The presented method subject to that method application is feasible with the standard calculation packages. We challenge the possibility of the different lines allocation providing the estimation of the parameters are triple deviation from the return mean of the new lines.

To the authors' knowledge there was not such research conducted on the Polish market.

The paper is structured as follows: section two provides the literature review on the discussion about broker-dealers market. The third section deals with the methodology and controlling support tools. The fourth section provides the results. The fifth section summarizes the conclusions.

2. Literature review

BIA and SA models are intellectually simplified thus in contrary to AMA they do not provide the insight into the operational risk drivers. This characteristic of BIA and SA provides little help for the risk management process [Chapelle et al. 2008]. One of widely used variants of AMA is based on the loss distribution approach which is well applied in insurance. The implementation of AMA pays attention to such issues as the incorporation of external losses to model [Frachot, Roncalli 2002], copula construction for both frequency and severity distribution [Chavez-Demoulin et al. 2006] risk allocation procedures in case of the financial groups or syndicates' [Staszkiewicz 2011].

Our former research in the area of the operational risk focused on the isolated issues like the limitation of the double entry reporting system [Staszkiewicz 2012] or capital impact [Staszkiewicz 2013]. The issue seems not to be raised by others while the discussion on the Polish broker dealer market is conducted mainly on technical accounting and organization issues [Aleksandrowska 1998; Drewiński 2007; Dziuba 2002; Werwińska 1996], the implementation of the electronic channels [Chmielarz 2004; Chmielarz 2002] or capital requirement from the bank perspective [Cicirko

2009]. This paper is focused on the possibility to construct the alternative standard approach measurement for the broker dealers market. The solution is customized for the small and medium size companies. The requirement on that market is to provide the solution based on the ready available analytical tools. This requirement satisfies the postulate for the reasonable capital expenditures into IT development [Chomiak-Orsa 2010].

The method is presented under the assumption that the data source should be maintained as prescribed in the accounting legislation. This assumption is derived from the general business environment and legal requirements. Thus the working hypothesis of this research is:

H_a: There is a market specific set of business lines to be aggregated for the operational risk standard approach.

3. Methodology

The matrix of the licensed activates (L) was weighted with the return on equity matrix (R) using the transposition matrix (T) to obtain the weighted activities with return on activities (W) matrix.

Thus:

$$\mathbf{W = LxTxR}$$

where:

$$\mathbf{W}_{n,m;} \ \mathbf{L}_{n,m} \ \mathbf{T}_{k,\ m;} \ \mathbf{R}_{m,n}$$

n – number of observations (financial statements), m – number of licensed activities; k – number of return ratios.

The correlation analysis upon **W** was applied to identify the uncorrelated variables and the set of highly correlated variables.

The **W** matrix was analyzed with the principal components factor [Stanisz 2007, pp. 165-181, part III; Panek 2009, pp. 175-182]. The set of correlated variables included in **W** was reduced with the cutoff of eigenvalues above 1^2. Such a reduced set of variables was verified against the business lines used for the operational risk standards method calculation (Capital Adequacy Directive requirement).

The activity line of the specific broker dealer was reconciled to the broker-dealers activity register held by the Polish FSA as of 22 October 2012. It was assumed that the changes to the register scope for the period to two reporting periods (2010 and 2009) were immaterial. The categories disclosed in the register were treated as the variables representing the activities lines of a broker.

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[2] The application of other criteria did not influenced our findings.

Based on the financial statements the return on equity was calculated on the specific accounting disclosure section. The following formulas were used:

(RoE) Return on Equity = Net result/Equity

(RoE_{MA}) Return on Main Dealers Activity to equity = Result on Dealers Activity/ Equity

(RoE_{IN}) Return on Instruments to equity = The sum of results on instruments at fair value through the profit or loss, available for sell and held to maturity investments/ Equity

(RoE_{OR}) Return on other operational result to equity = Other operational result/ Equity

(RoE_{FI}) Return on financing to equity = Result on financing/Equity

The following conversion was used for the linkage between the scope of activities and ratios:

Table 1. Transformation key for activities[3]

RoE_{MA}	1 Transfer, 2 Execution, 4 Management, 5 Advice, 6 Offering, 7 Underwriting, 9 Storage, 11 Structure,12 M&A,14 Analyses
RoE_{IN}	3 Own account, 10, *
RoE_{OR}	15 Standby
RoE_{FI}	13 FX, 16 Derivatives

Source: own presentation.

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[3] Variables definition: 1 – Transfer – art. 69/2/1; 2 – Execution – art. 69/2/2 – the execution of the orders referred to in Art 69.2.1 for the account of the customer; 3 – Own account – art. 69/2/3 – the acquisition or disposal for the broker's account of financial instruments; 4 – Management – art. 69/2/4 – the management of portfolios including one or more financial instruments; 5 – Advice – art. 69/2/5 – investment advice; 6 – Offering – art. 69/2/6 – offering financial instruments; 7 – Underwriting – art. 69/2/7 – the provision of services under standby underwriting agreements and firm commitment underwriting agreements or the execution and performance of other similar agreements on financial instruments; 8 – MTF – art. 69/2/8 – organising an multilateral trading facility; 9 – Storage – art. 69/4/1 – the storage or registration of financial instruments, including keeping of securities accounts and cash accounts; 10 – Loans – art. 69/4/2 – giving loans to finance transactions in one or more financial instruments, if the transaction is effected through the intermediation of the investment firm giving the loan; 11 – Structure – art. 69/4/3 – advising companies on capital structure, corporate strategy and other matters related to such a structure or a strategy; 12 – M&A – art. 69/4/4 – advisory and other services relating to the mergers, demergers and acquisitions of companies; 13 – FX – art. 69/4/5 – providing foreign–exchange services where these are connected with investment services, as provided for in Art 69.2;14 – Analyses – art. 69/4/6 – the preparation of investment analyses, financial analyses and other recommendations of a general nature relating to transactions in financial instruments; 15 – Standby – art. 69/4/7– additional services related to standby underwriting and firm commitment underwriting; 16 – Derivatives – art. 69/4/8 – conducting the activities specified in art 69.4.1–7 and art 69.2, related to the underlying instruments of derivatives specified in art 2.1.2.d–f and art 2.1.2.i.;17 – * – Base instruments of derivatives specified in art 2.1.2.d–f and art 2.1.2.i. The articles are based on the Act on Trading in Financial Instruments of 29 July 2005, No 183, Item 1538, status as of 2010 (No. 211, item 1384).

The **T** matrix became a zero-one matrix for the application of a specific ratio to a specific scope of activity line. The values one denotes the application of the ratio to the activity, while values zeros denied such a relation.

Out of the entire market (54 companies) of the broker-dealers entities (as of 22 October 2012) the companies with licenses granted after 2010 were excluded. After that restriction a random sample of the entities was selected. The sample consists of 34 entities and represents 62% of the market in terms of the number of entities. Both consolidated and unconsolidated financial statements for the periods ending in 2010 and 2009 were taken into consideration. The total financial statements included in the sample were 84 yearly observations. All entities constituting the Polish broker--dealers market are allocated to small or medium size entities.

4. Results and discussion

Basic text was without indentation. The calculations were preformed with the application of Statistica and Gretl software [StatSoft 2011; Cottrell, Luckett, "Jack" 2012]. Table two shows the result of the correlation analysis.

In the tested sample the following activities were not presented: MTF, FX and Derivatives. The following variables were not significantly correlated with the others: (3) Own account, (10) Loans, (11), Structure, (15) Standby, (17) *. Loans are significantly correlated with Own account (0.47). Structure is negatively correlated with Own account (–0,23), while Own account is highly positive and significantly correlated with*.

Table 2. Variables correlation matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Transfer	1																
2	Execution	**0,92**	1															
3	Own account	-0,15	-0,14	1														
4	Management	**0,51**	**0,43**	-0,04	1													
5	Advice	**0,58**	**0,48**	0,02	**0,72**	1												
6	Offering	**0,8**	**0,87**	-0,01	**0,44**	**0,41**	1											
7	Underwriting	**0,77**	**0,79**	-0,01	**0,44**	**0,54**	**0,74**	1										
8	MTF								1									
9	Storage	**0,83**	**0,92**	**-0,24**	**0,25**	**0,29**	**0,79**	**0,65**		1								
10	Loans	0,03	0,03	**0,47**	-0,05	0,06	-0,03	-0,04		0,03	1							
11	Structure	0,18	0,12	**-0,23**	**0,55**	**0,39**	0,04	-0,01		0,11	0,06	1						
12	M&A	**0,79**	**0,81**	0	**0,4**	**0,36**	**0,95**	**0,71**		**0,73**	-0,03	-0,09	1					
13	FX													1				
14	Analyses	**0,97**	**0,91**	0,01	**0,52**	**0,59**	**0,82**	**0,79**		**0,81**	0,03	0,12	**0,8**		1			
15	Standby	0,02	0,01	0,02	0,1	0	0,07	0		0,02	0,01	0,04	0		0,08	1		
16	Derivatives																1	
17	*	0,17	0,17	**0,5**	0,11	**0,23**	0,09	0,12		0,05	**0,95**	0,07	0,1		0,17	0,01		1

Bold represents significance at $p < .05$.

Source: own calculation.

Table 3. Variables excluded from the factor analysis

	Means	σ	3	10	11	15	*
3 Own account	0,03	0,13	1,00				
10 Loans	0,01	0,06	**0,47**	1,00			
11 Structure	0,10	0,24	**−0,23**	0,06	1,00		
15 Standby	0,00	0,05	0,02	0,01	0,04	1,00	
*	0,01	0,07	**0,50**	**0,95**	0,07	0,01	1,00

Bold represents significance at $p < .05$.

Source: own calculation.

The set of following variables was selected for the factorial analysis: 1 – Transfer, 2 – Execution, 4 – Management, 5 – Advice, 6 – Offering, 7 – Underwriting, 9 – Storage, 12 – M&A, 14 – Analyses. The eigenvalues of correlation matrix is presented below:

Table 4. Factors eigenvalues

Factor No.	Eigenvalue	% Total	Cumulative	Cumulative
1	6,50	72,26	6,50	72,26
2	1,24	13,73	7,74	85,98
3	0,43	4,73	8,16	90,71
4	0,35	3,86	8,51	94,57
5	0,22	2,45	8,73	97,02
6	0,16	1,76	8,89	98,78
7	0,04	0,49	8,93	99,27
8	0,04	0,47	8,98	99,75
9	0,02	0,25	9,00	100,00

Source: own calculation.

Factor one and two together represent 86% of total variability in the set. Both factors have the eigenvalues above one. Factor one, based on factor – variable correlations, represents Transfer; Execution, Offering, Underwriting, Storage, M&A and Analyses. The composition of variables indicates an unobserved broad scope of activities. This broad scope of activities might be described as "transmission". Factor two is strongly correlated with Management and Advice, and broadly represents "assets management" line of business. Other factors did not link significantly to the activities. The simplicity of the methods applied provided the evidence for the possibility of the construction of the method for risk controlling without the need for the implementation of the advanced IT solutions.

The structure of the standards method for the operational risk monitoring is delivered under the assumption that within each business line any business activities correlation is equal or close to zero (A1). Thus the variance of independent variables will be the sum of variances. Another assumption is that within each business line business activities have common distribution (A2) thus average variance and average standard deviation of the mean is:

$$V(\bar{X}) = V\left(\frac{x_1 + x_2 + ... + x_n}{n}\right) = \frac{1}{n^2}\left[V(X_1) + V(X_2) + ... + V(X_n)\right] =$$

$$= \frac{1}{n^2}nV(X) = \frac{V(X)}{n}$$

and standard deviation is:

$$\sigma(\bar{X}) = \sqrt{\frac{V(x)}{n}} = \frac{\sigma(x)}{\sqrt{n}}\sqrt{\frac{V(x)}{n}} = \frac{\sigma(x)}{\sqrt{n}} \text{ [Hellwig 1980, p. 114].}$$

In addition, assuming that losses within band 2σ are covered by normal run of operation the additional provision should be for the losses 2σ to 3σ, while losses above 3σ should be covered with bankruptcy procedures and risk management. For the on-going well managed risk an entity should provide one standard deviation[4]. Thus the reclassification of the scope of activities to new lines based on the factorial analysis is shown in the table below.

The 3xσ column actually indicated the estimated parameters for the aggregated business lines of the reduced model. Assuming the normal distribution of returns, and the stationary of the process generating returns, the parameters might fulfil even the I pillar of requirements. The proposed estimation might be downsized with the equity available for events within the company risk appetite. Nevertheless the proposal relates to the economic capital instead of capital requirements indicated with the standard method. It should be noted that principal factors analysis requires the normal distribution, however it is reasonably stable and is not violated.

The proposal actually reduces lines to three and "stand by" and "other" can be treated together due to the limited number of observations and actually no significant presence on the market. In terms of the mean by line analysis the set could be reduced to a two dimensional object. The line own management should be managed separately while the transmission and assets management could be included into the broader risk management system. Due to their insignificant nature "stand by" and other activities could be rather treated as insignificant risks lines and tested occasionally for their significance to an organization. The evident merit of the above solution is its simplicity of implementation. The actual data stream is based on the

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[4] It is not necessary with the condition of AMA to set up the risk value as the 99.9% quartile of the losses distribution less the expected losses. However, it constitutes a pragmatic simplification.

Table 5. Revision of business lines according to the factorial analysis

Business line	Variable No	Means	Std.Dev.	Var	Mean	Avg St Dev	3xσ
Own account	10 Loans	0,008	0,064	0,004	0,040	0,190	0,571
	11 Structure	0,101	0,239	0,057			
	(*)	0,010	0,070	0,265			
Transmission	1 Transfer	0,143	0,336	0,113	0,116	0,124	0,371
	2 Execution	0,132	0,332	0,110			
	6 Offering	0,097	0,361	0,130			
	7 Underwriting	0,085	0,276	0,076			
	9 Storage	0,146	0,297	0,088			
	12 M&A	0,08	0,35	0,12			
	14 Analyses	0,13	0,33	0,11			
Asset	4 Management	0,125	0,292	0,085	0,116	0,193	0,580
management	5 Advice	0,106	0,253	0,064			
Standby	15 Standby	0,00	0,05	0,00	Too insignificant to judge		
Other	8 MTF						
	16 Derivatives						
	Other container						

Source: own calculation.

verified accounting records, while there is no need for the IT capital expenditures and implementation project. The integration of the accounting records with the calculation based environment allows for the risk monitoring on the daily basis. Actually the method does not require any application of the business intelligence solution to be operating. In addition the data stream has a legally prescribed format and is subject to the annual audit procedures to a significant extent, therefore the year-end quality of data is certified with the materiality precision. Further discussion on the standard method efficiency is pursued by Iwona Chomiak-Orsa and Piotr Staszkiewicz [Chomiak-Orsa, Staszkiewicz 2014].

5. Conclusions

The application of the factor analysis for the reallocation of activities towards business lines does not reveal significant additional lines, thus taking the cost benefit approach and the lack of potential additional values into account the entities tend to apply the BIA. However the BIA application imposes an inadequate requirement on the profitability from the point of view of the majority of company stakeholders, which is not supported with the real risk profile on the market. There is a slightly better transposition of the risk matrix for the operational risk, which could be applied

solely as the economic capital measurement model. The proposed approach might contribute to the smooth increase of the risk assessment quality within organization without either relevance on oversimplified methods or incurring burden for the maintenance of the internal control system for the advanced measurements methods.

When judging upon the results it should be underlined that: the available population is short in term of the time span due to the late implementation of the Basel II in Poland. The generalization of the results from the small and homogenous local market is subject to the target market characteristic. While arriving of the revised model, strong assumptions on activities distribution and independence were applied. There is some subjectivity at arriving at the transposition matrix and application types of return, which might constitute a field for further study.

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ZREDUKOWANA FORMA METODY STANDARDOWEJ DO OCENY KAPITAŁU EKONOMICZNEGO

Streszczenie: Artykuł przedstawia modyfikacje metody standardowej dla celów oceny ryzyka operacyjnego. Przedstawiona została procedura identyfikacji linii biznesowych oraz współczynników narzutu. Proponowana metoda jest oparta o analizę czynnikową, identyfikację zakresu działalności oraz ocenę zwrotu z kapitału dla poszczególnych czynności podmiotowych. Na podstawie analizy czynnikowej proponujemy inną agregację zakresu działania do linii biznesowych. Model został skonstruowany na podstawie 34-elementowej próby podmiotów z rynku firm inwestycyjnych w Polsce. Próba obejmuje 62% liczby podmiotów na rynku. Analizowane były sprawozdania finansowe z lat 2010 oraz 2009, całkowita próba sprawozdań obejmowała 84 obserwacje. Zaproponowano zredukowaną formę metody standardowej dla celów szacowania kapitału wewnętrznego.

Keywords: domy maklerskie, kontroling, kapitał ekonomiczny, wymogi kapitałowe, linie biznesowe, analiza czynnikowa.