Relation between supply chain efficiency
And supply chain finance

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ABSTRACT: Supply chain management can help a company achieve the true return on investment of customer relationship management systems. In supply change management, supplier finance that is also called supply chain finance is used to deal with the financial issues in supply-side value chain management. Supply chain finance can affect corporate performance and improve the supply chain efficiency in terms of cost saving payable processes and payment term extension. Some performance measures that are derived from the financial supply chain management have influences on profitability. Global supply-chain finance refers to the set of solutions available for financing specific goods and/or products as they move from origin to destination along the supply chain. It is related to a quickly growing use of a battery of technologies and financial business practices that allow for dynamic payables discounting. The supply chain finance is a financial solution that provides win-win outcomes for all the participants in the supply-side value chain.

Keywords: invested capital, supply chain finance, corporate performance, participants

INTRODUCTION

Supply chain is system of organizations, people, technology, activities, information and resources involved in moving a product or service from supplier to customer. Supply chain activities transform natural resources, raw materials and components into a finished product that is delivered to the end customer. The Council of Supply Chain Management Professionals defines supply chain management as follows: “Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies. Supply Chain Management is an integrating function with primary responsibility for linking major business functions and business processes within and across companies into a cohesive and high-performing business model. It includes all of the logistics management activities noted above, as well as manufacturing operations, and it drives coordination of processes and activities with and across marketing, sales, product design, and finance and information technology (Aczel Amir, 2006).

A typical supply chain begins with ecological and biological and political regulation of natural resources, followed by the human extraction of raw material, and includes several production links (e.g., component construction, assembly, and merging) before moving on to several layers of storage facilities of ever-decreasing size and ever more remote geographical locations, and finally reaching the consumer.

Payables discounting and asset-based lending add an additional US$100 billion and $340 billion, respectively. Only a small percentage of companies are currently using supply chain finance techniques, but more than half have plans or are investigating options to improve supply chain finance techniques. Since 2008 the financial crisis has resulted lots of banks or financial institutions in confronting serious credit risks, which subsequently bring liquidity tightening, bank runs and even bankruptcies. Absolutely, this issue will affect their financing activities to companies. In the meanwhile the international business has also faced to a big challenge, because trading partners are ought to seek for alternative capital financing sources or approaches.

Many of the exchanges encountered in the supply chain will therefore be between different companies that will seek to maximize their revenue within their sphere of interest, but may have little or no knowledge or
interest in the remaining players in the supply chain. More recently, the loosely coupled, self-organizing network of businesses that cooperates to provide product and service offerings has been called the Extended Enterprise.

Dynamic discounting, early discount payment and lengthening payment terms are crucial for corporates to deal with insolvencies and remain competitive at the same time. In the history of trade finance, factoring and letter of credit are often applied to help the international business partners manage cash flows. However, the impact of financial crisis will amplify counterparty risks and increase transaction costs. Problems of aging payables and increasing credit risks have become the main reasons to cause inefficiency in operational and financial performances. The supply chain disruptions in relations to supplier defaults can have long-term negative effects on a firm’s financial performance. Furthermore, the impact of supply chain performance on financial indicators has also been revealed by (Altman Edward, 2000) from financial accounting points of view. The risks in the supply chain management associated with “volatility and supplier failure” had increased 54% between mid-2007 and mid-2008 (Assadej Vanichchinachai and Barbara Igel, 2011) (Badell, 2005). The importance of supply chain risk management is illustrated by the results of a recent survey, which reveal that 90% of firms felt threatened by supply-side risks (Barnett, 1994). The contribution of this research is about to help business partners seek a superior financial solution for solving supply chain cash flow issues in the crisis (Bauer David F, 1972). The financial crisis in 2008 is not so far away from now, so the mid-term effects are difficult to detect at this moment. Additionally, some companies may adapt to the program after 2008. Furthermore, in Wang’s paper two-year time interval outcomes are not different from the findings for one-year time interval. Therefore, the assumption of the short-term positive impact of SCF is logical. If this is true even around the financial crisis, then the expectation of using the SCF program is more realistic. The immediate positive outcomes are able to show that the SCF program is efficient to help the business partners live on from the transitory overwhelming turmoil.

**Literature review**

In this section a framework of supply chain finance and its integration to supply chain management will be introduced first. The impact of financial crisis brings new challenges as well as new opportunities to the development of supply chains. The link between supply chain and financial flows is considered as an inevitable strategic solution while improving corporate performance. The introduction of supply chain finance to the supply chain management is able to help corporates remain competitive and increase economic value added. Ideally, the effects of development are possible to be observed in short term. Ultimately, the win-win outcomes will benefit both large and small participants.

Nowadays the supply chains have been developed more complicated as the business has become more international. The term of supply chain management is first introduced by U.S. industry consultants in the early 1980s (Beamon, 1998). The expansion of physical capabilities in international logistics has started since the early 1990s, and the trend of global economic integration becomes evident everywhere. With the development of e-business, communications between suppliers and buyers become instant by information systems. For example, the buyers can have access to any suppliers irrespective of location and available at any time. It reduces costs, improves service levels and increases profits. The improved communications through new technology are the enablers of supply chain integration. The popularity of international integration brings the new challenges to the management of multiple relations in the supply chain.

There are many researchers have studied on various processes of in supply chains. Lambert and Cooper point out that a successful SCM requires a cross-functional integration in the firm by coordinating activities of the key business processes. The links of business processes have direct effects on the levels of decision making, such as operations and financial planning, supplier risk and customer services management. Thus, analyzing and designing an efficient and effective supply chain have gained an increasing attention, and models of evaluating supply chain performance are diverse as investigated by (Beaver, 1966). He implies that a traditional supply chain is characterized by a forward flow a materials and a backward flow of information and finance. Farris and Hutchison have emphasized the cash-to-cash cycle concept to the supply chain management perspectives. It contains three important leverages which are account payables, account receivables and inventory. In the meanwhile, the idea of cash management has also been sentient in supply chain business processes (Berk, 2007).

Cash flows are involved in each supply chain business process and the optimization of the financial flows is required at each stage. It shows the necessity of managing financial flows in the supply chain business processes, and it is significant to implement the financial-SCM strategic plan. It heightens the decision-making capacity of the CEO and the CFO in complex scenarios. The cash inflows and cash outflows in supply chains are strongly dictated to the capital capacities in companies. The synchronized level between supply chain management and the financial flows can be seen as indicator to measure the operational efficiency and as a result the financial liquidity in the companies. There are many companies have not noticed the disconnection between overall business strategy and supply chain strategy in the organization; financial, information and
physical flows are seldom synchronized. However, economic growth and capital utilization in the firm are expected to be optimized through the integration of information, financial and physical supply chains. The strong interdependency between operations and financial departments enables corporate to maintain competitive advantages in industries.

This has been broadly applied in multi-level, manufacturing organizations. In the 1990s many companies move their concentrations on competitions to reduce their own costs as well as those of related partners in supply chains. The competitions among companies rely on a more cost-effective chain – a lower cost to serve the final marketplace and achieved in the shortest time period possible. The ABC tools are not used for the evaluation of financial performance, because delayed payment, return on investment/equity are not concerned as analytical indicators. Therefore, this evaluation tool is not satisfactory enough to be applied at the tactical stage for the overall corporate valuation (Bhagwat, 2007).

The analysis of profit or NPV determines implementations of certain projects. But using DFCF method to assess the strategic supply chain decisions cannot maintain sustainable competitive in case that the financial impact on different operational alternatives is not assessed in advance (Birnbaum, 1951). Normally, conventional organizations choose internal financing resources to finance the supply chain and the related business processes. Yet, retained earnings, depreciation, redistribution of capital from the balance sheet of a company do not have cash payments associated. Accounting earnings can present the economic value added in the firm but not the direct cash that are ready to be spent (Blome, 2011). Many academic researchers have described the differences between financial chain and physical chain in terms of inventory, process and cash management. Yet, the measures on the cost of capital regarding the impact of SCM solutions have not been explicitly considered2, because the financed assets as well as the cost of financing are not normally concerned on the bases of supply chain activities.

As a consequence new tasks at the intersection of finance and logistics SCM open new business areas for banks as well as financial and logistics service providers (Hofmann, 2005). The new concept about the integration of financial, information and physical flows brings supply chain managers new thoughts to concern the importance of the financial side of business activities. In turn, it gives the new challenges to supply chain executives of speaking the financial languages to communicate on board and in the mean while to build up cross-functional competences. The new trend of inter-organizational interactions and cross-functional relationships provides new opportunities for the development of supply chain efficiency and financial performance (Camerinelli, 2009). Collaborations between the financial side and the operating side need an encompassing approach. It should not be an isolated concept but rather as an aspect of a more integrated system or program to map the gaps between SCM operating performance and financial performance (Ceccarello, 2002). The physical supply chain uses analysis and planning tools to meet and predict future demand as well as international logistics; the financial supply chain incorporates external financial service providers to jointly create value through means of planning, steering, and controlling the flows of financial resources. The SCF program aligns the operational flows with the financial flows (William H. Beaver, 1968).

Reducing the financing costs and optimizing cash flows in the supply chain can be seen as the main functions of the SCF program. It is orientated to motivate supply chain development, risk adjustment and value creation through improved operational performances with respect to the reconfiguration of financial resources (Wooldridge, 2002). The levers of the SCF program are volume, duration and cost of money. Benchmark financial indicators using supply chain operations reference (SCOR) model can help supply chain managers to visualize the link between operational performance and the financial statement (Jeffrey, 2003). Nowadays, the supply chain management expands to a scope beyond the operational level of management. The task of SCF is to save the capital cost by means of integrated relationships of partners and advanced financing activities in supply chains. Applying this financial aspect to finance the supply chain gives us a new knowledge on the level of management - financial supply chain management (FSCM).

The financial supply chain management is a specific set of solutions and services to expedite the flows of financial resources and information between trading partners (Michael 2009). The development of e-invoicing - paper-free transferring process of payment and the supplementary corporation with third-party financial institutions result in a simplified integrating supply chain procedure.

Wang (2010) has conducted an empirical study on the impact of SCF on short-term corporate performance. KPIs for both supply chains and financial flows are applied to present corporate performances. He concludes the implementation of the SCF program is mostly used to solve short-term cash flow issues and to reduce operating costs. In the summary, inventory turnover, return on sales and return on equity have been increased at certain significant levels. In addition, the reduced cost of goods sold can increase profitability significantly. The selection of the analytical variables in Wang’s paper relies on experience, so it is a kind of empirical analysis on common corporate valuation indicators and ratios by a consideration of SCF application.

The introduction of the SCF program contributes financial services to business processes that relate to financial issues in supply chains. The collaborations are based on committing to share the resources, capabilities, information and risks on a contractual basis. Stronger/larger participants are orientated to
concentrate on the process optimization and visibility between trading partners; smaller/weaker participants are expected to provide sufficient financial and operating information. Generally, the large participants who initiate the SCF program are intended to increase the economic valued added through payment term extension, and the small participants who join the SCF program are going to enhance the liquidity through financing costs reduction. The improved corporate performance can be observed from profitability, cash flows and credit ratings.

Changing suppliers is risky but essential and beneficial for the supply chain under certain circumstances. However, sometimes many supply chains rely on a set of specialized suppliers who are not easy to be replaced, and in the meanwhile it takes long time to build up the new mutual trust supplier-buyer relationships in a short time. Therefore, financing the supply chain is the most effective time-saving strategy. Additionally, the application of open account rather than letter of credit (LC) in international trade condenses the transaction costs in terms of charge fees from banks and increases the cash flow speed in terms of a simplified payment process. By the means of letter of credit, a vendor/supplier has to prepare all the required documentation and then claim the payment from the bank with certain LC costs.

**Methodology**

In order to increase liquidity, the supplier promotes terms on early discount payment with cost of money and the buyer applies dynamic discounting method with upfront cash reserves. This method works all right when the situation is not extremely downside in the financial crisis. When the bank runs occur often and in turn affect the financing activities to companies, the buyer starts to consider lengthening payment term in order to fulfill internal financing on working capital needs. Indeed, the dynamic discounting method is redundant for the sake of holding cash reserves. This phenomenon results the supplier in complexity of managing its account receivables. Eventually the supplier will borrow money from other financial factors with higher credit costs in order to further operate the business processes. In the meanwhile it is not rational anymore for the supplier to offer early discount payment, because the lower credit ratings may lead to bankruptcy at the end.

The consequence of supplier failures in the supply chain is expensive; hereby the resolution to help the buyer and the supplier live on from the transitory overwhelming turmoil is a further contribution of this study. The introduction of the SCF program in the supplier-buyer trade relations breaks the door to the next level of supply chain management – financial supply chain management.

The concept of financial supply chain management is derived from the introduction of supply chain financing programs from the bank or the third-party financial institution with new forms of payable processes and payment terms between business partners. The superior financial services provided by large participants and external financial providers assist on increasing supply chain efficiency as a whole as well as remaining competitive. Mainly it reduces the complexity of payable processes through open accounts and in the meanwhile let small participants take large participants’ credit ratings to reduce costs of capital financing. Overall it improves short-term liquidity in the value chain and consolidates long-term supplier-buyer relationships.

The introduction of the SCF program to supply chain management can be seen as part of the design of financial flows in supply chains. As we know supply chain decisions are usually close to operational management instead of financial management. However the SCF program is a financial solution to develop the supply chain management, and in return the improved supply chain efficiency will enhance financial performance. To explore that, companies are ought to link operational drivers to top level financial indicators. The EVA model in figure 1 is used to link the value drivers from the operations to the financial performance. The EVA model tree leads to 1) the net operating profit after taxes (NOPAT), and 2) the cost of capital.

**RESULT AND DISCUSSION**

The data is collected randomly by searching announcements on internet (Beamon, 1998). The search covers the time period from 2006 and 2009, for the focus of the study is to figure out the outcome of applying SCF around the financial crisis. In addition, the dataset of short-term performance is attained by one-year differenced figures, before and after the event. Thus companies who have adapt SCF in and after 2010 are not possible to be analyzed at this moment. To be included in the analytical sample, firms with SCF announcements must satisfy the following criteria:

1) The common stock is listed on stock trading market: the New York Stock Exchange (NYSE), the American Stock Exchange (AMEX), or the NASDAQ exchange.

2) The firm must be the large participate who is responsible for initiating SCF programs in supply chains.

3) The firm has not made an announcement to leave the program within one year.

Criteria 1 and 2 are imposed because some raw financial accounting figures are needed from annual reports in order to calculate the indicators and ratios. The financial statements of non-listed companies are not easy to
get from public resources. Large companies are usually listed in the stock market and provide their financial reports to the public. Criterion 3 is imposed to avoid the missing values and to make sure of the consistency in the analysis. The sample consists of 23 announcements. The final dataset contains the figures of short-term corporate performance. If the announcement year is 2008, then the analytical data should be calculated by subtracting the figures in 2007 from the figures in 2009. Table 1 presents the descriptive statistics of the sample based on the target time period. IT and CCC are described by numbers; other indicators and ratios are described by percentages. The dummy variable gives “1” to the year 2009 and “0” to the years from 2006 to 2008. The use of dummy variable is to show the increased popularity of aligning the SCF program after financial crisis.

The application of the SCF program in supply chains can create win-win outcomes for the collaborating partners through simple and fast payable processes. The agreement established between the buyer and the financial institution contains legal issues, such as transparent data transforming in processes5. In the meanwhile, the buyer has to provide detailed and timely financial and operating information to the financial institution regarding the supplier.

In this section, operational and financial indicators regarding the SCF program will be discussed broadly based on the EVA model. The selection of important FSCM performance indicators depends on the features of SCF and the value drivers in supply chains. Profitability ratios are chosen in accordance to the key figures that can present growing profits in companies. The cause-effect relationships between the FSCM performance indicators and the profitability ratios are derived by considering the overall impact of supply chain improvements on corporate performance.

Key performance indicators (KPIs) are also known as key success indicators. There are various KPIs that are used for the measurement of financial supply chain management. FSCM performance indicators will be defined from both supply chain operations and financial flows. Some of the KPIs are determined according to supply chain solutions; some of the KPIs are derived with respect to financial-SCM connection.

Capital utilization is the area with the greatest potential for SCM solutions to improve the overall financial performance. The optimization of inventory, account receivables and account payables are the main elements to be considered regarding the features of SCF. Cash conversion cycle seems having the character to build up the connections for these elements (Farris and Hutchison 2002), and it is also one of the value drivers of SCM to improve the financial performance in the EVA model.

The long cash conversion cycle requires large working capital in operations, thus to keep this value as low as possible is what the SCF program is ought to contribute (Hofmann 2003). The cash conversion cycle covers the whole period from the cash outflow of paying for production and cash inflow of selling products to customers. There are three important components in the process: 1) Days Inventory Outstanding (DIO), 2) Days Sales Outstanding (DSO), and 3) Days Payable Outstanding (DPO).

\[ CCC = DSO + DIO - DPO \]
The CCC metric covers the value drivers from both supply chain and financial flows. We can see that shortening the days in inventory, reducing days in average receivables, and extending days in average payables can result in the decrease of working capital requirement in operations. Cost of goods sold is used as a denominator to obtain DIODPO, because DIO and DPO are the values related to supplier relationships. DSO is paired with revenue, because customer relationships generate sales/revenue.

First of all, let us see how operating processes and financial structure can be integrated based on the EVA model. The net operating profit after taxes (NOPAT) and invested capital are seen as independent of the company's financial structure and non-operating assets. It is a kind of component that purely symbolizes the impact of operations on financial figures. It can be used to calculate the return on invested capital (ROIC) which assesses how well a company is using its money to generate returns.

\[
ROIC = \frac{NOPAT}{Invested\ Capital}
\]

If we expand the equation into details including considerations of profitability maximization, capital efficiency optimization, and tax minimization, then we have

\[
ROIC = (1 - Cash\ Tax\ Rate) \times \frac{EBIT}{Revenues} \times \frac{Revenues}{Invested\ Capital}
\]

where \( NOPAT = (1 - Cash\ Tax\ Rate) \times EBIT \), EBIT, is equal to revenue less operating expenses (e.g. COGS, SG&Å, depreciation). All the profits included in NOPAT are available to both debt and equity holders. ROIC is a financial indicator, but it solely focuses on a company's operational drivers, over which the manager has control.

| Table 1. Distribution of the announcement year for the sample of 23 firms of supply chain finance |
|---|---|---|
| Year | Number of firms | % of firms |
| 2006 | 2 | 8.70% |
| 2007 | 6 | 26.09% |
| 2008 | 3 | 13.04% |
| 2009 | 10 | 52.17% |
| 2006-2009 | 23 | 100% |

Table 2 presents the number of firms with the announcement of SCF by year. Nearly 40% of the announcements in the final sample are made during 2007-2008, and over 50% of them are made in 2009. Obviously, most announcements are occurred after the financial crisis.

| Table 2. Descriptive statistics for the sample of 23 firms of supply chain finance |
|---|---|---|---|---|---|---|---|
| Measure | N | Minimum | Maximum | Mean | Std deviation | Skewness | Kurtosis |
| ROIC | 23 | -0.46 | 0.18 | -0.03 | 0.14 | -1.24 | 3.11 |
| ROE | 23 | -0.47 | 0.53 | -0.04 | 0.23 | 0.20 | 1.23 |
| ROA | 23 | -0.26 | 0.38 | 0.01 | 0.14 | 1.12 | 3.06 |
| ROS | 23 | -0.38 | 0.25 | -0.02 | 0.11 | -1.19 | 5.57 |
| CR | 23 | -0.20 | 0.06 | -0.01 | 0.05 | -2.09 | 5.53 |
| SR | 23 | -0.09 | 0.20 | 0.01 | 0.06 | 1.69 | 4.57 |
| GM | 23 | -0.06 | 0.20 | 0.01 | 0.05 | 2.09 | 5.55 |
| IT | 23 | -5.77 | 344.62 | 14.25 | 72.04 | 4.79 | 22.97 |
In table 2 we can see that the kurtosis of variables IT and CCC are relatively high and the standard deviations are also very large in comparison with other variables. In this situation, a consideration of outliers in the sample is essential (Barnett and Lewis 1994). Outlier is an observation that is distant from the rest of the sample data. Mostly, the extreme observation may be show as sample minimum or sample maximum.

CONCLUSIONS

The implied methodology to determine FSCM performance indicators is step by step from supply chain value drivers to operational drivers. For instance, if the supply chain value drivers are not possible to be calculated, then the author moves further to supply chain related operational value drivers. The selected financial ratios for profitability rely on the empirical literatures; however the cause-effect relationships between operational and financial performances are not only limited by the configurations in this research. If the research starts with qualitative method, then the selection of indicators and ratios will be more precise and adequate. For example, DPO could be used for empirical analysis instead of CCC. More FSCM performance indicators might be derived from practical supply chain business processes in the company and used in cross-sectional estimation. The performance indicators related to supply chain solutions might not always be recorded by figures but language interpretations sometimes.

The formulation of research problems determines research methods and resolve consequences. The structure of this study is outlined from financial points of view, and the empirical analysis on the financial accounting data has become the foundation to cope with theories and practices. To continue with this research design, further statistical analysis on an expanded sample is optional. For instance, other large organizations without SCF can be compared with the large organizations with SCF in the sample. The distinction can be settled by adding an additional dummy variable, where the large organizations with SCF are indicated by “1” and others by “0”. The extended sample is about to provide supplementary evidences highlighting the significance of applying the SCF program. Certainly, we would like to see the positive impact of SCF is true and the large organizations with SCF can generate more profits than the large organizations without SCF. This phenomenon could be applied to specify that competitors in industries are able to use the SCF program to enhance organizational capabilities.

A company based case study of SCF has the possibility to continue exploring thoroughly, and additional FSCM performance indicators are expected to be derived. The design of performance control by a consideration of SCF is a tendency; it is useful to clarify target values for corporate sustainability management. On the performance control panel, both numerated and non-numerated components should be involved. The predicted growth on the key figures influenced by SCF and the optimization of the related supply chain business processes are the targets.

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