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On the relationship between cash flow bullwhip and the company performance: study of the Moroccan detergent products branch

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Keywords: cash flow bullwhip, bullwhip effect, COVID-19, supply chain, performance.
Abstract: The COVID-19 pandemic had a significant bullwhip effect, which resulted in a cash flow bullwhip (CFB) in the Moroccan FMCG industry. As illustrated by a previous study, some companies were more affected by CFB than others. This indicates that CFB could be correlated to some specific aspects or characteristics of these companies. The objective of this article is to thoroughly examine the connections between CFB control and the company's internal control performance, financial performance, and supply chain performance. Therefore, a field study is conducted on the producers of detergent products. The results confirm that some performance criteria are directly correlated to the degree of exposure to CFB. In fact, a firm is able to regulate CFB when it has an effective internal control system, a reliable supply chain, and strong financial efficiency. However, the relative importance of these performance criteria is not evident. This opens the opportunity to develop a multi-criteria model that could hierarchize the different performance criteria.

1 Introduction

The previous research study demonstrated that the COVID-19 pandemic caused a great bullwhip effect that led to cash flow bullwhip (CFB) in the Moroccan FMCG sector [1]. CFB is a cash flow distortion that can be explained by the fact that the amplification of orders produced by the BWE does not reflect actual demand, which decreases the flow of products, and results in a high cost of stock holding, a cost of opportunity, and a greater need for working capital [2].

For these impacted companies, the cash flow conversion cycle's unpredictability raised their need for working capital and constrained their ability to finance themselves. To deal with this circumstance, those businesses turned to alternative sources of funding, such as their equities or bank loans, to support their operating activity [1].

Still, the degree of exposure of these companies to CFB has been different [1]. This research aims to explore the reasons that made certain companies less impacted than others. For this purpose, this research proposes to study the correlation between a company's performance and the level of CFB control. The selected performance attributes are related to the components of the cash conversion cycle, namely, inventory, accounts receivables, and accounts payables.

1.1 Problem statement

Due to COVID-19, FMCG Moroccan companies suffered from CFB. The influence of CFB on the company's cash flow is described by the fluctuation in CCC components, such as inventory flow periods and accounts receivable delays. As a result, the more the flow times fluctuate and lengthen, the longer it would take the organization to collect money, severely impacting its cash flow. Despite being profitable, CFB-affected companies are being kept hostage by their inability to finance their operations. They are forced to seek outside financing as a result, and the cost of doing so has an impact on their profitability [1].

As demonstrated in a previous study, the degree of a company's exposure to this CFB is different [1]. In order to understand what makes a company more resilient than others, a field study is conducted on a specific category of companies operating in the same branch, which is the production of detergent products.

Given that the CFB impacts the CCC and that CCC is mainly related to supply chain, financial and internal control activities, this research work aims to analyze in depth the relationship between CFB control and the company performance on the supply chain side, financial side, and internal control side.

1.2 Research objectives

The aim of this research is to determine which performance dimension contributes to CFB control. Thus,

through a field study, the objective is to answer the following research questions:

- What characterize the resilient companies from the most affected ones?
- Can supply chain performance impact the degree of exposure to CFB?
- Can financial performance impact the degree of exposure to CFB?
- Can internal performance impact the degree of exposure to CFB?
- Which performance criteria are most related to CFB control?
- Is there a combination of performance criteria that can lead to a specific degree of CFB control?

1.3 Research contributions

This research is of major interest to companies which are suffering from CFB given that it will give deep insights into the relationship between CFB exposure and the 3 dimensions of performance. It will give the managers a better understanding of the lever that could be used to prevent and control the CFB, which will contribute to the financial safety of their firms, especially in the context of major crises such as the COVID-19 pandemic.

For researchers, this article offers another angle to analyze the CFB and to identify potential levers to control CFB, through the study of the correlation between a company's performance and its CFB control.

On the other hand, by examining the particularity of the phenomena in relation to large crises, which can take the shape of a pandemic or other comparable event, this paper, is intended to be a contribution to the different research that has been conducted on the phenomenon of cash-flow bullwhip.

To meet the various objectives assigned to this research work, the first part is dedicated to a brief literature review of the Cash flow Bullwhip and the presentation of the three performance dimensions with the criteria that will be used for the survey guide. The second part is for the description of the study design and the presentation of the primary results. The third part is devoted to the analysis and discussion of the results, and to propose future research perspectives.

2 Theoretical basis

2.1 CFB literature review

CFB is the disruption of cash flow caused by the bullwhip effect [2]. This cash flow distortion directly impacts the working capital requirements of the company, because it deteriorates the cash conversion cycle [3].

Before the introduction of this notion by Tangsucheeva & Prabhu in 2013, many research studies focused on the financial aspect of the supply in general, and the cash conversion cycle precisely. In this regard, Farris presented the effective methods for managing the cash to cash cycle and underlined the significance of the cash to cash cycle as a metric to evaluate the performance of the supply chain [4]. By analysing the standard deviations of the receipt, disbursement, and net flows for each period within a planning horizon, Tsai provided a modelling of the cash flow risks related to the supply chain [5]. Tsai recommended using an asset-backed securities (ABS) policy to finance accounts receivables in order to reduce the time it takes to convert money into cash and the likelihood of collection. Randall and Farris offered a way for enhancing the supply chain by sharing weighted average capital costs with trading partners and working together to control cash-to-cash cycles [6]. According to Hofmann and Kotzab, collaborative techniques are more effective than delaying suppliers' payments or collecting receivables early to increase the working capital for supply chain partners [7]. Tsai showed that businesses, particularly those with limited financial resources, suffer cash collection risks when attempting to increase sales. Tangsucheeva and Prabhu proposed a stochastic forecasting model that combines a Bayesian model for each individual customer's payment behaviour with a Markov chain model for the company's overall payment behaviour across all of its customers [8]. This has a very accurate forecast and is not dependent on the BWE. Tsai demonstrated how cost structure affects cash flow risk and how Just in Time production philosophies and new technologies can help to lower this risk [9]. Goodarzi developed a simulation model that includes a multi-stage supply chain, as well as a centralized and decentralized supply chain, to study the effects of the bullwhip effect's causes and the effect of their interactions on the CFB [10]. Despite the fact that each link in the chain employs an "Order Up To" replenishment strategy, their findings imply that the CFB can be found in both centralized and decentralized supply chains. Serrano looked at how order fluctuations affected supplier payment deadline variability at the supply chain level, as well as how they affected risk and how it spread upstream in the chain [11]. In order to examine working capital optimization in a two-echelon supply chain with one supplier and one retailer, Peng and Zhou created three models based on various supply chain collaboration levels [12]. Despite the degrees of cooperation, the authors recommend extending the payment time whenever the retailer's discount rate is greater than the suppliers. Using a system dynamics simulation model and genetic model, Badakhshan et al., created a simulation-based optimization strategy. For each SC member, the best financial and inventory choice criteria are discovered to lower the overall cost, BWE, and CFB [13]. Using 238 semiconductor businesses as a sample, Prabhu looked into the presence of CFB and the conventional bullwhip effect (BWE) from 2010-Q1 to 2020-Q4 [14]. Authors discovered that a semiconductor business's CFB and BWE are positively correlated with procurement and payment lead times, and negatively correlated with company size, the degree of seasonality in demand, and the company's payment policy conservatism.

Lamzaouek examined the effects of digital technologies on CFB and discovered through a systematic literature review that a number of technologies can positively contribute to containing this phenomenon by addressing its operational causes, namely the accuracy of forecasts, batch orders, price volatility, rationing games, and lead times [15]. During the COVID-19 epidemic, CFB was examined for its effects on the financial health of Moroccan FMCG companies. According to the survey's findings, SMEs and very small enterprises were the ones who suffered most from the effects of CFB due to the rise in working capital requirements and decline in cash flow. By enhancing internal control mechanisms at the level of the processes of purchasing, inventory management, sales, and cash management, the authors suggested an organizational strategy to handle this issue [1].

According to X. Chen et al., the growth in CFB is positively connected with the increase in the price cross-sensitivity coefficient, the same research examined the effect of market share and price cross-sensitivity coefficient on the CFB [16]. Prabhu looked at how credit risk affected the cash-bullwhip in the supply chain. The findings of this study show that taking credit risk into account increases the amounts of cash and accounts payable that are transferred from downstream members to upstream members. This study also demonstrates how, when credit risk is taken into account, the account receivable turnover index accurately depicts the cash-bullwhip effect of every link in the supply chain [17].

2.2 Performance models – a brief literature review

Many authors defined the term performance through the years. In this regard, for Miles, performance is the ability of the organization to achieve minimal satisfaction of the expectations of its strategic clients [18]. For Chandler performance is an association between functional efficiency and strategic effectiveness [19]. Functional efficiency focuses on enhancing the company's offerings, purchasing, manufacturing process, marketing strategy, and employee relations. Gaining an advantage over rivals by entering a market that is experiencing growth or leaving a market that is experiencing a fall is the definition of strategic effectiveness. For Lorino, performing in the company is everything that, and only that, contributes to improve the value-cost couple (conversely, performance is not necessarily what contributes to reducing the cost or to increase the value in isolation) [20]. That's said multiple models have been introduced in the past to evaluate the performance of an organization. Campbell considers that the measurement of performance happens through the setting of criteria which are quantitative and/or qualitative. In this sense, he put up a list of around thirty performance standards. 57% of the criteria include reference to social and human elements. 13% is directly related to financial and economic factors. The rest is a mixture of strategy, production, environmental factors, etc [21]. Steers provides a multifaceted viewpoint that links the following three ideas: Optimization of goals, the systemic perspective, and the significance of workers. The 29 components that make up the Steers analytical framework are divided into four sets, which are as follows: The characteristics of the organization, the characteristics of the external and internal environment, the characteristics of the employees, and the management policies and practices [22]. Along with economic factors, Welge and Fressman emphasized the significance of social and human parameters. their analysis revealed that economic and financial factors should be prioritized when evaluating a company's overall success [23]. Peters and Waterman identified eight characteristics of excellence through their model, which can be summed up as follows: action orientation, listening to customers, autonomy and entrepreneurship, productivity through staff motivation, the law of shared values, stick to what you know how to do, a simple and light structure, flexibility in rigor [24]. Quinn and Rohrbaugh highlighted three dimensions in their model [25], internal/external objectives, flexibility and control, and means/results. Rambhujun proposed twenty-eight criteria for assessing the success of businesses, categorized along five axes: management factors, sales elements, customer interaction factors, production factors, and talents aspects [26]. In the Model of Pascal and Athos, business performance is based on six elements, which are as follows: System, staff (people), style (behaviour of the boss and his subordinates), staff (personnel), strategy (way of allocating resources over time to achieve the intended objectives), and skills (know how). The Lynch and Cross model offers an integration of strategic and operational indicators. For these authors, business strategy cannot neglect operational data, a clear link must exist between the two. Six performance criteria are listed in Fitzgerald, Johnston, Brignall, Silvestre, and Voss's matrix of determinants: financial performance criteria, competitiveness, service quality, flexibility, resource efficiency, and innovation. The Model of Kaplan and Nortan makes it possible to assess performance in four areas, which are the customer vision, the financial vision is notably that of the shareholder, the internal process vision, and the ability for a company to innovate, improve and learn. The four-dimensional model of Morin, Savoie and Beaudin is articulated around the following axes: the value of human resources, economic efficiency, the legitimacy of the organization, the sustainability of the organization. In the model of Atkinson, Waterhouse and Wells, the authors present a model of organizational performance based on the stakeholder approach. These stakeholders are, for most organizations, investors, employees, customers and the community. According to the Adams and Neely's Prism and Success Maps, because the performance is not flat, the author wants to demonstrate its complexity. It is crucial to examine it from several angles connected by the Performance Prism in order to comprehend it completely. Additionally, this model is built around five axes that

describe the company's overall vision: Stakeholder contribution, strategy, procedures, and resources (both tangible and intangible).

2.3 Company performance and CFB

From the previous literature review, it's obvious that there are various dimensions that can be used to evaluate the company's performance. In the following, three dimensions—financial, supply chain, and internal control—will be used to evaluate performance of targeted companies. This choice is justified by the fact that the CFB directly concerns the cash conversion cycle, and that the 3 components of the CCC, namely inventory turn, accounts receivables, and accounts payables, are dependent on the policy and company actions on the logistical, financial and internal control aspects. Indeed, a company's ability to provide exceptional customer service will enable it to have strong inventory flow, which will help it maintain an ideal inventory level. In addition, a good internal control system will allow the company to have good control of the risks relating to accounts receivables and accounts payables. Ultimately, a balanced financial structure will make the business more resilient to cash flow disruptions.

That's said, in order to assess the performance of these companies in relation to the three dimensions retained, it is necessary to define the adequate standards and reference systems. In this regard, the SCOR reference framework is chosen for the evaluation of logistics performance, the COSO reference framework for internal control performance, and the ratio analysis method for the evaluation of financial performance. This choice is justified by the completeness and reputation of these standards (Figure 1).

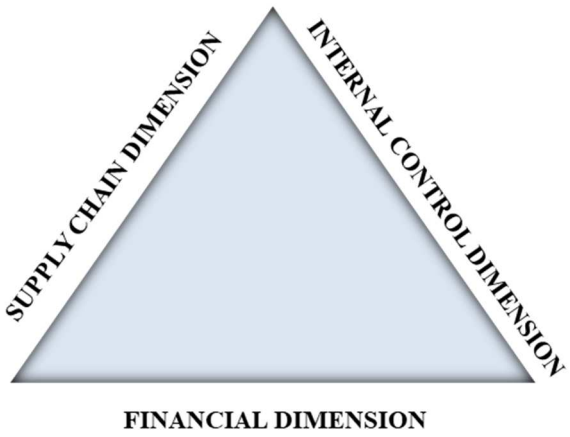

Figure 1 Performance evaluation model

3 Methodology

This study is a follow-up to the previous investigation into the effects of CFB on Moroccan FMCG firms during the COVID-19 crisis [1]. It is conducted on a homogeneous sample of detergent-producing enterprises. These companies were chosen from the earlier research participants.

The goal is to investigate how the CFB's level of control, is influenced by these companies' performance levels on the financial, logistical, and internal control dimensions.

In order to respond to the many questions posed for this research work, a quantitative study has been carried out. The research technique that was used, the findings and their interpretation, as well as our recommendations and conclusions are all presented in the paragraphs that follow.

3.1 *Research methodology*

3.1.1 Research design

It is crucial to go through a design phase acting as a cartography strategy for our study in order to have the answers to our research questions. In this regard, we decide to carry out a quantitative study on Moroccan enterprises that make detergent goods. A survey of a target population was carried out during June and July 2022 for this reason.

3.1.2 Target population

The term "population" in research refers to all the items connected to the research purpose and used to build conclusions and suggestions [27]. For this research, the target population concerns all the companies producing detergent products. The decision to engage in this particular branch of business was not arbitrary, given that this type of product's demand pattern saw significant fluctuations.

3.1.3 Sampling

Sampling is the process of choosing a portion of a research population for analysis. The size of the sample depends on the objective of the research. The sample for this study consists of the detergent-producing businesses that were involved in the earlier investigation of the effects of CFB on Moroccan FMCG firms [1].

Seven companies make up this sample, which seems to be the ideal balance between the study's complexity and degree of representativeness.

3.1.4 Data collection

To collect the necessary data for this study, questionnaires were administrated by emails to the representatives of the targeted companies. The targeted respondents hold managerial positions in finance, supply chain, and executive management. Financial documents have been recovered from these companies.

3.1.5 Summary of variables

In what follows, a summary of the selected variables from the survey that was conducted. These variables represent performance criteria's according to the adopted performance model (Table 1).

Table 1 Summary of the survey's variables

Performance dimensions	Performance criteria's	Performance sub criteria's	Description
Internal Control Performance	Control Activities	Control Activities	Existence of rules and procedures which aim to provide reasonable assurance that the instructions of the management to control the risks likely to affect the achievement of the objectives [28,29].
	Control Environment	Control Environment	Existence of policies, processes, and institutional structures for internal control implementation across the board [28,29].
	Risk Assessment	Risk Assessment	Existence of iterative methods for locating and analyzing risks that could compromise a company's goals [28,29].
	Information and Communication	Information and Communication	Existence of data necessary for internal control operations [28,29].
	Monitoring	Monitoring	Existence of an evaluation intended to confirm the existence and proper operation of each of the five internal control principles and the components [28,29].
Supply Chain Performance	Supply Chain Reliability	% of Orders Delivered in Full	Percentage of orders where the customer receives every item in the quantities promised [30,31].
		Delivery Performance to Customer Commit Date	The proportion of orders that are delivered on the day that the customer originally agreed upon [30,31].
		Perfect Condition	Percentage of orders that are successfully completed, configured correctly, and accepted by the customer and are delivered in an undamaged state [30,31].
		Documentation Accuracy	Percentage of orders with timely and accurate invoices, bills of lading, packing slips, and other supporting documents [30,31].
	Supply Chain Responsiveness	Cycle Time	The regular average actual cycle time for completing customer orders [30,31].
	Supply Chain Flexibility	Upside Supply Chain Flexibility	The number of days needed to supply a 20% increase in quantity that was not accounted for [30,31].
		Upside Supply Chain Adaptability	The amount given that can increase by a maximum sustainable percentage in 30 days [30,31].
		Downside Supply Chain Adaptability	At 30 days before delivery, the quantity ordered can be reduced without incurring inventory or cost penalties [30,31].
	Supply Chain Costs	Cost of Goods Sold	Cost of purchasing raw ingredients and creating final goods including direct and indirect costs (overhead) [30,31].
	Supply Chain Asset Management	Days Sales Outstanding	The number of days in which a sales balance is outstanding [30,31].
		Inventory Days of Supply	The stock's quantity, measured in days of sales [30,31].
		Days Payable Outstanding	The period in days from the moment labour, materials, and/or conversion resources are purchased until cash payments are required [30,31].
		Cash Conversion Cycle	The amount of time it takes for an investment to make its way back into a business after being used to purchase raw materials [30,31].
Financial Performance	Financial Debt	Self-financing rate	The self-financing rate quantifies the portion of investments that the business is able to fund solely through its economic activities [32].
		Solvency ratio	Assessing a company's financial health by selling assets to pay off all debts. [32].
		Debt ratio	The debt ratio compares equity capital to that provided by financial institutions [32].
		Minimum Payback Period	Measures the company's ability to repay all of its structural debts by its own means [32].
		Weight of interest	The weight of interest is an indicator of the company's future difficulties [32].
	Financial Profitability	Revenue growth rate	Percentage of the company's revenue that fluctuated [32].
		Production growth rate	Percentage of the company's production that fluctuated [32].
		Gross profitability rate	Measures the company's profitability and profitability [32].
		Economic rate of return	Measures the company's profitability and profitability [32].
		Asset rotation	Measures the company's ability to generate revenue for every dollar invested in the company [32].
		Margin rate	Reflects the consequence of actions taken to reduce costs and maximize sales [32].
	Financial Efficiency	Working Capital Requirements	Measures, in number of days, the importance of the working capital requirements [32].
	Financial Liquidity	Current ratio	Current ratio assesses company's ability to meet immediate financial obligations [32].
		Acid-test ratio	Comparing short-term assets to short-term liabilities to determine cash [32].

4 Result and discussion

4.1 Descriptive analysis of variables

Following are the results of a primary examination of the survey's data:

- The radar chart (Figure 2) shows that company 2 is the most performing on the internal control side, followed by company 1. The company 3 has the weakest score due to a poor risk assessment, control environment, information and communication, and monitoring. Risk assessment is very weak for companies 3, 5, and 6.

- Looking at the supply chain reliability of these companies, it's obvious that company 1 and 2 are better performing comparing to the rest of companies. That's the case for the orders delivered in full, the commitment to delivery date, and the perfect condition of deliveries (Figure 3).

- For the responsiveness of the supply chain, the comparison of companies' cycle time shows that company 2, 1, and 4 have the shortest cycle. Company 3 has the highest cycle with more than 40 days.

- The upside supply chain flexibility, the upside supply chain adaptability, and the downside supply chain adaptability are the three metrics used to assess supply chain flexibility. According to the findings, company 2 has the most upside flexibility, while firms 5 and 3 perform better in terms of downside and upside adaptability.

- For the supply chain costs, results show that companies 3 and 7 have the least costs, comparing to the rest of firms.

- For the supply chain asset management, performance is compared based on four metrics: Days Sales. Outstanding, Inventory Days of Supply, Days Payable Outstanding, and Cash Conversion Cycle. Results show that companies 2 and 1 are the better performing, while companies 6 and 7 are the weakest ones.

- At the debt ratios level, companies 2 and 1 present the best self-financing rate and solvency ratio. Company 1 is better at the ratio of weight of interest. On the other side, company 6 suffers from a high debt ratio and weight of interests, while companies 3 and 4 have the lowest self-financing capacity.

- At the level of the efficiency ratio, the working capital requirement is very high for companies 7, 6, and 3, while companies 2 and 1 are better performing on this side.

- For the profitability ratios, results show that companies 2 and 1 are more profitable than the other companies. Companies 3 and 4 are the companies with the lowest growth rate of production and revenue.

- Liquidity ratios analysis shows that companies 6, 7, and 3 have the lowest performance level.

- Looking at the coefficient of variation of cash flow, it's clear that companies 6 and 7 have a highest variation, comparing to the rest of companies.

- The preceding results show that the performance of the seven companies is heterogeneous for the 3 dimensions studied. Results also shows that company 6 have the most varying cash flow. Therefore, a correlation analysis is needed to analyse in depth the relationship between the different performance attribute and the variation of cash flow (Figure 4).

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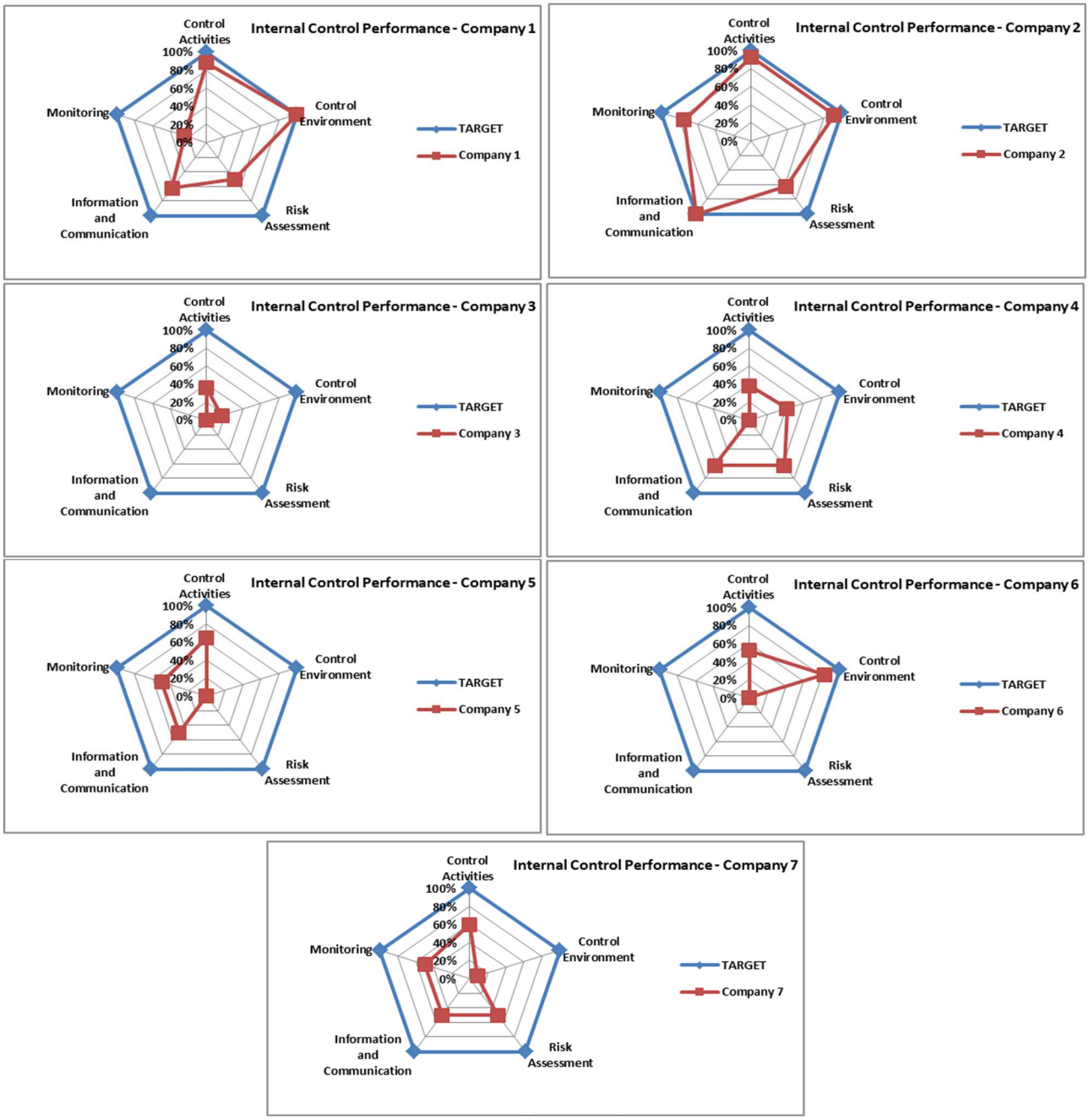

Figure 2 Internal control performance of the companies studied

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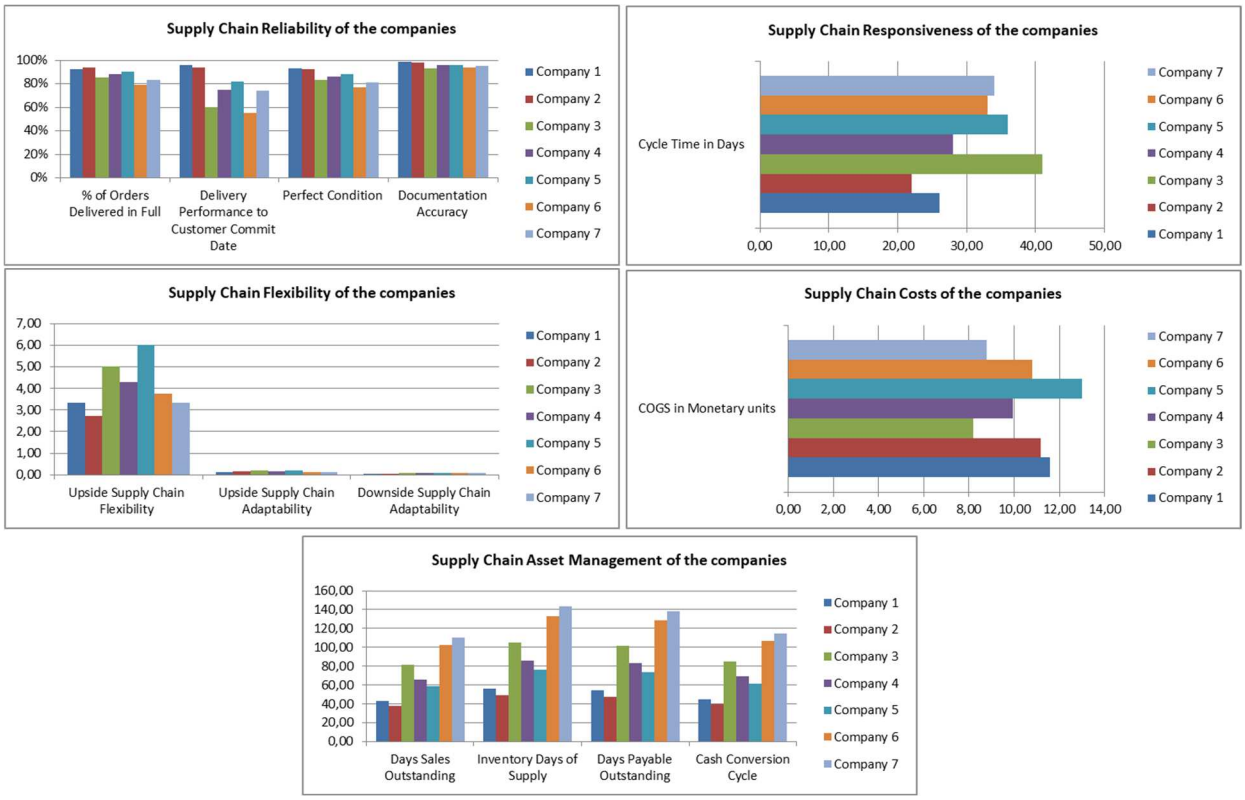

Figure 3 Supply Chain performance of the companies studied

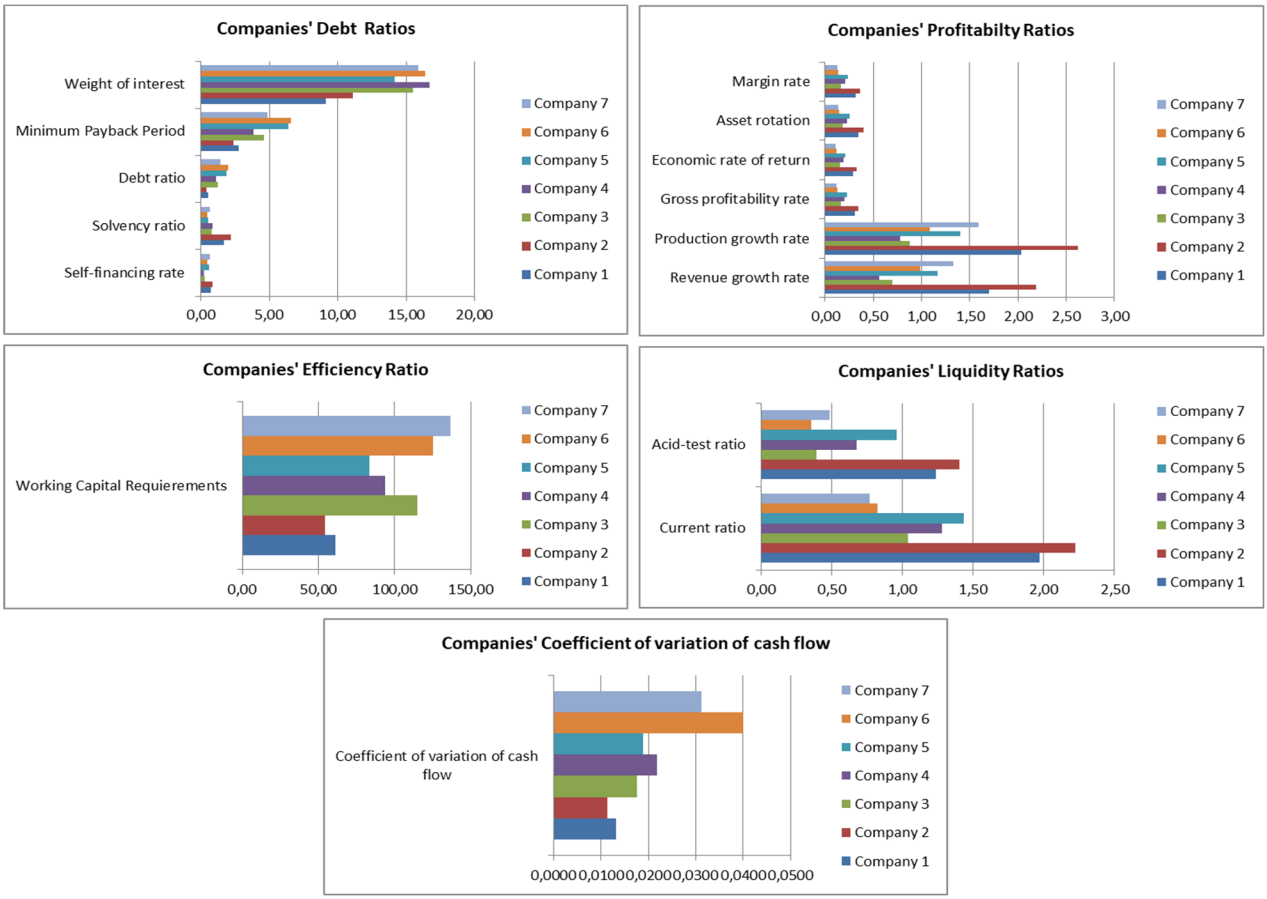

Figure 4 Financial performance of the companies studied

4.2 Principal component analysis

Principal component analysis (PCA) has been done on the variables acquired from this study in order to thoroughly assess the survey's results. The results of the PCA that was performed in connection to the study questions are presented in the sections that follow.

For each PCA the KMO and Bartlett's Test, the sum of the explained variance, and the component plot are computed. In this regard, the outcomes of all KMO and Bartlett's Tests demonstrate the appropriateness of the sample and disprove the hypothesis that the matrix is an identity matrix by having sampling accuracy more than 0.5 and significance lower than 0.0005.

4.2.1 Can internal control performance impact the control of CFB?

A PCA is conducted, to establish the degree and nature of the relationship between the following variables: Control Activities, Control Environment, Risk Assessment, Information and Communication, Monitoring, and Cash Flow Coefficient of variation (Figure 5).

The resulting component plot indicates that there is a negative correlation between the Cash Flow Coefficient of variation, and the following variables: Control Activities, Risk Assessment, Information and Communication, and Monitoring. It's also obvious that Control Activities, Risk Assessment are positively correlated. These results means that companies with higher performance on control activities, risk assessment, monitoring, and information and communication tends to have lower cash flow variability, and controls more the CFB than other companies.

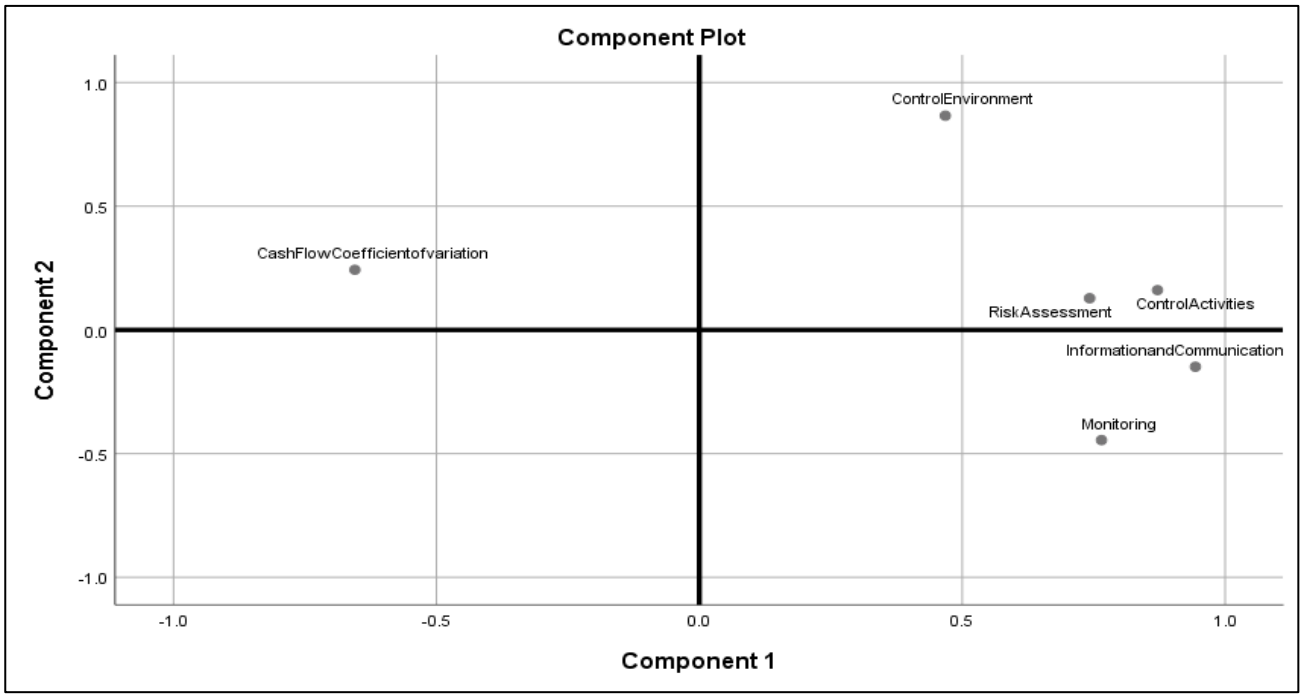

Figure 5 Component plot of the PCA n°1

4.2.2 Can supply chain performance impact the control of CFB?

A PCA is conducted, to establish the degree and nature of the relationship between the following variables: % of Orders Delivered in Full, Delivery Performance to Customer Commit Date, Perfect Condition, Documentation Accuracy, Cycle Time, Upside Supply Chain Flexibility, Upside Supply Chain Adaptability, Downside Supply Chain Adaptability, COGS, Days Sales Outstanding, Inventory Days of Supply, Days Payable Outstanding, and Cash Conversion Cycle, and Cash Flow Coefficient of variation (Figure 6).

The resulting component plot indicates that there is a negative correlation between the Cash Flow Coefficient of variation, and the following variables: % of Orders Delivered in Full, Delivery Performance to Customer Commit Date, Perfect Condition, and Documentation Accuracy. These results means that the more the supply chain of a company is reliable the lower cash flow variability is, and therefore the CFB is more controlled.

On the other side, there is a positive correlation between the Cash Flow Coefficient of variation, and the following variables: Cycle Time, Days Sales Outstanding, Inventory Days of Supply, Days Payable Outstanding, and

Cash Conversion Cycle. These results means that companies with higher performance on supply chain asset management tends to have lower cash flow variability, and controls more the CFB than other companies.

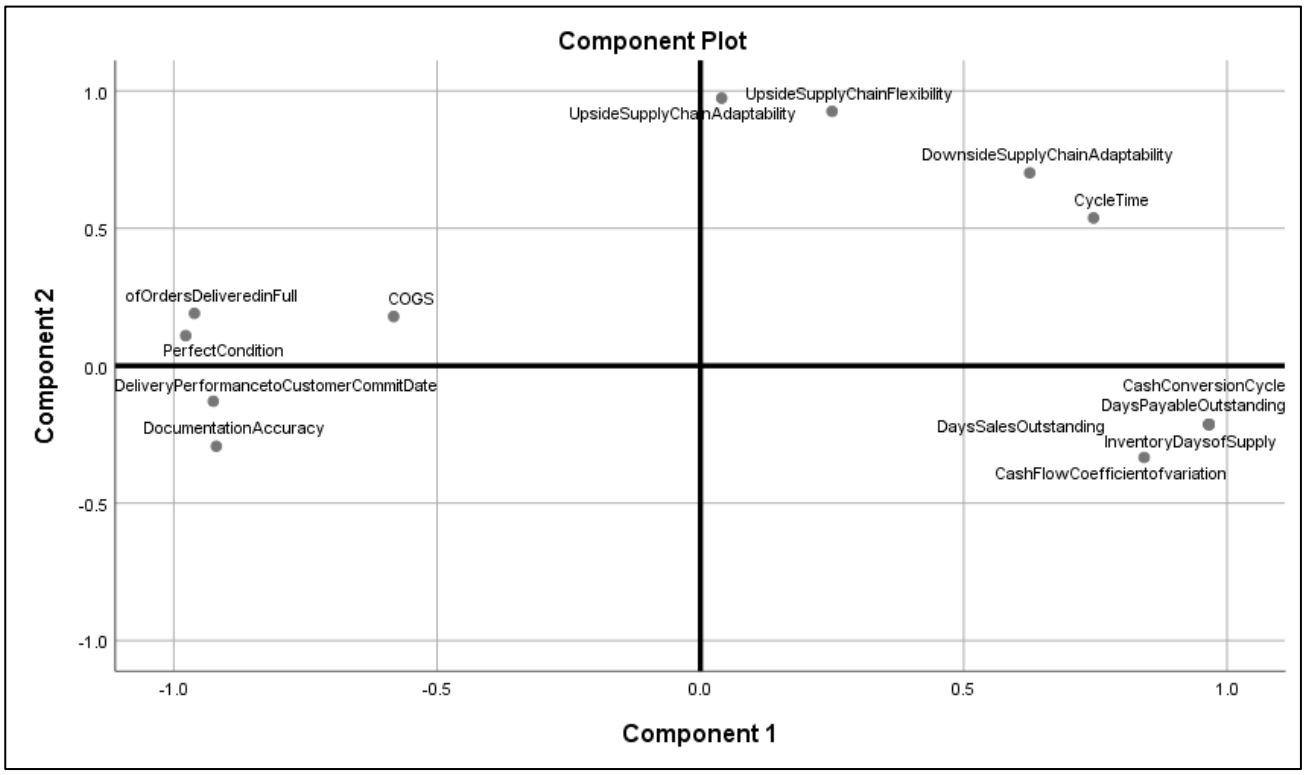

Figure 6 Component plot of the PCA n°2

4.2.3 Can financial performance impact the control of CFB?

A PCA is conducted, to establish the degree and nature of the relationship between the following variables: Self-financing rate, Solvency ratio, Debt ratio, Minimum Payback Period, Weight of interest, Revenue growth rate, Production growth rate, Gross profitability rate, Economic rate of return, Asset rotation, Margin rate, Working Capital Requirements, Current ratio, Acid-test ratio, and Cash Flow Coefficient of variation (Figure 7).

The resulting component plot indicates that there is a negative correlation between the Cash Flow Coefficient of variation, and the following variables: Self-financing rate, Solvency ratio, Revenue growth rate, Production growth rate, Gross profitability rate, Economic rate of return, Asset rotation, Margin rate, Current ratio, and Acid-test ratio. These results indicate that companies with bad debt levels have more cash flow variation. This is also the case for companies with growing production and revenue.

On the other side, there is a positive correlation between the Cash Flow Coefficient of variation, and the following variables: Debt ratio, Minimum Payback Period, Weight of interest, and Working Capital Requirements. These results means that companies that suffers from cash flow variation are those with high level of financial debt and working capital requirement.

4.3 Discussion

The analysis of the data collected from the field survey, confirms that many performance criteria are correlated to the variation of cash flow. In general, the observation is that high cash flow variation is associated with poor internal control performance, high debt ratios, lower financial efficiency, lower liquidity, bad supply chain reliability, low responsiveness, and high cash conversion cycle. Companies with good financial performance, internal control performance, and supply chain performance, seem to have a lower variation of cash flow.

Finally, it seems that some performance criteria in particular supply chain flexibility have no correlation with the variety of cash flow.

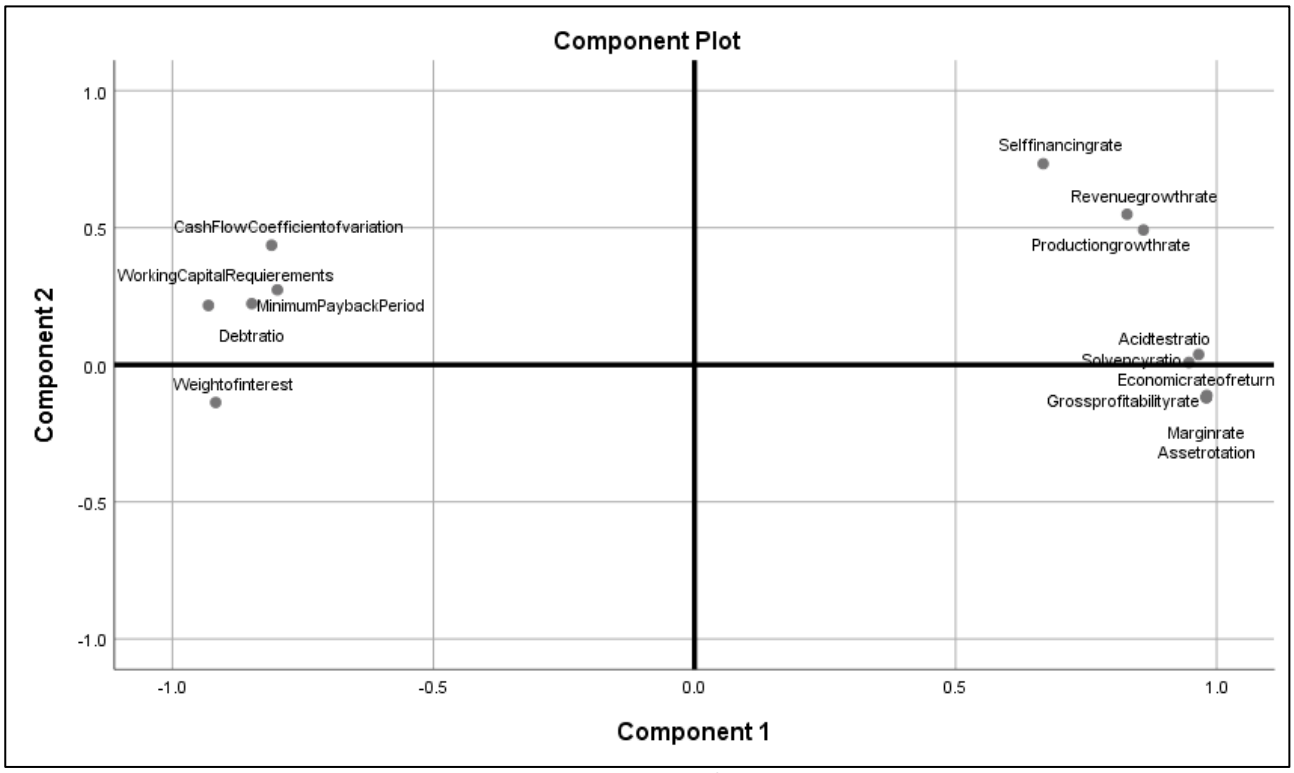

Figure 7 Component plot of the PCA n°3

5 Conclusions

The results of this study confirm the relationship between CFB control and supply chain, financial, and internal control performance. Indeed, all the companies presenting a good level of CFB control seem to be performing on the supply chain, financial, and internal control sides. In this regard, companies with reliable and responsive supply chains, are less exposed to CFB. This can be explained by the fact that the ability of supply chain to deliver the correct product, in the agreed upon time, to the correct place in the correct condition and quantity, with the accurate documentation, leads to an accelerated inventory flow, that smooth and accelerate the financial flow. Where as responsiveness will lead to a stabilized and short cycle time, that leads to less variable working capital requirement. Also, CFB is controlled when the company has an efficient internal control system, than can detect and contain the possible risks associated with the processes related to the components of the CCC (purchasing-suppliers process, inventory management process, treasury process, sales-customer process), while insuring the existence of iterative methods for locating and analyzing risks related to these processes. Finally financially balanced companies, with good self financing capacity and low debt ratio control more CFB. This is also the case for companies with reduced working capital requirements, and companies holding enough cash on hand to cover their short-term debt. Detailed interactions between CFB and the performance criteria are presented in the table bellow (Table 2). Having said that, it is impossible to determine from actual research which performance criterion or dimension, is more important for CFB control. Because of this, it will be interesting to investigate the relative significance of each performance criterion using a multi-criteria approach in the upcoming research. This can lead to a multi-criteria mathematical model, that could explain the level of control of each company, and that could be generalized on other business sectors.

Table 2 interactions between the CFB and the performance criteria's

Performance criteria's	Impact on CFB	How
Internal Control Performance	Control accounts payables flow time	Existence of iterative techniques for identifying and evaluating risks associated to the "Acquisition & Payment" and "Treasury Management" processes. Existence of appropriate rules and procedures to manage: - The synchronization between suppliers' debts recording and the supplier's deliveries. - The conformity of the invoices' payment in line with the payment authorization's rules, and contractual payment deadlines. - The cash conversion cycle and working capital requirement. - The purchase order authorization thresholds. - The verification of purchase amounts, quantities, lead times, and pricing. - The oversight of the suppliers' invoices with respect to the predetermined terms of the acquisition. - The revision of the timetable for receipts and payments. - Postponing dates for customer payments.
	Control inventory flow time	Existence of iterative techniques for identifying and evaluating risks associated to the "Inventory Management" process. Existence of appropriate rules and procedures to manage: - The inventory's precision to prevent irrational purchasing orders from creating excess storage. - The techniques for inventory valuation. - The inventory levels and fluctuations. - The monitoring of inventory turnover.
	Control accounts receivables flow time	Existence of iterative techniques for identifying and evaluating risks associated to the "Sales & Collections" process. Existence of appropriate rules and procedures to manage: - The customers' risks assessment, to prevent bad debt. - The customer credit and discounting authorization rules. - The monitoring of payments and doubtful debts. - The aged receivables. - The invoicing process in order to prevent delays of customers payments.
Supply Chain Reliability	Control inventory flow time	Every time perfect order accelerates the inventory flow and avoid flow distortions over time.
Supply Chain Responsiveness		Stable cycle time for completing customer orders leads to controlled flow times of inventory. Which contributes to less CCC variation, and CFB control.
Financial Debt	Control accounts receivables and payables flow time	The self-financing capacity of the company and the low level of debt contribute to lower the risks of cash conversion cycle variation and consequently reduces the CFB exposure.
Financial Efficiency		The lower the cycle time is, the more the Cash Conversion Cycle variation is reduced. This contributes to a better CFB control.
Financial Liquidity		The more the company is liquid, the less it's fragilized by Cash Conversion Cycle variation, and CFB.

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