PREDICTING STRATEGIC AREAS OF A FINANCIAL INTERMEDIATION SERVICES (SIF) COMPANY USING BSC AND PLS

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Abstract
The Balanced Scorecard (BSC) analysis can identify relationships between different sectors of the company's activities and the interactions between them. Prof. Bernard Morard together with Dr. Alexandru Stancu and Dr. Christophe Jeannette from University of Geneva, Switzerland developed a way of identifying these relationships and interactions using the Partial Least Squares (PLS) regression technique. Their technique identifies the strategic areas (or strategic axes) by highlighting the groups of performance indicators with the highest correlation coefficient between them. The strategic axes can, in turn, identify performance sectors of the company. Our final model identified the interaction among the strategic areas of a financial intermediation services company (SIF) as well as the interaction between the SIF's performance indicators and the group they are a part of.

Our goal was to first apply a Principal Component Analysis to find the most important sectors for a SIF company (e.g. axis 1 = Capital and Results) and then to focus on 4 to 6 relevant performance indicators, that are strongly correlated with the respective strategic sectors (axes). The other indicators were discarded or were transferred to other axes where they have a significant weight, obviously, a little less than on the axis from which they were discarded.

Once these economic judgments on the strategic areas were completed, we applied the PLS analysis to reveal the correlations between the strategic axes (sectors). These correlations highlight the intensity of interrelations within the company (SIF) and lead to possible strategic lines of interaction.

Mainly, we intended: to identify relationships between different strategic axes (sectors) of the company's activities and the interactions between them using the Balanced Scorecard (BSC) analysis; to assign to these economic sectors the most appropriate name (for example, Axis 1 = CAPITAL and RESULTS and so on) and to retain maximum 6 relevant indicators for each axis; to reveal the correlations between strategic axes (sectors), highlighting the intensity of interrelations; to lead to the prediction of possible strategic lines of interaction within the company (SIF).

Basically, BSC explains the relationship between the corporate governance variables and the company's performance. We intended that, besides the causal interrelations, we would also identify a logical relationship between the analyzed sectors of activity.

Keywords: Strategic sectors (axes), Balanced Scorecard (BSC), Partial Least Squares (PLS), Principal Component Analysis (PCA), Corporate governance.

JEL Classification: C38, D22, E37, L25

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Introduction

Given the initial hybrid status of these investment firms (FPPs formed by transferring a part - 30% - of the former state ownings), currently SIFs must be managed so as to obtain income exclusively from financial investments on the capital market and not by disinvesting of the valuable assets, sold in order to obtain profit for the dividends' distribution. The evaluation of SIFs must be made taking into consideration their capacity to generate profit.

Our research goals were:

- to apply a Principal Component Analysis to find the most important strategic areas (or strategic axes) for SIF;
- to highlight the groups of performance indicators having highest correlation coefficient with strategic areas;
- to apply the Partial Least Squares Analysis to reveal the correlations between the strategic axes (sectors);
- to highlight the intensity of interrelations within the company (SIF) and lead to possible predictions of strategic lines of interaction.

Firstly, we were concerned to assign to these sectors the most appropriate economic name (for example, Axis 1 = CAPITAL AND RESULTS etc.) and to retain at most 6 relevant indicators for each strategic axis, based on the intensity of the correlation between the indicators and the respective strategic axis. We considered the other indicators (with smaller correlations) as irrelevant or we transferred them to other axes where they had a significant weight, but smaller than the one on the axis they were disregarded from.

After these economic judgment processes on which depends the power of strategic analysis and prediction of the model, the PLS regression revealed the correlations between the strategic axes (activity sectors), correlations that highlight the intensity of the interrelations and may lead to the prediction of the possible strategic lines of interaction within the company (SIF).

The paper was structured as follows. In the first section we reviewed the BSC's literature on this subject. In the second section we presented the statistical methodology for the optimal BSC model and we identified the results from the SIF data analysis. In the end, we presented the conclusions and possible future applications of the model.

1. Literature review

"Balanced Scorecard" System (BSC) is a strategic management concept introduced by Robert Kaplan and David Norton in the early 1990s. The Balanced Scorecard (BSC) contains both financial and operational measures on customer satisfaction, internal processes, as well as innovation and organizational improvement activities (Kaplan and Norton, 1992, 1996). For managers, BSC identifies a comprehensive vision of their company's strategic objectives and a set of measures to improve its strategic performance. The BSC is either a complex management tool or a strategic management tool. Specialized articles referring to BSC analyze and promote the Balanced Scorecard as a performance measurement tool, as a performance management system, but also as a strategic management and control system. *"BSC is a strategic planning and management system that*

is used extensively in business and industry, government, and nonprofit organizations worldwide to align business activities to the vision and strategy of the organization, improve internal and external communications, and monitor organization performance against strategic goals." (Balanced Scorecard Institute, 2010)

The BSC strategic scheme (figure no. 1) exemplifies the way to create value for the company, respectively, progressively presents the logical link between the strategic objectives under the form of a cause-effect chain. Starting from the ORGANIZATIONAL CAPACITY (knowledge and skills, as well as managerial tools and process-technology), the performance improvement is registered by improving the INTERNAL PROCESSES (improving efficiency and reducing the cycle time), which, in turn, allows the organization to improve the relationship with the CLIENTS (reducing waiting time and consumer retention) as well as to improve the results in the FINANCE sector (lower costs, increase revenues and profitability).

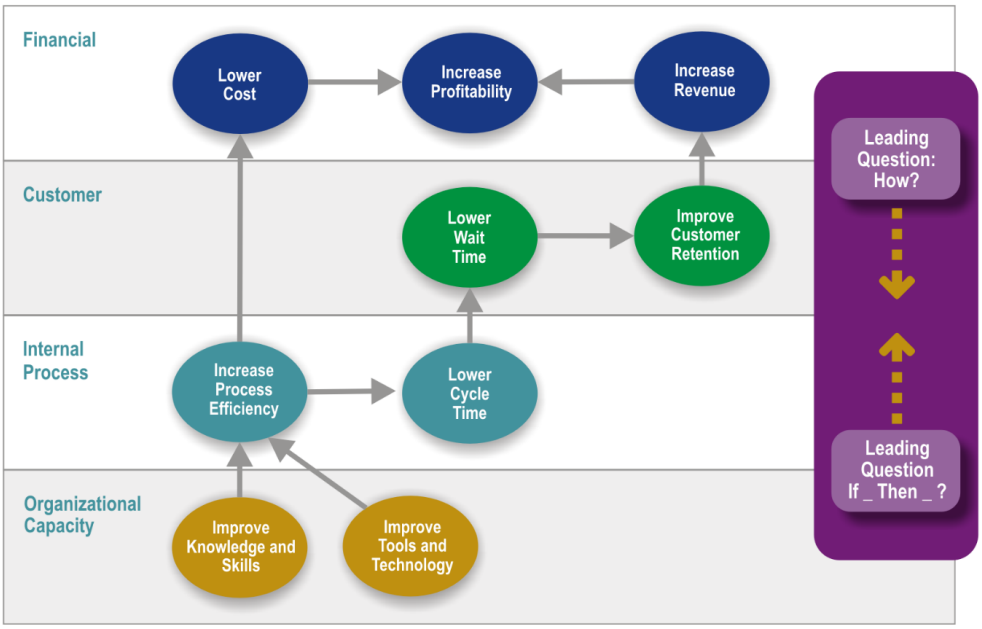

Figure no. 1: The Balanced Scorecard Strategic Scheme
Source: Balanced Scorecard Institute, 2010

In spite of all these causalities illustrated by BSC, as initially introduced by Kaplan and Norton (1992), the method has limitations generated by its main hypotheses and by the (non-) relevance of relationships highlighted by it. Norreklit (2000) states that there is no causality, but rather a logical relationship between the strategic analyzed perspectives. Moreover, BSC is not a representative tool of strategic management because it does not take into account any link between the organization and competition. Consequently, a discrepancy should be allowed between the company's current strategy and its assumed strategy. Kanji and Moura (2002) summarize several limitations of BSC stressing that the model is too abstract and not easy to use as a measurement model. Moreover, he notes that the relations between strategic perspectives are not clearly explained and causal relationships are not sufficiently relevant. Kanji and Moura (2002) identify the relationships

between strategic axes more as interdependence, rather than actual correlations. Last but not least, Malina and Selto (2003) point out that BSC is very difficult to put into practice. Also, the two authors have determined that the performance indicators identified in the BSC model are bias or inaccurate. Communication about BSC within a company is hierarchical, and comparisons between companies using BSC are inadequate due to lack of standardization.

Despite its inherent limitations (especially as it is a limited information technique, designed to maximize the prediction power), the PLS method has proven to be a very useful way for statistical modeling in general management, financial management, controlling etc. The method can lead to good results without the need for large data samples. Such difficulties were often faced by the management and management control scientists. Another advantage of PLS is the ability to operate with non-normal data due to less rigorous assumptions underpinning the statistical technique (Smith and Langfield-Smith, 2004).

Using techniques to overcome these limits of PLS, Creamer and Freund used the AdaBoost technique to generate alternative decision trees that explain the relationship between corporate governance variables and business performance. The AdaBoost technique selects the most important indicators of the BSC board for strategic planning of the company (Creamer and Freund, 2010).

In their article, Michael Haenlein and Andreas M. Kaplan perform an analysis of PLS starting from the modeling of structural equations based on covariance (SEM, Joreskog, 1973) and from the LISREL[†]'s predominance. LISREL is the best known tool for this type of analysis. Using LISREL we reach the smallest partial squares (PLS) analysis. The article's authors intended to provide an easy understanding of this technique, particularly useful for situations where the company's performance is measured by a large number of indicators (Haenlein and Kaplan, 2010).

2. Methodology and database

Regression through the smallest partial squares (PLS) is a recent statistical technique that generalizes and combines features of the principal component analysis (PCA) and of multiple regression. PLS is extremely useful when analyzing a large set (significantly large) of interdependent data in order to anticipate a set of dependent variables.

PCA is the statistical method that identifies a small number of non-correlated variables called principal components, out of a large number of correlated variables. The first principal components justify the main part of the existing variability in the initial data. PLS tries to identify the latent factors that cannot be measured directly and accurately. In order to define and validate the causal relationships that constitute the Balanced Scorecard structure, these latent variables require measurable variables that are expressed through directly observable and measured by factorial analysis indicators. In conclusion, we pointed at least 3 advantages of PLS: no need for large samples, ability to accommodate non-normal data, as well as stable, accurate and highly predictive models.

[†] LISREL (linear structural relations) is a statistical software used in modeling structural equations (SEM, Structural Equation Modeling) for manifest and latent variables

By PCA, we regrouped the economic and financial variables of SIF within specific axes (sectors) to highlight the relevance of the available variables. Further on, we selected the relevant indicators for each axis and we attempted a rational explanation for this selection. Last, PLS regression generated the causal chain between the latent variables (axes) and the intensity of their influence.

2.1. Methodology

The causal link between the strategic axes, on the one hand, and the empirical variables, on the other hand, makes it possible to prioritize the SIF's activities. Causal links between the axes (their hierarchy) will simulate the impact of different variables on the modifications in the overall performance of SIF.

For Principal Component Analysis (PCA) and Partial Least Squares Regression (PLS) we used a software developed by Prof. Bernard Morard with Dr. Alexandru Stancu and Dr. Christophe Jeannette from University of Geneva, which creates a means of identifying relationships and interactions between the analyzed variables (Morard, Stancu and Jeannette, 2013a;2013b).

2.2. Database

Historical data was collected from Thompson Reuters database with additions of Bucharest Stock Exchange and SIF websites. On the basis of 32 economic and financial indicators with a quarterly history from 1998 to 2016, we outlined five strategic areas (axes):

- Capital and Results;
- Capital Structure and Employees;
- Profitability;
- Working Capital and Taxation;
- Investments.

Each axis comprises 4 to 6 explanatory variables, with the most intense connections (or best value) for the respective axis. Rough variables (initial values) are dominant because they directly (without bias) reflect SIF activities, rather than the financial ratios (more synthetic).

3. The results of PCA and PLS on the analyzed company

The strategic axes define the most relevant activities of SIF. For their correct definition, it is necessary to remove those variables that would not adequately explain the definition of the axis, those variables that have approximate values, as well as those that would not fit well the definition of the axis. For example, on the PROFITABILITY axis, we considered that ROE (Return on Equity) and ROIC (Return on Invested Capital) variables are sufficiently accurately defining this axis, so we removed the EBITDA Margin variable (Table no.1).

Table no. 1: Distribution of variables on SIF axes using the PCA method

Indicator	Capital and results	Capital structure and employees	Profitability	Working capital and taxation	Investments
ROE	17.116 %	16.997 %	28.423 %	1.391 %	13.891 %
ROIC	17.938 %	13.207 %	31.183 %	7.875 %	13.680 %
~~EBITDAMargir~~	~~5.813 %~~	~~22.688 %~~	~~25.625 %~~	~~5.710 %~~	~~20.012 %~~
AssetTurnover	23.778 %	14.388 %	9.869 %	11.454 %	7.998 %
..					

Source: Authors' compilation of statistical data with Optimal PLS of University of Geneva

If we estimate that some of these variables are relevant to other axes, then we may transfer them to those axes[‡].

Each of the axes comprises 4 to 6 explanatory variables, with the most intense links (or best meaning) with that axis. On these Axes we have operated a PLS regression whose results will be further analyzed. For example, Axis 1, CAPITAL and RESULTS axis has a very good reflection (coefficients between 0.9 and 0.7) of the variability of the 6 explanatory variables in figure no.2.

The above figure identifies a performance of the CAPITAL and RESULT axis which is mainly explained by Asset Turnover, Total Revenue, and obviously by Net Profit and Operational Income. Consequently, a significant modification of these variables will strongly influence the CAPITAL and RESULT axis. The positive cause-to-effect relationships between these variables, on the one hand, and the analyzed axis, on the other hand, reflect that an increase in asset turnover, implicitly in revenue, will, for example, produce a positive influence on the entire CAPITAL and RESULTS axis. Similar considerations may be made to the cause-to-effect relationships in the other axes: CAPITAL STRUCTURE and EMPLOYEES, PROFITABILITY, WORKING CAPITAL and TAXATION, INVESTMENTS.

‡ In an wider evaluation, we have replicated the above methodology on 57 variables, the initial 32 plus 25 variables concerning the industrial sectors of the SIF participation, the categories of titles in which the SIF investments were made, the structure of SIF holdings, as well as the shareholders' structure. This time, the quarterly history is shorter, respectively, from 2007 to 2016, during which official data from the SIF Directors' Reports were available. In the economy of this paper we did not present these results as well.

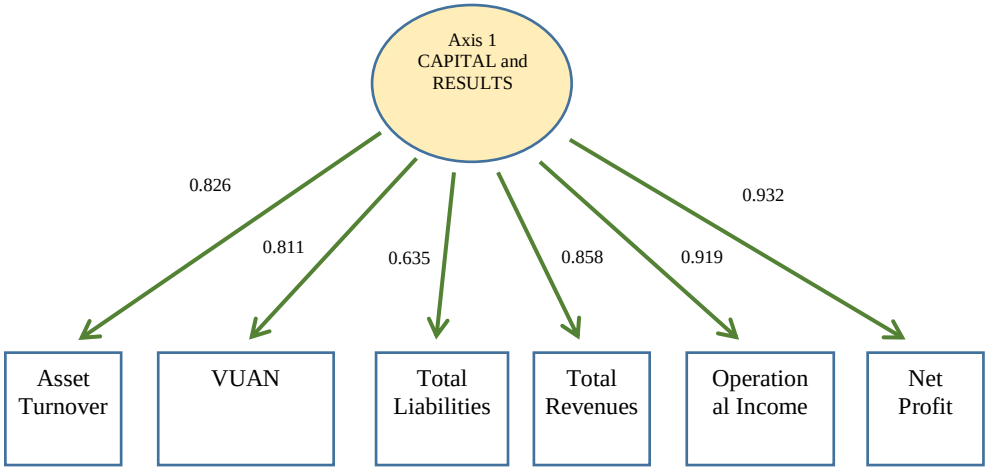

Figure no. 2: Variability coefficients of the 6 explanatory variables to CAPITAL and RESULTS axis

Source: Authors' compilation of statistical data with Optimal PLS of University of Geneva

The PLS method has the advantage that the cause-to-effect relationships are not imposed from the start, they are constructed and finalized by PLS regression. As a result of this PLS regression, we obtain a statistically stable model, the most stable among all interaction models (validated by using the Bootstrap technique). In our research, the most relevant results are registered by the application of this PLS model, respectively, the axes interrelations, the possible cause-to-effect links between the axes (see figure no. 3)

The results of our research closely correspond to the intuitive management that SIF has practiced until the end of our analysis (2016). Moreover, this method is able to measure the impact that CAPITAL and RESULTS axis has on INVESTMENTS axis (0.782) and the contribution of PROFITABILITY (0.649), CAPITAL STRUCTURE and EMPLOYEES (0.289), WORKING CAPITAL and TAXATION (0.267) axes have on the formation of CAPITAL and RESULTS axis. It is also worth mentioning the contribution of the INVESTMENT (0.709) axis to the formation of the CAPITAL STRUCTURE and EMPLOYEES axis.

This approach allows both the highlighting of the relevant strategic indicators and also the logic of the strategy applied by the SIF management, namely the allocation of the company's capital to investments that in turn influenced the Assets / Equity indicator as well as the Employability.

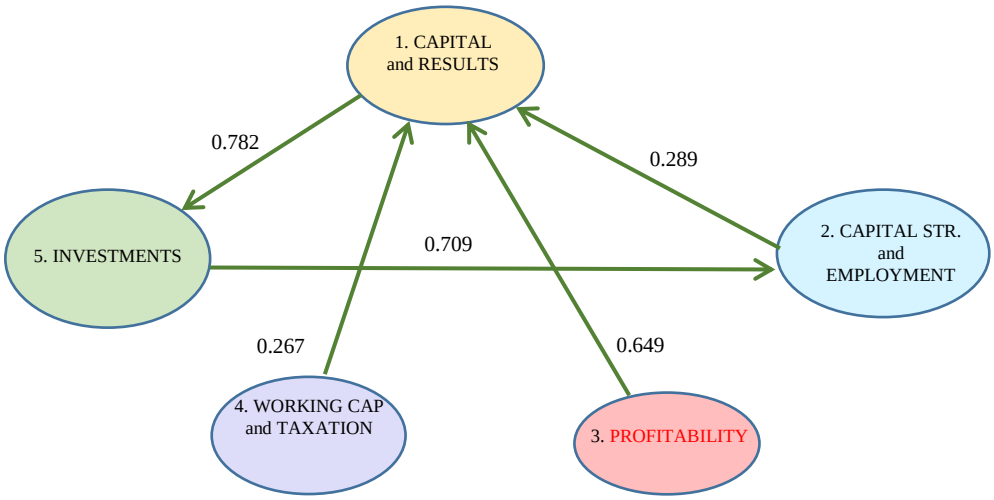

Figure no. 3: Possible cause-to-effect links between the SIF axes
Source: Authors' compilation of statistical data with "Optimal PLS" software of University of Geneva

The intensity of the cause-and-effect connections from the model allows for a better understanding of the company's trend. It also suggests measures to be taken by the management in order to update, correct and anticipate the SIF's strategy with the help of selected indicators from the axes.

The detailed form of the diagram of axes interrelations, as well as the explanatory power of each axis with the significant variables, is shown in figure no. 4.

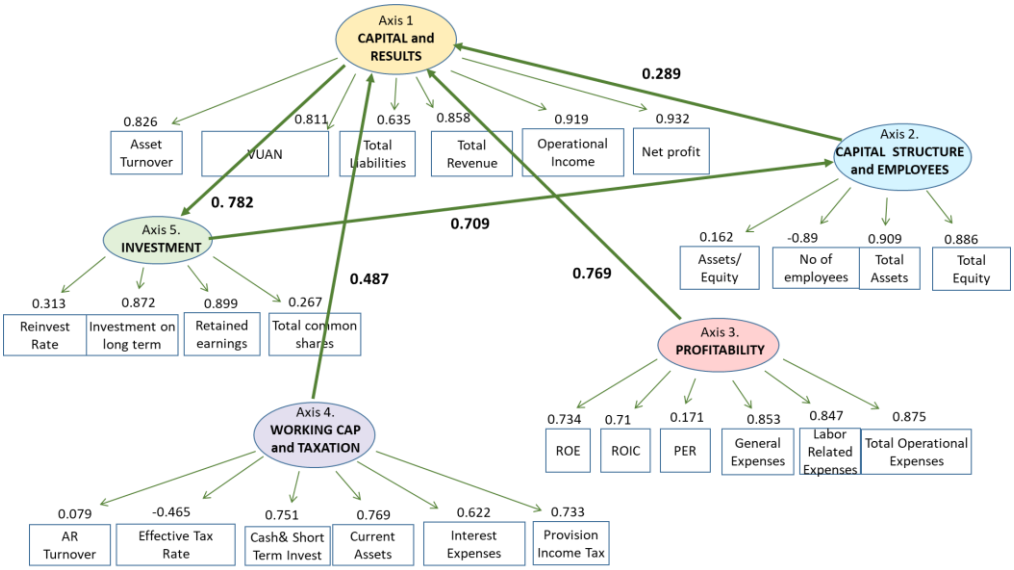

Figure no. 4: Explanatory power of each axis with the significant variables
Source: Authors' compilation of statistical data with "Optimal PLS" software of University of Geneva

The statistical validation of the model reveals high values of the consistency of the model's reliability (exception, axis 2), of the extracted variance (exception, axis 4) and of the determination coefficient R^2 (with values of 0.889, 0.611 and 0.503). The explanation of the cause-effect link between axes 1, 5 and 2 may be seen in table no.2.

Table no. 2: Statistical Validation of applying PLS model

> 0.6 > 0.5

>0,67 = strong
>0,33 = moderate
>0,19 = weak

Axis	Composite Reliability	Average Variance Extracted	R-square	Redundancy Index
1. CAPITAL and RESULTS	**0.932**	**0.699**	**0.889**	**0.91**
2. CAPITAL STRUCTURE and EMPLOYEES	**0.42**	**0.607**	**0.503**	**-1.013**
3. PROFITABILITY	**0.866**	**0.547**	**-**	**0.797**
4. WORKING CAPITAL and TAXATION	**0.626**	**0.384**	**-**	**0.667**
5. INVESTMENTS	**0.759**	**0.476**	**0.611**	**0.599**

Notes: Composite Reliability is a measure of internal consistency reliability that allows the assessment of the construct reliability: the extent to which a variable or set of variables is consistent in what it intends to measure.

Average Variance Extracted measures the amount of variance that is captured by the construct in relation to the amount of variance due to measurement error.

R-squared coefficient is a statistical measure of how close the data are to the fitted regression line. It is also known as the coefficient of determination or the coefficient of multiple determination for multiple regression.

Redundancy Index measures the duplication of a system's relevance with the intent to increase its reliability

Source: Authors' compilation of statistical data with "Optimal PLS" software of University of Geneva

Conclusions

- Determining the correct axis is crucial for gaining added value, efficient resource management, risk control and success in competition. If the goal of the study is the performance strategy, it is necessary for the variables to explain accurately the axis. The correct determination of the axes is generated by the collection of performance indicators, resource management, risk control, success in competition, etc. The increased relevance of performance indicators gives greater power to the optimal BSC model.

- The intensity of the cause-effect connections in the model allows a better understanding of the trend of the company. We have thus identified how much of the variability of each indicator is captured by the strategic axis from which these variables are part. It also suggests measures to be taken in order to update, correct and predict SIF strategy using selected indicators on the axes.

- PLS approaches the strategic performance synthesis by identifying cause-effect connections between variables and axes, on the one hand, and between axes (their hierarchy), on the other hand. This approach allows the understanding of the causal chain of strategic performance. PLS approach could give a real advantage for SIF in economic competition.

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