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INTER-INDUSTRIAL VALUE MIGRATION

Dariusz Siudak
Institute of Social Sciences and Management of Technologies
Lodz University of Technology
e-mail: dariusz.siudak@p.lodz.pl

Abstract: In this paper there is discussed value migration from the perspective of all economic sectors. It was introduced the method for measuring the sectorial value migration and the algorithm for classification with respect to three stages value migration model. The value migration measurement was conducted employing multivariate comparative analyses and in particular linear ordering to construct a synthetic variable of development. On the basis of the proposed measure, the ranking of value migration development and classification of sectors to the particular phases of value migration processes were delivered.

Keywords: value migration, synthetic variable, industry

INTRODUCTION

Value migration is defined as the shift in value-creating forces [Phillips 2012, p.36]. The degree of realization of the companies' goals aimed at value creation for the shareholders causes its migration between individual companies and industries [Szczepankowski 2007, p. 36]. Hence value migration analysis can be carried out in an aggregate way at the level of individual industries.

The analysis of the value migration process can be performed using the three stages of value migration model, proposed by A. Slywotzky in his theoretical framework [Slywotzky 1996, p. 46-59]. The essence of the model is the assumption that every company can be in one of the three stages of value migration [Siudak 2001, p. 195], whose short description is provided in table 1.

Table 1. Description of the individual stages of value migration

Phases of value migration	Description
Inflow stage	Limited competition, high increase in market share, high profitability.
Stability stage	Competitive stability, stable market share, stable margins.
Outflow stage	Competitive intensity, declining sales, low profits, competences, resources, talent, and customers leave at an accelerating rate.

Source: own based on [Slywotzky 1996, s. 50]

The purpose of the article is a classification of the industries based on the presented three stages of value migration model and the value migration analysis in the relation company-industry. The study includes all companies quoted on the Warsaw Stock Exchange in 2007, 270 companies in total. A division into separate industries is based on the industry classification proposed by the Warsaw Stock Exchange and documented in the official bulletin „The Main List of the Warsaw Stock Exchange" [2007]. The number of companies assigned to the individual industries is provided in table 2.

Table 2. The number of companies assigned to the individual industries

Industry		Number of companies
1	Building industry	22
2	Developers	9
3	Power industry	5
4	Finance-other	19
5	Financial industry	16
6	Retail	17
7	Wholesale	21
8	Hotels and restaurants	5
9	Computer science	25
10	Construction materials	12
11	Media	12
12	Chemical industry	22
13	Wood and paper industry	7
14	Electromechanical industry	15
15	Light industry	10
16	Metal industry	14
17	Food industry	18
18	Telecommunications	7
19	Services	14
Total:		270

Source: own work based on The Main List of the Warsaw Stock Exchange [2007]

METHOD OF THE INDUSTRY VALUE MIGRATION ANALYSIS

The measurement of the value migration can be performed by adopting the linear ordering method, constructing an appropriate synthetic variable based on three independent variables acting as stimulant [Siudak 2013b]:

1. Share in the economy migration balance

$$\text{SHARE IN THE MIGRATION BALANCE} = \frac{\Delta MVA_i}{\left|\sum_{i=1}^{n} MVA_i\right|} \quad \left(\sum_{i=1}^{n} MVA_i \neq 0\right) \qquad (1)$$

where: MVA_i – market value added of i company (i=1, …, n).

2. Share in the industry migration balance

$$\text{SHARE IN THE INDUSTRY MIGRATION BALANCE} = \frac{\Delta MVA_i}{\left|\sum_{i \in I_s} \Delta MVA_i\right|} \quad \left(\sum_{i \in I_s} \Delta MVA_i \neq 0\right) \qquad (2)$$

where: MVA_i – market value added of i company included in s industry, ($i \in I_s$, $i=1, \ldots, s$).

3. Change MVA/K

$$\Delta(MVA/K) = \left(\frac{MVA}{K}\right)_T - \left(\frac{MVA}{K}\right)_{T-1} \qquad (K \neq 0) \qquad (3)$$

where: K – book value of invested capital.

Market value added (MVA) is expressed with the following formula [Steward, 1991]

$$MVA = V - K \qquad (4)$$

where: V – gross market value.

Both categories – market value added and invested capital – on which independent variables are based, are additive. Hence the measurement of the value migration can be carried out among companies as well as in an aggregate way at the level of individual industries.

To measure value migration process at the industry level, market value added and invested capital were aggregated separately for each industry.

The construction of the synthetic variable requires that the following parameters are determined: (1) a system for weighting variables, (2) a variable normalization method, and (3) an aggregation function. The influence of the individual variables on the investigated process was expressed with differentiated weights, whose values were as follows:

- share in the economy migration balance – 25%,
- share in the industry migration balance – 25%,
- change MVA/K – 50%.

The variable normalization was carried out with the following equation [Siudak 2013b]:

$$z_{ij} = \frac{x_{ij}}{\max_i \{x_{ij}\} - \min_i \{x_{ij}\}} \quad (\max_i \{x_{ij}\} - \min_i \{x_{ij}\} \neq 0) \tag{5}$$

where: z_{ij} – normalized value of *j* variable for *i* company,
x_{ij} – value of *j* variable for *i* company.

The aggregation was carried out employing the pattern method which used weighted coefficients and was based on Euclid's distance

$$d_i = \sqrt{\sum_{j=1}^{m} w_j \left(z_{ij} - z_{0j}\right)^2} \tag{6}$$

where: d_i – value of the synthetic variable in *i* company,
w_j – weighted coefficient of *j* variable (*j*=1, 2, …, *m*),
z_{ij} – normalized value of *j* independent variable in *i* company (*j*=1, 2, …, *m*; *i*=1, 2, …, *n*),

between the analysed objects and an element which is an anti-pattern (lower development pole for the parameters above working as a stimulant) – determined by the relation

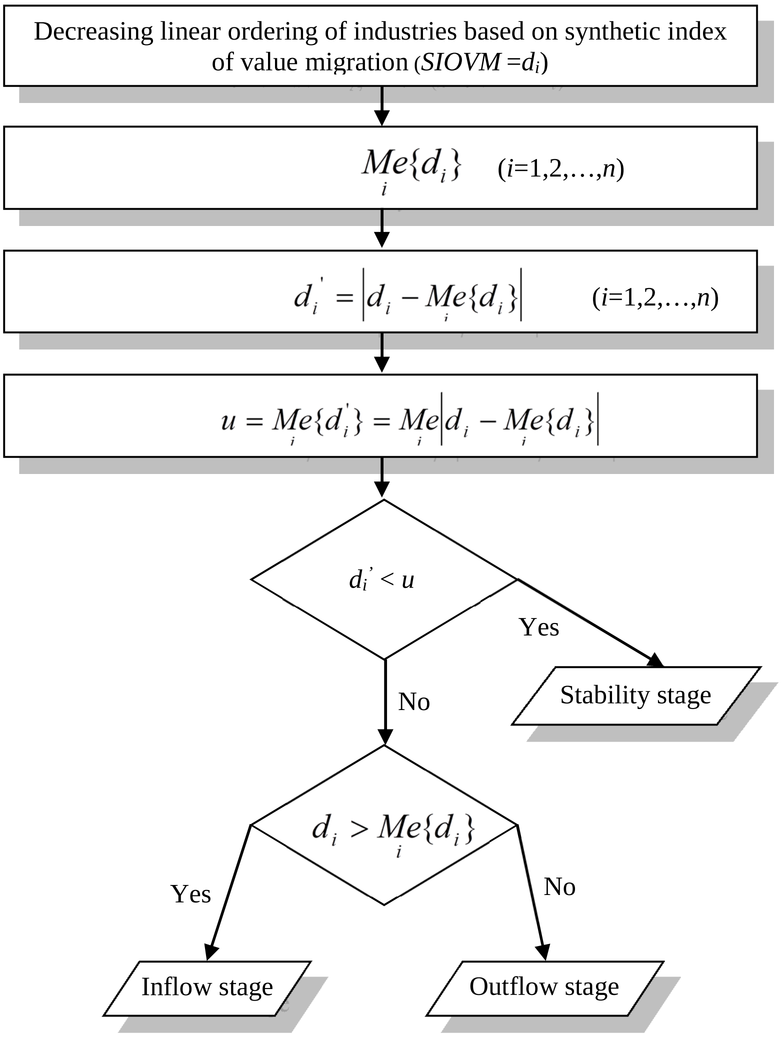
$$z_{0j} = \min_i \{z_{ij}\} \tag{7}$$

The constructed synthetic variable was named the synthetic index of value migration (*SIOVM*). Its values fall within the range ⟨0÷1⟩. The construction is based on the concept of the taxonomic measure of development introduced for the first time by [Hellwig 1968].

Linear ordering of industries in relation to the synthetic variable is non-growing. Lower values of $SIOVM_i$ correspond to a lower level of value migration. Remarks on the ways of creating synthetic variable can be found in the following studies: Hellwig [1968], Gatnar, Walesiak [2004], Grabinski, Wydmus, Zeliaś [1989], Witkowska [2010], Jaworska, Kożuch [2012], Łuniewska, Tarczyński [2006], Łuniewska [2008], Malina [2004], Młodak [2006], Nowak [1990], Ostrowska [2007], Panek [2009], Pociecha, Podolec, Sokołowski, Zając [1988], Walesiak [1996], [2006], and Zeliaś [2000]. The problem of the normalization of independent variables is addressed in the works of: Kukuła [2000], [2012], and Pawełek [2008].

The grounds for synthetic variables (abbreviation *SIOVM*) with regard to the rationale for choosing: diagnostic variables, applied system of weights, methods of normalization and aggregation can be found in Siudak's work (2013a).High estimates of the discriminatory property of the synthetic index of value migration (*SIOVM*) using the measure analysis (*G*) were provided in [Siudak, 2013a, p. 154-168]. The description of the measure (G) can be found in the following studies [Pociecha Podolec, Sokołowski, Zając 1988], [Nowak 1990].

Figure 1. Algorithm of the classification of the analyzed objects in relation to the three stages of value migration



Me - median

Source: based on D. Siudak [2013a, s. 162]

As diagnostic variables contain outliers, there cannot be applied standard procedures for analysis of the considered set using available methods of cluster analysis. The application of median approach in the presented algorithm of classification makes the classification robust.

RANKING AND CLASSIFICATION OF INDUSTRIES IN TERMS OF THE DEVELOPMENT OF VALUE MIGRATION

Table 3 presents the ranking and division of the analyzed industries in terms of the development of value migration.
The number of industries belonging to the stability stage is 9. In 7 industries value migrated to 3 other industries – respectively in non-growing order of *SIOVM* – DEVELOPERS; POWER INDUSTRY; MEDIA.

Table 3. Ranking and division of industries into three stages of value migration

Threshold value (u)		Median d_i			
0.2395		0.5658			
Industry		$SIOVM = d_i$	d'_i	$d'_i \rightarrow u$	Migration stage
1	Developers	0,9434	0,3775	Larger	Inflow stage
2	Power industry	0,9241	0,3583	Larger	
3	Media	0,8326	0,2668	Larger	
4	Financial industry	0,6988	0,1330	Smaller	Stability stage
5	Retail	0,6268	0,0610	Smaller	
6	Chemical industry	0,6268	0,0609	Smaller	
7	Metal industry	0,6062	0,0404	Smaller	
8	Wholesale	0,6040	0,0382	Smaller	
9	Food industry	0,5665	0,0007	Smaller	
10	Hotels and restaurants	0,5658	0,0000	Smaller	
11	Electromechanical industry	0,5377	0,0281	Smaller	
12	Building industry	0,5145	0,0513	Smaller	
13	Telecommunications	0,3263	0,2395	Equal	Outflow stage
14	Services	0,1892	0,3767	Larger	
15	Construction materials	0,1772	0,3886	Larger	
16	Light industry	0,1626	0,4032	Larger	
17	Finance-other	0,0727	0,4931	Larger	
18	Wood and paper industry	0,0693	0,4966	Larger	
19	Computer science	0,0195	0,5463	Larger	

source: own calculations

What follows is a verification of the hypothesis for the equality of means of the synthetic variable $\left(\overline{SIOVM}\right)$ among the three classes of industrial value migration using one-way analysis of variance (one-way ANOVA). Before performing the analysis of variance, this method's assumption of equality of variances in groups is tested. Lavene's test for equality of variances provides the following result: $F(2, 16)=1{,}516$; $p=0.249$, which implies that the variances in the individual groups are equal at the level of significance $\alpha=0.05$. This conclusion is confirmed by the test statistics: (1) Hartley's $F\text{-}max=3.435$, (2) Cochran's $C=0.615$ and (3) Bartlett's

Chi-square=2.546; *p*=0.280 (the variances in the three sets are equal at the level of significance α=0.05).

The formal representation of the hypotheses for the equality and inequality of the values of the means for the synthetic variable is as follows:

H_0: $\mu_1=\mu_2=\mu_3$

H_1: $\exists j_1 j_2 : \mu_{j_1} \neq \mu_{j_2}$

Table 4 presents the statistics of the *F*-test.

Table 4. Statistics of the *F*-test

Specification	Sum square (*SS*)	*df*	Mean square (*MS*)	*F*	*p*-value
Between groups	1,431	2	0,715		
Within groups	0,094	16	0,006	121,38	0,000
Total	1,525	18			

Source: own calculations

The *F*-test statistics is *F*(2; 16)=121.38 (a value which is much higher than one) and is statistically significant at the level of significance α=0.01. As a result we the hypothesis H_1 is supported, which unambiguously points at a statistically significant difference in the values of the means of the synthetic variable $\left(\overline{SIOVM}\right)$ between at least two groups.

With multiple comparisons using post-hoc HSD tests proposed by Turkey (for different *N* in groups) and Scheffe, we determine between which classes there are statistically significant differences in the values of the synthetic variable which cause the support of the hypothesis H_1. Table 5 presents approximate *p*-levels for Turkey's and Scheffe's HSD tests.

Table 5. Approximate p-levels for post-hoc tests

Test	Phases of value migration	Inflow stage	Stability stage	Outflow stage
HSD Turkey	Inflow stage		0,0006	0,0002
	Stability stage	0,0006		0,0002
	Outflow stage	0,0002	0,0002	
Scheffe	Phases of value migration	Inflow stage	Stability stage	Outflow stage
	Inflow stage		0,0001	0,0000
	Stability stage	0,0001		0,0000
	Outflow stage	0,0000	0,0000	

Source: own calculations

Both tests show statistically significant differences in the values of means for all comparisons between the individual groups of the industrial value migration, at the level of significance α=0.001.

The mean values of the synthetic variable in the distinct stages of the industrial value migration are as follows: (1) inflow stage: 0.9000; (2) stability stage: 0.5941 and (3) outflow stage: 0.1452. Obviously the largest difference between the mean values of the synthetic variable is in two extreme classes (inflow stage-outflow stage), which results from the non-growing linear ordering of industries in relation to *SIOVM*.

The proper taxonomic division should have a high diversity of objects between various groups and a low diversity within the individual classes [D. Witkowska, 2002, p. 90]. For the evaluation of the results of the classification we use between groups dissimilarity (high values denote a high degree of dissimilarity of objects between groups) and within group dissimilarity (low values denote a low degree of dissimilarity and simultaneously low diversity of objects within the individual classes), using respectively [Witkowska, 2002, p. 91; Nowak, 1990, p. 190]:

1. Average between groups distance

$$D_{pq} = \frac{1}{N_p N_q} \sum_{O_i \in A_p} \sum_{O_j \in A_q} d(O_i, O_j) \tag{8}$$

where: D_{pq} – average between group distance,

A_p – concentration of i objects O_i (i=1, 2, …, Np), ,

A_q – concentration of j objects O_j (j=1, 2, …, Nq), ,

N_p – number of objects in group A_p,

N_q – number of objects in group A_q,

$d(O_i, O_j)$ – distance between i element of group A_p and j object of group A_q.

2. Average within group distance

$$D_{pp} = \frac{1}{N_p (N_q - 1)} \sum_{O_i \in A_p} \sum_{O_j \in A_p} d(O_i, O_j) \tag{9}$$

where: D_{pp} – average within group distance,

A_p – concentration of O_i, O_j (i, j=1, 2, …, Np),

N_p – number of objects in group A_p,

$d(O_i, O_j)$ – distance between individual elements of group A_p.

Table 6 shows measures of the evaluation of the classification based on mean between groups distance and average within group distance.

Table 6. Average between groups distance and average within group distance

Phases of value migration	Inflow stage	Stability stage	Outflow stage
Inflow stage	0,4964	0,7677	1,4198
Stability stage	0,7677	0,2986	1,0691
Outflow stage	1,4198	1,0691	0,1848

Source: own calculations

We observe lower values of the average within group distance as compared to the values of average between groups distance. Objects are more similar to each other within the individual groups (stages of value migration) and simultaneously more

diversified between the stages in question. It proves that the division of the industries in question into the three stages of value migration is correct.
It should be emphasized that the diversity of industries between the extreme groups, i.e. inflow and outflow of value is higher than in the two other pairs – (1) inflow stage-stability stage and (2) stability stage-outflow stage. It proves that the division is valid.

SUMMARY

The current study has proven the validity of the introduced division of the analysed industries in terms of the three stages of value migration using measures to evaluate the classification and the test of the differences in the values of the means of the synthetic variable in the individual groups.
Importantly, it should also be emphasized that there are more industries at the outflow stage than those at the inflow stage. Three industries captured the value flowing out of seven others, which indicates a concentration of an industrial allocation of capital.

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