

The relationship of Financial and Inventory Performance of Manufacturing Firms in Indian Context

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The extant literature on supply chain performance identifies two contradictory views about the relationship between inventory performance and financial performance of supply chains. While there are studies that suggest a positive association between inventory turnover and financial performance, few studies {Tunc & Gupta (1993), Vastag & Whybark (2005)} found that inventory turnover has no relation with financial performance. In addition, most of the studies considered total inventory value as a proxy of inventory performance. Capkun et al. (2009) suggested that inventory performance can be divided into its discrete components such as Raw material inventory (RMI), Work-in-progress inventory (WIPI), and Finished goods inventory (FGI). India is fourth largest economy, by Purchasing power parity, of the world and almost all global firms have started their operations in India. Hence, it is important to study about Indian firms' performance. It is noteworthy that there is not a single study, with respect to relationship between inventory performance and financial performance of supply chains, has been conducted for Indian firms. This paper is an attempt to study the relationship between the performance of the discrete components of inventory (RMI, WIPI, and FGI), and financial performance of Indian manufacturing firms.

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I. INTRODUCTION

Inventory Management plays an important role in improving the efficiency and competitiveness of manufacturing firms. This seemingly simple task to determine how much of an item to order or produce, and how much inventory of an item to hold, is at the foundation of all operational decisions. Inventory is one of the elements in the business cycle that absorbs cash. Excessive inventory on one hand can place a heavy burden on the cash resources of a business, on the other, insufficient inventory can result in loss of sales and delays for customers. However, a review of the literature on supply chain performance identifies three inadequacies. First, there is no consensus among the various studies on the

relationship between inventory performance and financial performance. While one array of the literature suggests that there is a positive relation between the two, another suggests that there is no significant relation between the inventory performance and financial performance. Second, most of the existing studies considered total inventory value as a proxy of the inventory performance and neglected its discrete components (RMI, WIPI, and FGI). Third, the results of these studies lack generalizability in a sense that most of them are conducted in US context. Despite the extensive research carried out in the area of supply chain management (SCM) across the world, SCM practices have not yet been very well-adopted in developing countries like India (Jain et al., 2011). Existing

literature also lacks studies on Indian manufacturing firms. This study therefore examines the relationship between the performance of the discrete components of inventory and the financial performance of Indian manufacturing firms.

II. LITERATURE REVIEW

In the literature, relationship between inventory performance and financial performance has been investigated from two distinct viewpoints, namely, direct and indirect. In the indirect paradigm, researchers analyzed that inventory performance affects other related indicators like IT performance etc., which in turn affect financial performance of the firm. However, in direct effects researchers tried to investigate the direct relationship between inventory performance and financial performance.

2.1. Evidence on Indirect effects

Dehning et al. (2007) observed that 'gross margin, RMI turnover, asset turnover, and WIP inventory turnover, market share, FGI turnover, total inventory turnover, ROA, ROS' are performance measures of a value chain. A careful analysis of all these measures suggests that several benefits accrue to manufacturing firms 'adopting IT based supply chain management', the most important being increase in inventory turnover and reduction in expenses. A study by Rajagopalan & Malhotra (2001) on the trends in inventory levels (RMI, WIPI, and FGI) of US manufacturing firms for the period of 34 years (1961-1994) reported that total inventory ratio at all three levels have decreased from 1961 to 1994. They reported in detail that RMI and WIP decreased in majority of sectors, but FGI decreased in some industry sectors while increased in others. Frolich et al (2001) defined arc of integration as level of integration a firm has, with its suppliers and customers. Inward facing strategy is defined as no integration with

suppliers or customers; and Outward facing is defined as extensive integration with both suppliers and customers. In between inward and outward strategies three more strategies exist, namely periphery, supplier facing, and customer facing strategies. Periphery strategy is the one in which there is little integration with suppliers and customers. Supplier facing strategy is defined as extensive integration with suppliers and little integration with customers. In customer facing strategy there is an extensive integration with customers and little integration with suppliers. Firms which are outward facing gain more financial benefits than inward, periphery, supplier, and customer facing ones. This gain in financial benefits can be shown in more inventory turnover, decrease in several costs, decrease in lead time, and subsequently increase in customer satisfaction (Frohlich et al. 2001).

In an attempt to study the link between Inventory and long-term stock returns of US manufacturing firms Chen et al. (2005) conducted an analysis on the 20 years (1981-2000) data. The findings suggested that, while firms with abnormally high inventory levels¹ have poor long-term stock returns, firms with slightly lower than average inventory do better than firms with extremely low Inventory. . Chen et al. (2005) also found that the rate of reduction in inventory was about 2% and the largest reduction was in WIP (about 6%) while FGI did not decline. In sync with the results of Chen et al. (2005) to showcase the indirect effects, Shah and Shin (2007) used publicly available sector data from 1960-1999 of manufacturing, retail, and wholesale sectors to show a link between information technologies (IT), inventory, and profitability. Their findings suggested that IT does not impact financial performance directly,

¹ Abnormal level of inventory is defined as normalized deviation from the industry norm i.e. 'if the normalized value of inventory of any specific firm is greater than zero; then it is said to have abnormally high inventory', 'if it is less than zero; then it is having low inventory'; and 'if it is equal to zero; then it is said to have average inventory.'

but rather mediates through inventory performance i.e. increase in investment in IT leads to an improvement in inventory performance which in turn leads to an improvement in financial performance for manufacturing firms.

Cachon & Fischer (2000) used simulation techniques to investigate the impact of information technology on supply chain management by comparing the supply chain costs with traditional no-information sharing, and full information revealed (that provides and exploits shared information). They found that the average difference is as low as 2.2%, and as high as 12.1%. Such differences are due to the fact that value of information technology used in information sharing leads to a reduction in lead time, batch size, and an improvement in inventory performance. It in turn reduces the supply chain costs and improves financial performance (Cachon & Fischer, 2000). However, in case of automotive suppliers the same relationship of supply chain, inventory performance, and financial performance is through customer services (Vickery et al. 2003).

2.2. Evidence of Direct effects

Unlike indirect effects, there are only few studies which show direct relationship between inventory performance and financial performance. For manufacturing firms in US, Capkun et al. (2009) observed a significant positive correlation between inventory performance and financial performance measures. In this study the authors decomposed inventory into discrete parts namely RMI, WIPI, and FGI and they took them as independent variables. Dependent variables were profit before interest & taxes (PBIT) and gross profit margin (GPM). The authors adjusted each variable with sales which was an effort to make each variable standardized. The correlation and regression analysis were used to determine the effects of inventory on performance measures. The study resulted in RMI having high correlation with

both financial measures. WIP and FGI having correlation with one of the measures not both. Almost similar positive correlations were witnessed while considering the relationship between JIT and financial performance, but inverse relations are prominent with inventory levels & other functional areas (Claycomb et al. 1999).

A study done on the relation between inventory management and firms' financial performance of Greek firms revealed that as the level of holding inventory increases the rate of returns decreases (Koumanakos, 2008). Gaur et al. (2005) used financial data of 311 public listed retail firms and presented an empirical model to investigate the correlation of inventory turnover with three measures, namely, gross margin, capital intensity, and sales surprise². The authors concluded that inventory turnover and gross margin are negatively correlated, and inventory turnover declined in retail sector. On similar lines, Roumiantsev and Netessine (2007) documented almost the same result, where data of 722 public US firms were used. The results suggested that, larger firms in terms of size benefit from economies of scale and keep fewer inventories than smaller firms. On the contrary, firms facing more uncertain demand, higher gross margin keep higher inventory levels. Huson & Nanda (1995) used the data of 55 firms and observed that the improvement of inventory turnover led to increase in EPS (earning per share). Manager can create shareholder value by reducing the number of inventory days (Deloof 2003). Whereas, Boute et al (2004) argued that the firms who have high inventory ratios are more prone to have bad financial performers.

There are few contradictory studies which say that there is no significant relation between inventory turnover and performance. Tunc & Gupta (1993) found in their study that ROS (returns on sales) and level of sales are not

² Sales surprise is a ratio of actual sales to expected sales.

affected by inventory turnover. Vastag & Whybark (2005) studied manufacturing firms and observed that there is no relation between inventory turnover and performance.

However, none of the above studies looked at discrete inventory components (RMI, WIP, and FGI) except Capkun et al (2009) which explicitly analyzes the relationship between discrete inventory components with financial performance measures. We study the relationship between financial performance and inventory performance in Indian context. Our study is worthwhile because of the following two reasons. First, Indian economy is growing rapidly and contributes a significant amount to the world GDP (gross domestic product). Second, foreign firms can take investment decision on the basis of our study. Furthermore, inclusion of performance of discrete inventory components will have the potential to open the avenues of testing for any differential impacts on the costs of production and operating expenses.

III. DATA SOURCE

Data for the study is collected from CMIE-PROWESS database for a time span of 16 years (1994-2009). PROWESS is a database of over 10,000 Indian companies. The rationale behind the time period is to see the impact of inventory on financial measures after the liberalization of Indian economy. The data of 122 firms is used, the firms belong to 10 industries namely Food & Beverages, Textiles, Chemicals, Non metallic, Metals & metal product, Machinery, Transport, Miscellaneous manufacturing, Electricity, and Services.

IV. RESEARCH METHODOLOGY

To study the relationship between the discrete components of inventory (RMI, WIPI, and FGI) and their impact on financial performance measures, regression analysis is used. All the variables are adjusted with sales so as to avoid sales surprises (Gaur et al 2005). This

will enable us to compare the firms as well as control the sales surprises. Gross profit is taken as financial measures and is adjusted with sales. Gross profit adjusted with sales $GPS = (Sales - Cost\ of\ goods\ sold) / Sales$. Similarly RMI, WIPI, and FGI are also adjusted with sales.

$$RMIS = \frac{Average(RMI_{i,t-1}, RMI_{i,t})}{Sales}$$

$$FGIS = \frac{Average(FGI_{i,t-1}, FGI_{i,t})}{Sales}$$

$$WIPS = \frac{Average(WIP_{i,t-1}, WIP_{i,t})}{Sales}$$

Table 1. Description & Notation of Dependent and Independent variables.

Dependent variable	Notation
Gross profit margin adjusted with sales	GPS
Independent variable	
Raw material inventory adjusted with sales	RMIS
Work in progress inventory adjusted with sales	WIPS
Finished goods inventory adjusted with sales	FGIS
Lagged Financial measure	LagGPS

Size is taken as control variable and to check the industry and age effects, industry dummies and year dummies are also used.

The regression equation is:

$$GPS = \alpha + \beta_1 Laggps + \beta_2 RMIS + \beta_3 WIPS + \beta_4 FGIS + \beta_5 Size + \sum \beta_i Industry\ dummies + \sum \beta_j Year\ Dummies + \epsilon$$

V. RESULTS

The regression is done in two steps for dependent variable GPS, first taking lag of GPS, RMIS, WIPS, FGIS, and SIZE as independent variables, in the second step industry effects and year effects have been checked using industry dummies and year dummies. GPS has been taken as a dependent variable, Table 2 shows the results of regression without dummies and Table 3 shows results of regression with industry dummies and year dummies.

For cross section data Heteroscedasticity is a rule rather than a constraint (Gujrati, 4th Edition). Hence we check Heteroscedasticity before estimating the regression and we found that the data is Heteroscedastic. The next thing to be done is to get White's Heteroscedastic consistent estimates, hence we run the regression, using E-views³ 6, asking for White's Heteroscedastic consistent estimates.

The regression results without dummies show that only Lag GPS and FGIS are significant at 1% and 5% level of significance respectively. The adjusted R square value is 0.19865 which means 19.86% of variance of GPS is explained by the explanatory variables. The F stat value (90.343) suggests that model is significant at 1% level of significance. Capkun et al 2005 found that all the discrete components were significant,

whereas, our results show that only FGI is significant but with negative sign. Consistent to the theory we can say that the less is the inventory the more is the profit, which is supported by our results (coefficient of FGI being negative).

In next step we tried to capture the industry and year effects by using dummies (see Table 3). This regression is again run with White's Heteroscedastic consistent estimates. The results show that Lag GPS and FGIS are still significant with same signs. The results also show that there is no year effect but there exist industry effects. Industries in category 4 (non metallic), industries in category 5 (metals & metal product), industries in category 8 (miscellaneous manufacturing), and industries in category 10 (electricity) have significant impact on performance. Except industries fall into category 8, rest three industries have positive impact on GPS. The constant term of the regression model is also significant which means reference category i.e. industry 1(food & beverages) and year 1995 both have significant impact on GPS. The adjusted R-Square value is 0.20773 which means 20.77% of variance of GPS is explained by the explanatory variables. The F stat value (17.874) suggests that model is significant at 1% level of significance.

Table2. Regression results without dummies.

Dependent Variable: GPS	Coefficient	t-Statistic	Probability
C	0.270108	3.714274	0.00021*
LAGGPS	0.388003	3.592879	0.000336*
RMIS	0.000508	1.032878	0.3018
WIPS	-0.00072	-0.98368	0.325404
FGIS	-0.00242	-2.14312	0.032237**
SIZE	0.001214	0.126685	0.899204
R-squared	0.200877	F-statistic	90.34316
Adjusted R-squared	0.198654	Prob(F-statistic)	0.00000001
Durbin-Watson stat	2.00173		

Note: A single (*) asterisk beside the coefficient denotes significant at the 01% level of significance, double (**) denotes significant at 5% level of significance, triple (***) denotes significant at 10% level of significance.

Table3. Regression results with industry and year dummies.

Dependent Variable: GPS	Coefficient	t-Statistic	Probability
C	0.266533	4.002738	0.00000001*
LAGGPS	0.364591	3.431526	0.000614*
RMIS	0.000673	1.252241	0.210647
WIPS	-0.00085	-1.19114	0.233758
FGIS	-0.00249	-2.11177	0.034845**
SIZE	0.003069	0.284858	0.775786
IND2	-0.05722	-1.53577	0.124773
IND3	0.015949	1.167686	0.24309
IND4	0.049086	2.525966	0.011624**
IND5	0.043303	1.899234	0.057696***
IND6	0.019113	1.502112	0.133246
IND7	0.016409	1.130813	0.258287
IND8	-0.03562	-1.88854	0.059117***
IND10	0.044939	2.413855	0.015885**
IND11	0.09652	3.165631	0.001574*
DUM1996	-0.01439	-0.75369	0.451134
DUM1997	-0.00161	-0.08477	0.932455
DUM1998	-0.0229	-1.13388	0.256998
DUM1999	0.001902	0.092085	0.926641
DUM2000	-0.00146	-0.07472	0.940442
DUM2001	-0.00369	-0.17082	0.864384
DUM2002	0.032047	1.435584	0.151297
DUM2003	0.016681	0.817696	0.41364
DUM2004	0.006073	0.291963	0.770349
DUM2005	-0.00208	-0.09794	0.921994
DUM2006	-0.00689	-0.29737	0.766222
DUM2007	-0.00724	-0.3174	0.750975
DUM2008	-0.07313	-0.8828	0.377461
DUM2009	-0.00836	-0.24661	0.805235
R-squared	0.22004	F-statistic	17.87415
Adjusted R-squared	0.20773	Prob(F-statistic)	0.00000001
Durbin-Watson stat	2.016893		

Note: A single (*) asterisk beside the coefficient denotes significant at the 01% level of significance, double (**) denotes significant at 5% level of significance, triple (***) denotes significant at 10% level of significance

VI. CONCLUSION AND MANAGERIAL IMPLICATION

In this study we tried to analyze the relationship between discrete inventory performance measures and financial performance measure. For the selected sample we found that (i) FGI is negatively associated with financial performance, (ii) RMI, and WIPI did not show any impact on GPS. Lag value of performance measure is significant at 1% level of significance. Our results also show that few industries have positive impact on financial performance but miscellaneous manufacturing is having negative impact on GPS.

The previous studies conducted on relation between firm performance and inventory performance primarily focused only on total inventory. If a manager wants to take any decision on the basis of total inventory, the results of such studies may lead to wrong results. Our paper provides an insight to the managers of Indian manufacturing industries to take a call on the basis of discrete inventory components. For example for some industry RMI is important and for other industry raw material is just a cost and FGI holds importance. Hence, taking decision on the basis of total inventory does not provide the managers a clear indication as to which part is to be reduced and which part is to be increased.

The results of our study indicate that FGI is an important decisive factor in strategic formation for Indian Manufacturers. Our results also suggest that those managers who do not focus on inventory performance may lose out to their competitors.

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