Influence of Selected Manufacturing Firm Characteristics on Choice of Inventory Costing Method

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Abstract

The study aims to examine the influence of selected characteristics of manufacturing firms on the choice of Inventory Costing Method. The food and beverage and the steel sectors listed in the Thailand Stock Exchange from 2016 to 2018 were studied, consisting of 36 firms and 24 firms respectively. These firms adopted inventory costing methods such as First-In-First-Out, Weighted Average Cost Method, and Moving Average Cost Method, and characteristics such as firm size, inventory size, profitability, firm financial leverage, inventory turnover, and current ratios were examined. A logistic regression test was used to find the influence that firm characteristics have on inventory costing methods. The results indicate that in 2017 and 2018, a significant relationship was found between profitability, inventory turnover, and current ratio the

inventory costing method used by food and beverage firms, while no statistically significant factors were found in steel sector firms.

Keywords: Inventory Costing Methods, First-In-First-Out, Weighted Average Cost Method

1. Introduction

The manufacturing sector plays an important role in the Thai economy, and firms in this sector create many jobs. As a result, this sector helps to reduce the country's unemployment rate. Manufacturers' main source of income is from the sales of inventory, which has an important role in company operations. The cost of inventory affects both the amount reported in the balance sheet, and the cost of goods sold reported in the income statement. Given that there are several choices of inventory costing methods available, managers have some flexibility in selecting among them. All decisions regarding the choice of inventory costing methods, however, have economic consequences.

Needles and Powers (2010) said that three widely used costing methods are the First-In-First-Out (FIFO) Method, the Last-In-First-Out (LIFO) Method, and Average Cost Method. Managers tend to select and consider an inventory costing method that shows price trends, along with the consequences that each method has on financial statements, income taxes, and cash flows.

Therefore, this study aimed to investigate and analyze the different characteristics of manufacturing firms that might potentially influence the choice of inventory costing methods such as firm size, inventory size, profitability, firm financial leverage, inventory turnover, and current ratio. These characteristics were tested to see if a relationship existed between them (Independent variables) and the choice of

inventory costing methods such as FIFO and Average Cost Method (Dependent variables).

2. Literature Review

Inventory is an asset in the balance sheet (Aiello, 2007). Once sold, the cost of this inventory (Cost of Goods Sold) is transferred to the income statement. Firms also report which Inventory Costing Method they use to determine the cost of the inventory (Warren et al., 2016). In Thailand, accounting standards allow the use of only four inventory costing methods: the Specific Identification Method, the FIFO Method, the Weighted Average Method, and the Moving Average Method (Department of Industrial Promotion, 2016).

2.1 First-In-First-Out (FIFO)

When the FIFO Method is used, the oldest goods produced are deducted from the inventory first, and the most recent goods produced are expected to remain in the inventory (Robinson et al., 2015). FIFO is often used for perishable and non-perishable goods (Dopson & Hayes, 2015), mostly by firms that are concerned about inventory spoilage or obsolescence (Epstein, 2012). The FIFO Method affects the bottom line of the income statement because if prices are rising, the older items cost less than the newer ones. Thus, the older items carry lower costs, which inflates profits, and leads to higher income taxes (Gu, 2013). Thus, more investors are attracted based on profit declarations (Simeon & John, 2018). FIFO gives more up-to-date results than the weighted average method during times of rising prices, but it is also more complex (Garrison et al., 2009*).*

2.2 Weighted Average Cost

When an average cost method is used with a periodic inventory system, the resulting method is referred to as the Weighted Average Method (Nikolai et al., 2009). This method allocates the average cost of goods available for sale to the units sold and those units remaining in inventory (Robinson et al., 2015). It is suitable for manufacturers that purchase raw materials for production because product cost is averaged, and the overall cost of manufactured products is better shown than with other methods (The Department of Industrial Promotion, 2016). It is not as precise for calculating income taxes, and income recognition are based on increasing or decreasing cost trends, but it represents a better choice for firms that do not wish to engage in detailed tax planning (Bragg, 2005). It presents a more satisfactory outcome during times of price fluctuation, since all inventories are valued at the same cost, no matter when the raw materials were purchased or how much the finished products were sold for (Simeon & John, 2018).

2.3 Moving Average Cost Method

The Moving Average Cost Method is an average cost method that applies Weighted Average Cost assumptions to a perpetual inventory system (Porter & Norton, 2016). Thus, this method requires the recalculation of average costs each time that items are purchased or sold (Epstein et al., 2009). According to Nikolai et al. (2009), "Average Cost is used to determine the cost of each sale made until the next purchase, when a new average cost is calculated (p. 381)."

2.4 Characteristics of Manufacturing Firms
2.4.1 Firm Size

Firm size is measured by the total assets or total revenue of a firm (Van Frederikslust, 2012; Saunders & Walter, 1994). An increase of total assets indicates that a firm has generated net income from its operations and added the profit back to its long-term assets for future expansion, while a decrease of total assets expresses a decline of its assets, which have been sold or the proceeds distributed to shareholders (Gildersleeve, 1999). The methods used to consider firm size should fit into the type of business, such as the number of employees, turnover, and profitability, number of shops/outlets, stock market valuation, and capital employed (Mottershead et al., 2012).

2.4.2 Inventory Size

Inventory to total assets determines the percentage of inventory tied up in the total assets of the firm. This ratio indicates how effectively a firm controls inventory as a percentage of its total assets (Rachlin, 1997). Normally, the lower the ratio, the better (Narsale, 2016). Effective inventory management attempts to create harmony in production and sales areas concerned with physical inventories to maintain the storage of adequate quantities (Prasad & Sinha, 1990).

2.4.3 Firm Profitability

Return on Assets (ROA) measures the income generated by the assets of a firm. The higher the ratio, the more profit is earned by a particular level of assets. However, using the Weighted Average Cost Method would result in a lower return on assets ratio (Robinson et al., 2012). Many equity analysts consider profitability to be the main focus

of their analysis. Earnings can be given to shareholders or reinvested in the firm, thus improving solvency and meeting short term obligations as they come due. (Robinson et al., 2015).

2.4.4 Firm Financial Leverage

This refers to the debt-to-equity ratio that compares the level of borrowing with the level of shareholders' invested capital. The lower the ratio, the better a business's capability of repaying its borrowings (Engle, 2010). Applying the Weighted Average Cost Method results in higher ratios, since it gives lower retained earnings than when the FIFO Method is applied (Robison et al., 2012). Adopting FIFO could increase a firm's credit rating by offering better terms on its borrowing and greater prices for its outstanding debt securities (Pratt, 2010). A low ratio indicates that a firm used more equity than debt, which means a larger safety margin for creditors. A ratio of 2:1 is usually considered to be acceptable, but of course, it depends on the particular industry (Tulsian & Tulsian, 2016).

2.4.5 Current Ratio

This represents a firm's ability to repay short term debts when they become due; the formula is Current Assets divided by Current Liabilities (Stickney et al., 2009). Using the Weighted Average Cost Method lowers this ratio, since inventory has a lower carrying value than with FIFO. Creditors see this ratio as a signal of whether a firm has enough liquidity to pay its current liabilities, which favors a high ratio (Bragg, 2012; Jagels & Ralston, 2006).

2.4.6 Inventory Turnover

Inventory turnover is highly industry dependent. However, high levels of inventory tie up cash and reduce a firm's profitability (Vinturella & Erickson, 2013). Inventory turnover shows the number of times in a year a firm can turn its average inventory into sales (Chang, 2010). It also indicates how efficiently a firm manages its inventory to meet the need of customers and the shortage of inventory should be appropriate. A higher ratio suggests that management is reducing the amount of inventory on hand, relative to the cost of goods sold (Kimmel et al., 2010). FIFO gives a better explanation regarding the turnover of inventory items since it divides the cost of goods sold by average inventory, which reflects both current costs and recent costs (Wahlen et al., 2011).

2.5 Prior Studies

Gopalakrishnan (1994) stated that there is a relationship between both size and profitability and the choice of both depreciation and inventory methods. In addition, inventory method choice seems to be supported by both the size and debt-to-equity assumptions. Size is likely to be positively related to use of the FIFO Method. The higher the leverage, the greater the likelihood that a firm would select the FIFO Method. However, his findings did not support the hypothesis that larger the company, the lesser the likelihood that a company would select the FIFO Method.

Zinkevičienė, D., & Rudžionienė, K. (2005) also found no support for the hypothesis that the higher a firm's financial leverage, the more likely are its managers to use the FIFO Inventory Method. Simeon and John (2018) found that a significant correlation between profitability, tax, and inventory size and the choice of inventory cost method. However, Asgari et al., (2014) stated that there was no significant

relationship between inventory accounting method (FIFO) and profitability. No significant relationships were found between inventory costing method and debt-to-equity ratios.

Ibarra (2018) stated that firms that use FIFO realize statistically significant lower tax savings, larger tax losses carried forward, higher leverage, lower current ratios, greater variability in inventory levels, and tend to be smaller in size. Hapsari (2016) expressed that firm size, financial leverage, liquidity ratio, and income before tax did not have any statistically significant effect on the selection of inventory cost flow assumption in retail companies listed in the Indonesian Stock Exchange from 2012 to 2014.

3. Research Methods
3.1 Research Questions

This research study aimed to determine the influences of selected manufacturing firm characteristics on the choice of inventory costing methods. The study sought to answer the following questions:

1. What inventory costing methods are used by selected firms?
2. How do firm characteristics (size, inventory, leverage, profitability, current ratios and inventory turnover) influence the choice of inventory costing methods?

3.2 Research Design

The research design used in this study was a descriptive method to describe selected firm's characteristics (independent variables). The inventory costing method (dependent variable) was stated in firm's financial statements, and described using frequencies and percentages. Logistic regression was used to measure the influence that

various manufacturing firm characteristics had on selection of inventory costing method.

3.3 Population, Sample Size and Sampling Techniques

The population was composed of publicly-traded firms in the food and beverage and steel sectors that were listed on the Stock Exchange of Thailand. They both represent different types of businesses because foods and beverages are perishable inventory goods with short shelf lives, while steel products last much longer. Thus, the researchers wished to examine whether firm characteristics in two sectors with very different types of finished products had any common influences on the choice of inventory costing method.

A purposive sampling technique was used in this research based on the following criteria:

1. Manufacturers had published their annual financial statements from 2016 to 2018.
2. Their complete financial statements were fully available on the Stock Exchange of Thailand website (www.set.or.th and www.settrade.com), along with the annual reports from each of the manufacturing firms.
3. Manufacturing firms must have adopted either FIFO or Average Cost for finished goods.
4. Based on these criteria, the total sample for this research consisted of 60 companies, with 36 companies were from the food and beverage sector and 24 companies from the steel sector.
5. Variance Inflation Factors for the food and beverage and steel sectors were less than 10. Therefore, there was no relationship between the independent variables and the model was free from bias (Gregory & Bader, 2018).

3.4 Statistical Formula

A Logistic Regression Model was employed to test the impact of the independent variables on the dependent variable as follows:

$Log(p/1-p) = B0 + B1*x1 + B2*x2 + B3*x3 + B4*x4 + B5*x5 + B6*x6$ Where p is the probability of inventory costing method, and Where X1 = Firm Size, X2 = Firm Financial Leverage, X3 = Inventory Size, X4 = Profitability, X5 = Inventory Turnover, and X6 = Current Ratio, are the predictors

3.5 Analysis of Data

This research study used total assets as a proxy for firm size, and debt ratio (debt/equity) as a proxy for firm financial leverage. In the case of inventory size, the amount of ending inventory was divided by total assets to eliminate the size effect. Additionally, profitability was calculated by dividing the net income by average total assets, inventory turnover was calculated by dividing cost of goods sold by average Inventory, and the current ratio was calculated by dividing current assets by current liabilities.

3.6 Analysis and Discussion of Results
2016-2018 Firm Characteristics and Inventory Costing Methods: Food/Beverage and Steel Sectors

Descriptive statistics, such as frequencies and percentages, were used to record the characteristics of manufacturing firms and their choice of inventory cost method. A majority of the food and beverage sector (72%) and steel sector (83.3%) firms used the

Average Cost Method; only a few (27.8% and 16.7%) such firms used the FIFO Method, even though FIFO usually shows higher net income and retained earnings.

3.6.1 Firm Size

Firm size is determined by the total net assets at year end. Findings in Table 1 revealed that from 2016 to 2018, over 60% of food and beverage manufacturers were relatively small firms. In 2016, Thailand encountered an extensive drought, declining exports, domestic instability, and unpredictable global financial markets driven by political instability (Bank of Thailand, 2016). These might be the reason why firms did not expand their operations. By 2018, average firm size had more than doubled to 37,270 million Baht when compared to previous years. Many firms may have increased their assets in order to boost production due to increased spending on consumption in the country, since purchasing power and international demand continued to expand in 2018.

Table 1. 2016–2018 Size of Food and Beverage and Steel Sector Firms

In Million Baht	Food and Beverage Sector*						Steel Sector**					
	2018		2017		2016		2018		2017		2016	
	FRE	%	FRE	%	FRE	%	FRE	%	FRE	%	FRE	%
100 – 10,000	22	61.11	23	63.89	25	69.44	18	78.26	19	79.17	19	79.17
10,001 – Above	14	38.89	13	36.11	11	30.56	5	21.74	5	20.83	5	20.83
Total	36	100.00	36	100.00	36	100.00	23	100.00	24	100.00	24	100.00

 * Avg. Firm Size 2018 = 37,270 mil Baht; Avg. 2017 = 17,085 mil Baht; Avg. 2016= 17,075 mil Baht

  ** Avg. Firm Size 2018 = 7,197 mil Baht; Avg. 2017 = 7,085 mil Baht; Avg. 2016 = 6,525 mil Baht

From 2016 to 2018, over 78% of steel manufacturers were small. However, the trend of average firm size was gradually increasing to 7,197 million Baht in 2018. In 2016, steel sector firms started to profit after experiencing price slumps in the previous year. In addition, steel prices increased starting at the beginning of the year because of rebounding demand from China due to investment in infrastructure projects (Bank of Thailand, 2016).

3.6.2 Inventory Size

Inventory size was determined by ending inventory divided by total assets. It indicates how effective a firm was in controlling inventory as a percentage of the total assets (Rachlin, 1997). Data collected in the food and beverage sector in Table 2 showed that in 2016 and 2017, 44% of firms had inventories of less than or equal to 10% of their total assets. They are likely trying to manage their inventory effectively in order to reduce the risk of unsold inventory due to out-of-date or damaged products during the previous years of declining sales. The average inventory size was relatively stable from 15–16% for the three years period. This modest increase in size might be because production and sales increased to meet growing domestic and international demand.

Table 2. 2016-2018 Inventory Size of Food and Beverage and Steel Sector Firms

Ratios	Food and Beverage Sector*						Steel Sector**					
	2018		2017		2016		2018		2017		2016	
	FRE	%	FRE	%	FRE	%	FRE	%	FRE	%	FRE	%
≤ 0.10	14	38.89	16	44.44	16	44.44	2	8.69	3	12.50	5	20.83
0.11 – 0.20	14	38.89	11	30.55	11	30.55	3	13.04	4	16.67	5	20.83
> 0.21	8	22.22	9	25.01	9	25.01	18	78.27	17	70.83	14	58.34
Total	36	100.00	36	100.00	36	100.00	23	100.00	24	100.00	24	100.00

* Avg. Inv. Size 2018 = 0.16; Avg. Inv. Size 2017 = 0.15; Avg. Inv. Size 2016 = 0.15
** Avg. Inv. Size 2018 = 0.27; Avg. Inv. Size 2017 = 0.26; Avg. Inv. Size 2016 = 0.22

For the steel sector, the data indicated that from 2016 to 2018, 50% to 78% of firms carried an inventory that was more than 20% of their total assets. The average inventory size was gradually increasing to 27% in 2018. This meant that most firms held high levels of inventory. This may be because steel products do not have expiration dates, and can be kept for longer periods of time than food and beverage products.

3.6.3 Financial Leverage

Firm financial leverage was determined by total liabilities divided by total equity; this ratio compares the level of borrowing with the level of shareholders' capital (Engle, 2010). The findings shown in Table 3 for the food and beverage sector show that in 2016 and 2017, 63.9% of firms had a debt to equity ratios of less than or equal to 1.00, with an average figure of 0.91 for those years. Since a majority of firms were small or might have been more recently established than larger firms, their loan requests were more likely to be rejected (Banternghansa, Paweenawat, & Samphantharak, 2019).

However, 36% or more of firms had ratios of more than 1.0. It is risky for them to carry heavy debt loads because they may not be able to repay them when they come due. In 2018, average firm leverage was equal to 1.00. An increase in production, sales, imports, and exports due to increases in domestic and international demand might be the reason why many firms expanded their businesses in 2018. Banternghansa et al. (2019) said, "large firms tend to finance their assets by debt more than small firms."

Table 3. 2016-2018 Financial Leverage of Food and Beverage and Steel Sector Firms

Ratios	Food and Beverage Sector*						Steel Sector**					
	2018		2017		2016		2018		2017		2016	
	FRE	%	FRE	%	FRE	%	FRE	%	FRE	%	FRE	%
≤ 1.00	21	58.33	23	63.89	23	63.89	15	65.22	18	75.00	17	70.83
> 1.00	15	41.67	13	36.11	13	36.11	8	34.78	6	25.00	7	29.17
Total	36	100.00	36	100.00	36	100.00	23	100.00	24	100.00	24	100.00

 * Avg. Lev 2018 = 1.00; Avg. Lev 2017 = 0.91; Avg. Lev 2016 =0.91

** Avg. Lev 2018=6.10; Avg. Lev 2017=1.09; Avg. Lev 2016=1.25

From 2016 to 2018, over 65% of steel manufacturers had a debt to equity ratios of less than or equal to 1.00. This may be because over 70% of the steel firms were small, and so this may have been a reason why a majority of them were not able to borrow more. The average firm leverage from 2016 to 2018 was 1.25, 1.09, and 6.10, respectively. In 2018, many firms may have tried to borrow more to expand their businesses to support increasing market demand from the expansion of the construction industry, government infrastructure construction, and construction of private residences (Ministry of Industry, 2018).

3.6.4 Profitability

Profitability (Return on Assets, or ROA) is determined by net income divided by average total assets. It indicates how effectively a company generates a profit through the use of its total assets. The findings in Table 4 show that from 2016 to 2018, over 20% of food and beverage manufacturers were using their total assets to generate net income of higher than 10%. However, during this same period of time, over 19% of such firms recorded operating losses. Average profitability gradually declined to 5% in 2018. These results were opposite to increasing production and sales from 2017 to 2018. This might be because, in 2018, the prices of raw sugar and refined sugar had declined due to high competition from abroad, causing export revenue to decline. In addition, the domestic market competition also increased (Local sugar industry outlook neutral, 2019), and the new excise tax on beverages with high sugar content, alcohol beverages, cigarettes, and imported wine (Jitpleecheep & Arunmas, 2019) reduced the profitability of the firms.

Table 4. 2016-2018 Profitability of Food and Beverage Sector and Steel Sector Firms

Ratios	Food and Beverage Sector*						Steel Sector**					
	2018		2017		2016		2018		2017		2016	
	FRE	%	FRE	%	FRE	%	FRE	%	FRE	%	FRE	%
≤ 0.00	7	19.45	8	22.22	7	19.44	11	47.83	7	29.17	6	25.00
0.01–0.10	21	58.33	18	50.00	15	41.67	11	47.83	16	66.67	12	50.00
> 0.10	8	22.22	10	27.78	14	38.89	1	4.34	1	4.16	6	25.00
Total	36	100.00	36	100.00	36	100.00	23	100.00	24	100.00	24	100.00

* Avg. Profit 2018 =0.05; Avg. Profit 2017= 0.07; Avg. Profit 2016 = 0.08

** Avg. Profit 2018= 0.02; Avg. Profit 2017 = 0.01; Avg. Profit 2016 = 0.06

Over 70% of steel manufacturers had positive ROA ratios for 2016 and 2017, while in 2018 only about half of the steel firms were profitable. The average profitability from 2016 to 2018 was 6%, 1%, and 2%, respectively. However, over the period from 2016 to 2018, 25% to 48% of such firms suffered losses, while some only broke even. This may be because the production of flat steel, tin plate steel, and hot-rolled steel coil declined in 2018 due to cheaper imported products being available from China and Vietnam (Ministry of Industry, 2018).

3.6.5 Inventory Turnover

Inventory Turnover is determined by the cost of goods sold divided by the average inventory. It shows the number of times in a year that a company can turn its inventory into sales. High levels of inventory tie up cash and reduce a firm's profitability. The findings in Table 5 show that average inventory turnover for food and beverage firms declined each year, from 7.55 times in 2016 to 7.07 times in 2018. From 2016 to 2018, over 50% of such firms converted their inventory into sales more than 5 times per year, which is better for food and beverages with perishable goods. Good inventory management could help to reduce the risk of expired, damaged, and out-of-date inventory. On the other hand, from 2016 to 2018, 30.55% to 44.44% of firms had inventory turnover ratios of less than 5 times, and the middle category has dropped from 69.44% to 55.56% in 2018. They had high levels of inventory on hand, which is not a good idea for perishable goods with short shelf lives. The slower the inventory is being converted into sales, the lower the profits.

Table 5. 2016-2018 Inventory Turnover of Food and Beverage and Steel Sector Firms

Ratios	Food and Beverage Sector*						Steel Sector**					
	2018		2017		2016		2018		2017		2016	
	FRE	%	FRE	%	FRE	%	FRE	%	FRE	%	FRE	%
≤ 5.00	16	44.44	11	30.56	11	30.56	11	47.82	14	58.33	13	54.17
> 5.00	20	55.56	25	69.44	25	69.44	12	52.18	10	41.67	11	45.83
Total	36	100.00	36	100.00	36	100.00	23	100.00	24	100.00	24	100.00

* Avg. Inv. Turnover 2018 = 7.07; Avg. Inv. Turnover 2017 = 7.48; Avg. Inv. Turnover 2016 =7.55

** Avg. Inv. Turnover 2018 = 10.05; Avg. Inv. Turnover 2017 = 7.09; Avg. Inv. Turnover 2016 = 11.71

From 2016 to 2018, over 47% of steel firms had annual inventory turnover ratios of less than 5 times. Many of them may have faced difficulties in quickly turning inventory into sales, while less than 50% had annual ratios above 5 times. However, in 2018, steel firms showed a little improvement in this area. This may have been due to increasing sales in the construction industry, government infrastructure construction, and construction of private residences, which boost demand for long steel, wire rod production, high tensile steel wire, and hot-rolled structural steel. Average ratios from 2016 to 2018 were 11.71 times, 7.09 times, and 10.05 times, respectively.

3.6.6 Current Ratio

Current Ratio is determined by current assets divided by current liabilities. It represents the ability to pay short-term debts when they become due (Stickney et al., 2009). The findings in Table 6 indicate that from 2016 to 2018, 36% to 41% of food and beverage manufacturers had current ratios lower than or equal to 1.0. Many firms were having a hard time to pay off their short-term debts when they came due, while over 30% of firms had ratios of 2.01 or higher. Too high a current ratio may not be effective because this may be the result of holding high levels of inventory in their current assets. This increases the risk of inventory damage, out-of-date inventory, and losses, and thus may reduce firm profitability (Vinturella & Erickson, 2013). In 2018, firms' current ratios that were lower than or equal to 1.0 increased to 41.67%. This may be because in 2018, many firms increased their firm size in order to prepare for higher domestic and international demand for food and beverages. This expansion may have led to increased borrowing, which would have increased liabilities in 2018, and caused current ratios to decline.

Table 6. 2016-2018 Current Ratios of Food and Beverage and Steel Sector Firms

Ratios	Food and Beverage Sector*						Steel Sector**					
	2018		2017		2016		2018		2017		2016	
	FRE	%	FRE	%	FRE	%	FRE	%	FRE	%	FRE	%
≤ 1.00	15	41.67	13	36.11	13	36.11	6	26.09	6	25.00	6	25.00
1.01 – 2.00	9	25.00	12	33.33	11	30.56	7	30.43	8	33.33	6	25.00
> 2.00	12	33.33	11	30.56	12	33.33	10	43.48	10	41.67	12	50.00
Total	36	100.00	36	100.00	36	100.00	23	100.00	24	100.00	24	100.00

* Avg. Current Ratio 2018= 2.27; Avg. Current Ratio 2017= 2.35; Avg. Current Ratio 2016= 2.19

** Avg. Current Ratio 2018 = 5.31; Avg. Current Ratio 2017 = 5.37; Avg. Current Ratio 2016 = 7.97

From 2016 to 2018, about 25% of steel manufacturers had current ratios of less than or equal to 1.0, and so they may have had difficulty in repaying their short-term obligations. However, over 75% of such firms had current ratios higher than 1.0, which means that these firms had adequate short-term liquidity. The average current ratios declined to 5.31 in 2018. Many firms had more than enough current assets to repay their short-term debts; some firms may have been carrying high levels of inventory, which can inflate the current ratio.

2016-2018 Logistic Equation for Variables, Food and Beverage and Steel Sectors

Tables 7.1 and 7.2 help to explain the relationship between the independent and dependent variables. They display information regarding an equation based on the

characteristics of food and beverage sector firms using B Coefficient data, p-values, and odds ratios.

The findings in Table 7.1 indicate that for both food and beverage and steel sector manufacturers from 2016 to 2018, firm size, leverage and inventory size did not have any significant influence (p-value > 0.05) on the Inventory Costing Method. Some smaller firms (10 out of 36 food and beverage firms and 4 out of 24 steel firms) used the FIFO Method to manage their inventory, while most large companies tended to use an Average Cost Method.

Table 7.1 2016-2018 Logistic Equations for Variables: Food/Beverage and Steel Sector Firms

	Food and Beverage Sector			Steel Sector		
	2018	2017	2016	2018	2017	2016
Constant						
B	-2.888	-1.883	-1.662	-2.720	-1.932	-5.343
p-value	.014	.015	.035	.110	.009	.252
Odds Ratio	.056	.152	.190	.066	.145	.005
Firm size						
B	-1.414	-.835	-1.927	2.035	.991	2.238
p-value	.364	.208	.426	.173	.420	.409
Odds Ratio	.243	.434	.146	7.651	2.694	9.378
Leverage						
B	-.326	-.046	.167	-2.102	-.588	-1.380
p-value	.670	.944	.817	.626	.565	.405
Odds Ratio	.722	.955	1.182	.122	.555	.252
Inventory Size						
B	-2.467	-2.504	-1.703	1.362	.252	-2.797
p-value	.052	.086	.118	.291	.829	.350
Odds Ratio	.085	.082	.182	3.902	1.287	.061

The findings are continued in Table 7.2. The data show that for the food and beverage sector, only profitability in 2017 and 2018, inventory turnover in 2018, and current ratio in 2018 exerted a significant influence (p-value < 0.05) on the choice of inventory costing method. In other words, their regression B Coefficients were significantly different from 0. Moreover, most odds ratios were also significantly larger or smaller than 1, while no statistically significant results were found for the steel sector.

Table 7.2. 2016-2018 Logistic Equations for Variables: Food/Beverage and Steel Sector Firms (Cont.)

	Food and Beverage Sector			Steel Sector		
	2018	2017	2016	2018	2017	2016
Profitability						
B	3.866	1.754	1.089	1.081	.131	1.232
p-value	.016*	.028*	.100	.197	.916	.274
Odds Ratio	47.754	5.780	2.971	2.947	1.140	3.427
Inventory Turnover						
B	-2.282	-1.272	-.654	1.601	-1.197	-8.061
p-value	.029*	.063	.280	.355	.474	.471
Odds Ratio	.102	.280	.520	4.958	.302	.000
Current Ratio						
B	-4.480	-1.177	-.359	.613	2.327	3.275
p-value	.044*	.195	.553	.697	.205	.334
Odds Ratio	.011	.308	.698	1.847	10.250	26.434

Among food and beverage manufacturers in 2017 and 2018, results showed that for a one-unit increase in the B coefficient value for profitability, the likelihood that the FIFO Method would be used increased by 1.754 and 3.866, respectively. It indicated

that increases in profitability in 2017 and 2018 might be a reason why food and beverage manufacturers selected the FIFO Method since it produces higher net profits. In 2018, for a one-unit increase in inventory turnover, the likelihood that the FIFO Method would be used decreased by -2.282. This shows that inventory turnover was probably negatively related to the choice of inventory method, even though the FIFO Method produces a higher inventory turnover ratio. In addition, in 2018, for a one-unit increase in current ratios, the likelihood that the FIFO Method would be selected decreased by -4.480. This indicates that the strength of the current ratio was probably not a factor in the choice of an inventory method, even though the use of the FIFO Method produces a higher current ratio.

One limitation of using odds ratios in this analysis was the limited sample size since usable data was collected from only 60 firms, and at least 100 samples are recommended (Ugon, Karlsson, & Klein, 2018). Small sample sizes tend to return values farther away from 1.0 when logistic regression is performed (Newsom, 2016). So attaching too much significance to these values may not be warranted. Both B values and odds ratios for current ratios declined a lot during the 3 years for the minority of food and beverage firms that used the FIFO Method. On the other hand, the current ratios of the majority of firms that used Average Cost Methods increased from 2016 to 2018. However, decreases in current ratios do not always mean that firms are operating ineffectively. Users of the FIFO Method may try to reduce the amount of inventory that is kept on hand if it consists of perishable goods with short shelf lives.

4. Conclusion

This study examined selected manufacturing firms' characteristics and their relationship to the choice of Inventory Costing method. A majority of both food and beverage and steel firms adopted the Average Cost Method for their inventory, while

only a few adopted the FIFO Method. Although the FIFO Method gives the more accurate cost of inventory figures than the Weighted Average Method, it is more complex to use (Garrison et al., 2019).

The average size of firms in both sectors, as measured by their total assets, increased from 2016 to 2018, especially for the Food and Beverage Sector. The same result holds for inventory size and average financial leverage, especially for the Steel Sector. This finding is consistent with that of Robinson et al. (2012), who stated that using the Weighted Average Cost Method results in a higher debt-to-equity ratio since retained earnings are lower than when the FIFO Method is applied. The amounts of inventory for both sectors increased in 2018 indicate that firms need to improve their inventory management to reduce the risk of expired, damaged, and out-of-date inventory. However, manufacturers usually hold more inventory than service firms (Wisner et al., 2018).

On the other hand, profitability (ROA), inventory turnover, and current ratios for a majority of firms in both sectors declined over the three-year period that was studied. Many firms had a hard time turning their inventory into sales revenue, which is especially problematic for perishable goods with short shelf lives.

Neither firm size (total assets), inventory size, nor financial leverage for either sector from 2016 to 2018 had any influence on the use of the FIFO Method. This is opposite to the findings of Gopalakrishnan (1994), who found that firm size was likely to be positively related to the use of the FIFO Method. But they were aligned with the study of Zinkevičienė, D., & Rudžionienė, K. (2005) who found no support for the notion that the higher a firm's financial leverage, the more likely it was to use the FIFO Method.

However, profitability (ROA) in the Food and Beverage Sector in 2017 and 2018 was related to the choice of the FIFO Method. This is in line with Robinson et al. (2012), who explained that using the Weighted Average Cost Method would result in lower

ROA. This is because the incremental profit added to net income has a bigger impact than the incremental increase to total assets. However, no statistically significant factors were found in the Steel Sector.

Inventory turnover for the 2018 Food and Beverage Sector was related to the choice of the FIFO Method, while no statistically significant relationship was found for the Steel Sector. This is in line with Wahlen et al., (2011), who stated that inventory turnover ratios gave better explanations regarding the turnover of inventory if FIFO was used.

Current ratios for the Food and Beverage Sector in 2018 were related to the use of the FIFO Method, while no statistically significant relationship was found for the Steel Sector from 2016 to 2018. These results are in line with the study of Troy (2008), who found that the current ratio affected the choice of the FIFO Method. Robinson et al. (2012) also added that using the Weighted Average Cost Method will result in lower current ratios since this method results in a lower carrying value for inventory than does the FIFO Method.

References

Aiello, J. (2007). *Rightsizing inventory* [Google Books version].

Asgari, M., Mehdizadeh, S., & Hassani, M. (2014). Explain the relationship between the selected inventory quality assessment profitability of the companies listed in Tehran Stock Exchange. *World Essay Journal, 1*(2), 55-58.

Bank of Thailand. (2016). *Thailand's economic conditions in 2016.*

Banternghansa, C., Paweenawat, A., & Samphantharak, K. (2019). *Understanding corporate Thailand I: Finance* (Discussion Paper No. 112).

Bragg, S. (2005). *Inventory accounting: A comprehensive guide* [Google Books version].

Bragg, S. (2005). *The ultimate accountants' reference including GAAP, IRS & SEC regulations, leases, and more* [Google Books version].

Bragg, S. (2012). *Business ratios and formulas: A comprehensive guide (3nd ed.)* [Google Books version].

Chang, C. (2010). *Service systems and management engineering: Creating strategic differentiation and operational excellence* [Google Books version].

Department of Industrial Promotion. (2016). *Inventory management by FIFO*.

Dopson, L. R., & Hayes, D. K. (2015). *Food and beverage cost control*. John Wiley & Sons.

Engle, C. (2010). *Aquaculture economics and financing: Management and analysis* [Google Books version].

Epstein, B., Nach, R., & Bragg, S. (2009). *Wiley GAAP 2010: Interpretation and application of generally accepted accounting principles* [Google Books version].

Epstein, L. (2012). *The business owner's guide to reading and understanding financial statements: How to budget, forecast, and monitor cash flow for better decision making* [Google Books version].

Garrison, R., Noreen, E., & Brewer, P. (2009*). Managerial Accounting (11ᵗʰ ed)* [Google Books version].

Garrison, M. E., Chou, T. M., & Hyde, G. M. (2019). *U.S. Patent No. 10,226,563.* Washington, DC: U.S. Patent and Trademark Office.

Gildersleeve, R. (1999). *Winning business: How to use financial analysis and benchmarks to outscore your competition* [Google Books version].

Gopalakrishnan, V. (1994). Accounting choice decisions and unlevered firms: Further evidence on debt/equity hypothesis. *Journal of Financial and Strategic Decision, 7*(3), 33-47.

Gregory, D., & Bader, K. (2018). Logistic and linear regression assumptions: Violation recognition and control. *Proceedings of Midwest SAS User Group 2018 conference, Indiana, AA-091,* 1-22.

Gu, S. (2013). Research and analysis on issued inventory valuation methods of enterprise. *Proceedings of International Academic Workshop on Social Science (IAW-SC 2013), China, 50*, 541-544.

Hapsari, L. (2016). *The influence of company size, financial leverage, liquidity ratio, and income before tax towards the selection of inventory cost flow assumptions in retail companies listed in IDX period 2012-2014* (Unpublished Bachelor's thesis). President University. Indonesia.

Ibarra, V. (2018). Choice of inventory costing method of selected companies in the Philippines. *Journal of International Business Research, 7*(1)*,* 17-30.

Jagels, M., & Ralston, C. (2006). *Hospitality management accounting (9ᵗʰ ed.)* [Google Books version].

Jitpleecheep, P., & Arunmas P. (2019). Sugary drink tax pushed innovation. *Bangkok Post*.

Kimmel, P., Weygandt, J., & Kieoso, D. (2010). *Accounting: Tools for business decision makers (4ᵗʰ ed.)* [Google Books version].

Local sugar industry outlook neutral. (2019). *Bangkok Post*.

Ministry of Industry (2018). *Industrial economic report 2018 and trend for 2019*.

Ministry of Industry (2018). *Industrial Economic Report Quarter 4/2018 and Trends in the 1ˢᵗ Quarter of 2019*.

Mottershead, A., Kelt J., & Grant, A. (2012). *OCR AS business studies student unit guide new edition: Unit F291 an introduction to business* [Google Books version].

Narsale, O. (2016). University of Mumbai project report on ratio analysis (PowerPoint slides).

Needles, B., Powers, M., & Crosson, S. (2010). *Financial and managerial accounting (9ᵗʰ ed.)* [Google Books version].

Newsom, J.T. (2016), *Sample Size and Estimation Problems with Logistic Regression* (Class handout). Retrieved from Portland State University PSY 510/610 Categorical Data Analysis.

Nikolai, L., Bazley J., Jones, J. (2009). *Intermediate accounting (11ᵗʰ ed.)* [Google Books version].

Porter, G. & Norton, C. (2016). *Financial accounting: The impact on decision makers (10ᵗʰ ed.)* [Google Books version].

Prasad, M., & Sinha, K. (1990). *Principles of management accounting* (Google Books version).

Pratt, J. (2010). *Financial accounting in an economic context (8ᵗʰ ed.)* [Google Books version].

Rachlin, R. (1997). *Return on investment manual: Tools and applications for managing financial results* [Google Books version].

Robinson, T., Henry, E., Pirie, W., & Broihahn, M. (2012). *International financial statement analysis* [Google Books version].

Robinson, T., Henry, E., Pirie, W., & Broihahn, M. (2015). *International financial statement analysis* [Google Books version].

Saunders, A., & Walter, I. (1994). *Universal banking in the United States: What could we gain? What could we lose?* (Google Books version).

Simeon, E., & John, O. (2018). Implication of choice of inventory valuation methods on profit, tax and closing inventory. *Account and financial Management Journal, 3*(7), 1639-1645.

Stickney, C., Weil, R., Schipper, K., & Francis, J. (2009). *Financial accounting: An introduction to concepts, methods and uses* [Google Books version].

Troy, L. (2008). *Almanac of business and industrial financial ratios* [Google Books version].

Tulsian, P., & Tulsian, B. (2016). *Financial management with Quick Revision (For CA-IPC, ground-1) (7th ed.)* [Google Books version].

Ugon, A., Karlsson, D., & Klein, G.O. (2018). *Building continents of knowledge in oceans of data: The future of co-created ehealth* [Google Books version].

Van Frederikslust, R. (2012). *Predictability of corporate failure: Models for prediction of corporate failure and for evaluation of debt capacity* [Google Books version].

Vinturella, J., & Erickson, S. (2013). *Raising entrepreneurial capital (2nd ed.)* [Google Books version].

Wahlen, J., Baginski, S., & Bradshaw, M. (2011). *Financial reporting, financial statement analysis, and valuation: A strategic perspective: A strategic perspective (7th ed.)* [Google Books version].

Warren, C., Reeve, J., & Duchac, J. (2016). *Financial and managerial accounting (14ᵗʰ ed.)* [Google Books version].

Wisner, J., Tan, K. & Leong, G. (2018). *Principles of supply chain management: A Balanced Approach* [Google Books version].

Zinkevičienė, D., & Rudžionienė, K. (2005). Impact of company's leverage on financial accounting method choice. *Inžinerinė ekonomika*, (5), 25-30.