IJFAEC
International Journal of
Food and Agricultural Economics

EXPLORING LINKS AMONG INVENTORY AND FINANCIAL PERFORMANCE IN THE AGRICULTURAL MACHINERY INDUSTRY

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Abstract

The paper aims to investigate the effects of Inventory Turnover and Inventory Days on firm performance in the United Kingdom agricultural machinery industry by examining past literature reviews and empirical evidence of a primary research. Specific performance measures such as Earnings before Interest and Tax to Sales Ratio, Gross Profit to Sales Ratio, and Return on Assets are examined by conducting statistical analyses to determine the correlations between inventory and financial performance in agricultural machinery industry. The analysis of Inventory Turnover with financial performance measures doesn't indicate any links between these variables. Furthermore, based on the results, Inventory Days plays a role in the financial performance of organisations however to varying degrees.

Keywords: *Financial Performance, inventory turnover, inventory days, UK agricultural machinery industry.*

1. Introduction

According to the Euromonitor International (2009) reports, the United Kingdom (UK) agricultural and forestry machinery market by the end of 2007 was worth £2 billion with the market having grown 52 per cent from 2000 to 2007. In addition, 49 per cent of the total industry revenue was constituted by agricultural tractors. With the threat of international imports at 20 per cent growth in 2007 the competition in the UK market intensifies to improve sales, customer service and the overall business performance whilst optimizing operations and efforts in cost reduction (Euromonitor International, 2009).

With inventory playing a crucial role in an organisations business and operational performance to meet customer service levels and seasonal demands, an organisation's ability to manage inventory (stock, lead time, forward moving stock, etc.) to meet demands whilst taking into consideration various drivers including exchange rates, sea and inland freight, government tax incentives, and environmental factors will ultimately affect the inventory costs incurred by agricultural machinery organisations in the UK. Thus the sensitive nature of the agricultural machinery industry requires the effective and efficient management of inventory to meet the demand and supply of agricultural machinery and simultaneously

optimizing inventory levels to maximize benefits whilst minimizing costs. However, the question of "What levels of inventory maximizes financial performance?" arises.

The high valued nature of agricultural machinery poses significant risks for an organisation's profitability such as aged inventory, end of year stock, and so on towards the balance sheet which in effect diminishes an organisation's ending profitability for the financial year. Moreover, the perception that inventory measurement playing a key role as an indicator to assess business performance prompts further research to determine how much the role of an organisation's inventory affects business performance (Martin & Patterson, 2009).

Overall, operational performance improvement have been key organisational issues over the past century in areas such as lead time reduction in raw materials and finished goods inventory, quantity management, and so on where philosophies such as Just-In-Time (JIT), Total Quality Management (TQM), and lean production have been derived to address these issues Loren *et al*. (2005). Several academic literature reviews are available in areas of inventory management, inventory levels, and inventory performance versus financial performance, business performance, and profitability to establish systematic and logical links between these variables and its ability to improve overall business performance such as Wernerfelt and Mongomery (1998); Margolis and Walsh (2001); Kannan and Tan, (2005; Lwiki, *et al*. (2013); Mogere *et al*. (2013).

The majority of these empirical studies are concerned with certain markets, organisations non-specific to industries, or the categorization of organisation types such as manufacturers, wholesalers, retailers, and so on. However, academic literature reviews in inventory and financial performance are vastly limited for slow moving goods and especially for the agricultural machinery industry specifically for the UK market. Thus this paper aims to contribute to the academic community and agricultural machinery organisations by expanding and adding to existing knowledge and researching inventory performance and its links with financial performance. This is achieved by including a unique market, UK into the equation and filling in the gaps that is much overlooked for the slower moving, high value, and highly seasonal commodities such as agricultural machinery.

In this paper, quantitative data is the primary research method choice to investigate the links between inventory and financial performance (how does the inventory affect the financial performance) of the UK agricultural machinery organisations. To ensure that the integrity of data collected is reliable; data is sourced from FAME of the Bureau van Dijk Company Information and Business Intelligence which holds comprehensive UK and Irish company information. Companies are chosen based on their UK SIC (2003) codes with reliable seven years of data (from 2002 to 2008).

The rest of the paper is organized as follows; the first section investigates the effects of inventory on firm performance by synthesizing the literature review and empirical evidence of the links between financial performance and inventory. The methods and methodologies in which reliable, accurate, and consistent quantitative data is gathered for quantitative analyses of the UK agricultural machinery industry is discussed in Section 3. Moreover, the discussion and interpretation of the derived results from the data gathered for quantitative analyses are presented. Finally, the conclusions, as well as, the limitations, recommendations, and the scope for further research into the effects of inventory on business performance within the agricultural machinery industry are presented.

Nonetheless, it should be noted that financial performance is not affected solely by a single variable but rather a complex combination of factors. Thus studies conducted by Swamidass (2007) attempted to investigate a multitude of factors to investigate the links on inventory and firm performance. There is no doubt that a multitude of factors can impact the performance of any organisation due to the organisational nature and complexities

surrounding its business. With inventory playing key roles and a major focus in operations management, researchers have attempted to investigate the roles of inventory and its links between inventory and financial performance albeit contradictory outcomes have resulted.

2. Literature review

This section focuses on the academic research conducted previously on the links of inventory performance and financial performance of organisations. Overall, limited academic papers and journal articles are available regarding the links between inventory and business performance where many methods and methodologies selected by the researchers are parallel while others are acutely disparate in their approach with differing results.

The investigation of the relationship among the Inventory Performance and Financial Performance has been the subject of many research initiatives. A list of inventory and financial performance investigations from Cannon (2008) are depicted in Table 1 to illustrate the varying results of this research with both positive and negative correlations between inventory performance and business performance, as well as, the performance measurement that was used.

Part of these recent researches focused heavily on the inventory and performance of organisations that underwent the implementation of JIT and have resulted in a considerable amount of empirical evidence demonstrating correlations between inventory and financial performance. As expected, the purpose of JIT is to streamline processes to maximize efficiency and minimize waste whilst increasing value of the firm and the subsequent studies by Huson and Nanda (1995) and Fullerton *et al. (*2003) supported the positive effect of JIT implementation on financial performance through the efficiencies experienced in inventory and productivity efficiency.

The exception was the study by Balakrishnan *et al.* (1995) and Biggart and Gargeya (2002) where evidence indicated "both internal and external factors affect a firm's ROA response to JIT adoption (Balakrishnan *et al.,* 1995) such as customer concentration, cost structure and so on. However, the majority of the JIT inventory and financial performance studies are positively correlated in the increase in financial and sales benefits.

Furthermore, several other recent studies of the direct relationship of inventory and financial performance have resulted in either an existence in correlations or none whatsoever. Strong positive correlations are found within the research of a sample of manufacturers investigated by Capkun *et al*. (2009) where the link was not only correlated with inventory but also the discrete components of RMI, WIP, and FGI. The strongest link between inventory and financial performance existed within WIP. On the other hand, studies by Koumanakos (2008) showed no apparent links of financial performance and the inventory of Greek manufacturers and Chen *et al. (*2005) also experience similar results where "*exceptional inventory performers do not have exceptional stock performance* Cannon (2008)" and subsequently discovered high inventory is associated with poor stock performance. Cannon (2008) had similar results of failing to find significant links between inventory and financial performance with a sample of manufacturers albeit the attempt to measure multiple accounting (book) ratios and market values. Capkun *et al.* (2009) also "documents a negative correlation between inventory performance and financial performance in the retail industry whose value proposition relates to efficient product availability. By contrast, the value proposition of the manufacturing industry is based primarily on value adding operations, product innovation and efficient order fulfillment".

Table 1. Literature Review Regarding Inventory and Financial Performance Investigations

Year	Author (year)	Research title	Sample size, source	Financial performance measures	Summary of findings
1995	Balakrishnan *et al.* (1996)	Financial Benefits from JIT Adoption: Effects of customer Concentration and Cost Structure	JIT manufacturers (*N*=46), from Compustat 1987-1989	Return on Assets (ROA)	Both internal and external factors affect a firm's ROA response to JIT adoption
1999	Claycomb *et al.* (1999)	Total system JIT outcomes: inventory, organisation and financial effects	Manufacturers (*N*=200) from list of 3069 manufacturers provided by Council of Logistics Management	Three year averages of return on investment, profit, and return on sales	JIT is inversely related to inventory levels. JIT has direct association with organisational efficiency
2002	Biggart and Gareya (2002)	Impact of JIT on inventory to sales ratios	Firms (*N*=74) over 7 year's data where yr 4 is adoption year	Sales Ratio	Total inventory and raw material inventory to sales ratio reduction post JIT adoption. Total inventory reduced as a reduction of raw materials.
2003	Fullerton *et al.* (2003)	An examination of the relationships between JIT and financial performance	Firms (*N*=253) where 93 firms are JIT, 158 are not. Data from compustat	Return on Assets, Return on Sales, Cash Flow Margin	Improved inventory margin strongly associated with improved performance
2003	Huson and Nanda (2003)	The impact of Just-In-Time manufacturing on firm performance in the US	Firms (*N*=55) with 9 years accounting data. Data from Compustat	Earnings per share	Improved turnover correlated with improved earnings per share
2005	Gaur *et al.* (2005)	An Econometric Analysis of Inventory Turnover Performance in Retail Services	US (*N*=311) retailers over 16 years, 1985 - 2000. SIC 5600 - 5699. SIC 5400 and 5411.	Gross Margin = (Sales - COGS)/sales. Capital Intensity = Gross fixed asset/(Inv valued at cost + gross fixed asset). Sales Surprise =Sales/sales forecast	Inventory turnover should not be used per se in performance analysis.

2007	Swamidass, P. (2007)	The effect of TPS on US Manufacturing during 1981-1998: inventory increased or decreased as a function of plant performance	Compustat SIC 3400-3900 with 1981-1998 data.	Altman's Z-score Model	Top-decile performers consistently out-perform bottom-decile performers on total inventory/sales. Bottom-decile performer's inventory growing over study (1981-1998). Total inventory/sales declining (on average) across manufacturing sector
2008	Koumanakos (2008)	The effect of inventory management on firm performance	Greek (*N*=1258) firms from 2000-2002 using ICAP database.	Gross margin where (sales-COGs)/sales. Net Operating Margin where Net Op Income/(sales + other op income)	No consistent patterns detected in industries
2008	Cannon (2008)	Inventory improvement and financial performance	Firms (*N*=244) from Compustat database with 10 years of data	Accounting based measures of Return on Asset and Return on Investment. Market Based measures - Market value added (MVA) and Tobin's Q	Accounting based results - better inventory performance equated to worse overall performance. Marketing based results - no significant links
2009	Capkun *et al.* (2009)	On the relationship between inventory and financial performance in manufacturing companies	Observations (*N*=52254) for US manufacturing firms (SIC 2000-3999) from 1980-2005	EBITS = EBIT/sales GPS = (sales - COGs)/sales	Strong correlation between inventory performance and financial performance across manufacturing industries
2011	Kolias *et al.* (2011)	Investigate the determinants of inventory turnover ratio	Greek retail firms (*N*=566) for the period 2000-2005	Return on Assets (ROA)	Inventory Turnover ratio is negatively correlated with gross margin and positively correlated with capital intensity

The clarity of the links has been less than transparent with the need of much more research and study in this field. With the limited studies conducted, the retailer and manufacturer samples investigated have somewhat been narrow and covered mostly consumer goods, fast moving goods, or products that do not have long inventory turnovers such agricultural machinery.

3. Research Methodology

The investigation of the relationship among inventory and financial performance in the UK agricultural machinery industry is the main objective of this research. Based on the literature review, the results of the direct links of inventory and financial performance have been varied and thus instigating further research in this field of study. The data collected to conduct quantitative analyses to investigate the links of inventory and business performance are the reported financial data available at Bureau van Dijk's FAME, a database and tool to search for specific profiles of UK organisations. FAME covers over seven million companies in the UK and Ireland and is the primary source of data for the research analyses conducted in the dissertation research.

The Research Methodology and specifically the collection of the data consisted of various steps to derive to the 55 organisations chosen to conduct investigation and analyses to verify the validity of the hypotheses. The first step was to segregate organisations in the UK agricultural machinery industry with the following UK SIC (2003) primary codes criteria: 1) SIC 2931 Manufacture of agricultural tractors, 2) SIC 2932 Manufacture of other agricultural and forestry machinery, and 3) SIC 5188 Wholesale of agricultural machinery and accessories and implements, including tractors. To obtain an increased accuracy of data averages, the availability of consecutive reported accounting data from 2002-2008 (7 years) offered the largest number of organisations with a total of 816 organisations within the SIC codes sought. However, the availability of the "right" data was limited and diminished the originally high number of 816 organisations to 55 organisations. Thus the number of organisations to conduct quantitative analyses and test the hypotheses after the search criteria's was a total of 55 organisations.

In order to achieve the research objective, the following research questions were raised: 1) Is there a link between inventory and financial performance and if so, what link?, and 2) How does inventory affect financial performance?

To investigate the above questions, the analyses method of approach encompasses the investigation of the correlations between Inventory Turnover and Inventory Days as performance measures. Inventory Turnover is a ratio showing how many times a company's inventory is sold and replaced over a period, while Inventory Days is the average number of days goods remain in inventory before being sold.

These are derived from the following formulas:

Inventory Turnover=Total Sales / INV and *Inventory Days=INV x 365 / COGS.*

Where INV is Total Inventory and COGS is Cost of Goods Sold.

The financial performance measures chosen are: 1) Earnings before Interest and Tax (EBIT) to Sales Ratio, 2) Gross Profit to Sale Ratio, and 3) Return on Total Asset. These are derived from the following formulas:

EBIT to Sales Ratio=EBIT / Total Sales

Gross Profit to Sales Ratio=Total Sales–COGS / Total Sales

ROA=Net Income / Total Assets

Where ROA: is Return on Total Asset, EBIT: is Earnings before Interesting and Tax, and COGS: is Cost of Goods Sold.

The correlation of these performance measures will be tested by following groups:

• Group A of investigations encompasses all 55 agricultural machinery organisations within the UK industry.

• Group B investigates the top 25 percentile organisations based on average sales turnover over 7 years and will undergo the same tests as Group A.

• The third set is Group C and investigates the bottom 25 percentile of organisations and undergoing identical investigations.

First, regarding the Group A (all cases), the following tables (Tables 2 to 4) present the coefficients of regression analysis between the Inventory Turnover - IT (independent variable) and: 1) Earnings before Interest and Tax / EBIT to Sales Ratio, 2) Gross Profit to Sale Ratio / GPS, and 3) Return on Total Asset / ROA (dependent variables).

Table 2. Coefficients of Regression Analysis (Independent Variable: IT and Dependent Variable: EBITS)

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std. Error	Beta		
1	(Constant)	3.562E-02	0.007		5.312	.000
	IT	-4.917E-04	.001	-.030	-.596	.552

Table 3. Coefficients of Regression Analysis (Independent Variable: IT and Dependent Variable: GPS)

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std. Error	Beta		
1	(Constant)	1.787	.010		184.650	.000
	IT	4.524E-04	.001	,019	.380	.704

Table 4. Coefficients of Regression Analysis (Independent Variable: IT and Dependent Variable: ROA)

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std. Error	Beta		
1	(Constant)	4.702	1.402		3.353	.001
	IT	8.293E-02	.173	.025	.481	.631

According to the results of the regression analysis there is no statistically significance among IT and EBITS *(F=0.355; p=0.552).* Moreover, there is no statistically significance

among IT and GPS *(F=0.144; p=0.704).* Also, there is no statistically significance among IT and ROA *(F=0.231; p=0.631).* For all the above the R^2 coefficients are extremely low *(R^2=0.000, R^2=0.000, and R^2=0.001)*.

Tables 5 to 7 present the coefficients of regression analysis between the Inventory Days - ID (independent variable) and: 1) Earnings before Interest and Tax / EBIT to Sales Ratio, 2) Gross Profit to Sale Ratio / GPS, and 3) Return on Total Asset / ROA (dependent variables).

Table 5. Coefficients of Regression Analysis (Independent Variable: ID and Dependent Variable: EBITS)

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std. Error	Beta		
EBITS						
1	(Constant)	4.850E-02	.008		5.729	.000
	ID	-1.766E-04	.000	-.109	-2.138	.033

Table 6. Coefficients of Regression Analysis (Independent Variable: ID and Dependent Variable: GPS)

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std. Error	Beta		
1	(Constant)	1.880	.011		168.285	.000
	ID	-9.782E-04	.000	-.417	-8.976	.000

Table 7. Coefficients of Regression Analysis (Independent Variable: ID and Dependent Variable: ROA)

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std. Error	Beta		
1	(Constant)	7.063	1.778		3.973	.000
	ID	-1.974E-02	.017	-.058	-1.138	.256

According to the results of the regression analysis, there is a strong relationship between ID and EBITS, as well as, between ID and GPS (no significant relationship appears among ID and ROA). Specifically, ID has a strong effect to EBITS *(F=4.569; p=0.033).* However, the predictive power is very low *(R^2=0.012),* as ID affects only the 1.2% of dependent variable's variance. Furthermore, ID has a strong effect to GPS *(F=80.586; p=0.000),* and the predictive power is R^2=0.174.

Regarding the regression analysis for the Groups B and C the results demonstrate that for Group B there is a strong relationship among Inventory Turnover and Gross Profit to Sale Ratio, as well as, among the Inventory Days and Gross Profit to Sale Ratio. For the Group C there is only strong relationship among Inventory Turnover and Gross Profit to Sale Ratio.

Moreover, regarding the Groups B and C (top 25 and bottom 25 percentile of organisations) the Mann-Whitney tests show that there are statistically significant differences in the levels of:

- Inventory Turnover *(U=2,201.0; p=0.000).* Specifically, Group B has statistically higher Inventory Turnover than that the Group C *(Mean Rank Group^B=112.81; Mean Rank Group^C=70.19).*
- Inventory Days *(U=1,618.5; p=0.000).* Group C maintain the goods in inventory before being sold for a higher number of days than companies in Group B *(Mean Rank Group^B=63.79; Mean Rank Group^C=119.21).*
- Return on Total Assets *(U=3,270.0; p=0.014).* Group B has statistically higher ROA than that the Group C *(Mean Rank Group^B=101.07; Mean Rank Group^C=81.93).*
- Gross Profit to Sale Ratio *(U=981.0; p=0.000).* Group B has statistically higher GPS than that the Group C *(Mean Rank Group^B=126.22; Mean Rank Group^C=56.78).*

On the contrary, regarding the Earnings before Interest and Tax (EBIT) to Sales Ratio (EBITS) there are no different outcomes for the two groups *(U=3,507.0; p=0.073).*

4. Conclusions

The effects of inventory on financial performance in the United Kingdom agricultural equipment industry is instigated due to the lack of academic research within the agricultural machinery industry where inventory is characteristically slower moving in comparison to more available academic research on faster moving inventory. The results from the data gathered demonstrated statistically that inventory performance has some correlations with an organisation's financial performance and it can be used as a critical indicator of financial performance however to varying degrees.

Specifically, the findings proves that there is no relationship between Inventory Turnover and the following financial performance measurements: Earnings before Interest and Tax (EBIT) to Sales Ratio, 2) Gross Profit to Sale Ratio, and 3) Return on Total Asset. These findings are aligned to previous research initiatives such as Gaur *et al.* (2005) and Koumanakos (2008).

Furthermore, the results justified previous studies such as Capkun *et al.* (2009) and Kolias *et al.* (2011) there is a strong relationship between Inventory Days and Earnings before Interest and Tax (EBIT) to Sales Ratio, as well as, between Inventory Days and Gross Profit to Sale Ratio. The same results appear autonomously to the companies in the agricultural machinery industry in the United Kingdom with a high or small average sales turnover over 7 years.

However, it should be noted that inventory itself cannot be utilized for predicting financial performance as unknown variables such as the weather play key roles in how an agricultural organisation results in financial performance but inventory management systems and tools such as Smart Ops utilized by Deere and Company assists in improving inventory management by taking into consideration lead time, seasonality, launches, programs, and so on to best manage its inventory to minimize costs without compromising customer demands and service levels. Thus the management of inventory is vital for any organisation as it plays a critical role in every aspect of the business that eventuates to a firm's financial performance.

To conclude, it is difficult to deem that inventory turnover is a 'critical' indicator of financial performance as the strength of the correlation is somewhat inconsistent throughout the groups as show in the results. As with all research, the investigations do have its limitations and should be taken into consideration as further research is encouraged to understand the characteristics of inventory and how it affects the overall financial performance of any organisation.

The topic of inventory performance and its ability to affect a firm's financial performance have only been a recent phenomenon and a young topic of discussion. With philosophies such as JIT, Supply Chain Management, Kanban, Quality Management, and so on being a recent advance in terms of inventory management, further study will no doubt be inevitable. As each market and industry is unique, such as the agricultural machinery organisations in the United Kingdom, it is recommended that further research should not only be limited to a specific industry but also conducted separately by market and industry to grasp a better understanding on how inventory actually affects a firm's overall financial performance for that specific market. In saying so, future studies should take into considerations the limitations faced by the researcher that can potentially affect the overall results of the links between inventory performance and financial performance.

Acknowledgments

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