

INVENTORY VALUATION METHODS ACROSS INDUSTRY GROUPS

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ABSTRACT

This thesis looks at inventory valuation methods, specifically first in, first out (FIFO) and last in, first out (LIFO), and the differences that these two methods create. Previous research focuses on the reasons why managers may choose one or the other and what they gain from their decision. I focus on the investor's perspective and how the chosen inventory method affects how they see the success of a potential investment. In this research, I look at seventeen industry groups spanning across approximately twenty-one years. Specifically, I examine earnings per share (EPS), return on assets (ROA), and profit margin. After my evaluations, I came to the conclusion that inventory valuation methods will affect how an investor sees a company and managers should take this into consideration when deciding which one to use. It is more likely that a LIFO firm will be more appealing to an investor than a FIFO firm. The number of firms using FIFO or LIFO is decreasing as managers switch to average cost. I suggest that more research be done into how many people invest in a company and how it correlates to their inventory valuation method.

INTRODUCTION

The way that a company values and reports its inventory is a decision that is integral to how investors view its successes and failures. One of the reasons that it affects perception so much is because it is a choice that managers are able to make at their own discretion. In a world of so much standardization, this is an opportunity for managers to control how their company is perceived. Managers are able to analyze the pros and cons of each cost flow assumption and determine what they value the most and what makes the most sense for their company in particular. It is difficult from the outside looking in to determine why managers make the decisions that they do. They could be looking for tax benefits, to present the best-looking financial information to investors, or even to improve their own compensation. The method that a firm chooses gives some evidence as to what managers are emphasizing and putting value on.

FIFO and LIFO inventory methods are somewhat opposite of each other. Some strengths of FIFO are weaknesses of LIFO and vice versa. Historically, one of the biggest advantages of LIFO is that the company reports a lower income and therefore pays less taxes. However, this may also lead to a worse perception of LIFO companies compared to FIFO companies and LIFO companies could miss out on potential investors. A lot of the advantages/disadvantages of the two methods can be traced back to inflation and inventory costs continuing to rise. In FIFO reporting, lower cost inventory is included in cost of goods sold, giving the company a higher pretax income. In LIFO cost of goods sold uses the most current inventory prices (which are likely higher than older inventory), resulting in a lower pretax income and therefore lower taxes. The inventory conformity rule requires that a company use the same method of reporting inventory for financial reporting and tax reporting. This rule is what keeps management from using LIFO for tax reporting and FIFO for financial reporting.

The majority of companies today subscribe to the FIFO inventory method (Dopuch and Pincus, 1988). Compared to its opposing inventory method, LIFO, FIFO has far less tax benefits. The question then must be asked - what benefit is there to the FIFO inventory method and how can this benefit be compared to that of LIFO? Previous research suggests that sometimes managers have their personal interests at heart and choose the inventory method that results in the highest salary via their management compensation plan (Hughes and Schwartz, 1988). Others suggest that debt contracting costs have a greater weight on decision-making than tax benefits even (Hunt III, 1985). Whatever the reasoning may be, it is certain that inventory cost flow methods affect how the performance of a company is presented, and therefore affect how investors view inventory. This research will attempt to explain if the inventory cost flow assumption is correlated with the type of industry that the company is in and how cost flow assumptions have changed over the years. I also examine whether an investor's decisions are correlated with the cost flow assumption because of the way it presents the financial data. I compare EPS, average ROA, and average profit margin of companies that use LIFO with companies that use FIFO.

LITERATURE REVIEW

As previously mentioned, similar studies have been conducted surrounding the inventory methods chosen by company management and why these methods may make sense. Dopuch and Pincus (1988) acknowledge that many researchers before them hypothesized that whatever inventory method resulted in the lowest amount of taxes would be adopted by management. However, they knew that this did not explain the number of FIFO and LIFO companies that exist. In exploring other hypotheses, they found that in the long-term FIFO firms do not lose out on as significant of an amount of tax savings as previously believed. This means that companies could potentially have the best of both worlds in tax benefits and in reporting a higher accounting income.

Investors also benefit from the FIFO choice because the inventory information reported on the balance sheet is more reflective of recent prices and they can make more informed investment decisions. However, this is a benefit that most investors are probably not even aware of. The number of investors that are aware of a company's inventory method and know what it means for their investment are likely fairly low.

Hunt (1985) looked at management compensation and debt covenants. This study made the argument that firms can be categorized as either LIFO firms or non-LIFO firms because LIFO is often the exception from what is normal and creates different pros and cons than the inventory methods. FIFO and all other inventory cost flow assumptions can be grouped together because they offer similar benefits. The reported income of a company is often the basis for the compensation of the top leaders, more so in non-LIFO firms than LIFO firms. Do managers take this into consideration when deciding how to structure their inventory costs? The conclusions made throughout the course of this study were surprising to researchers at the time and contradict their original assumptions.

Managers must also take into consideration how different financial statements will change based on their inventory valuation method. Jennings, Simko, and Thompson (1996) examined how using LIFO improved the income statement presented data while making the balance sheet appear worse to investors. Inventory and cost of goods sold look different whether you are looking at them from a single point in time or as a change across the period. They determined that each financial statement serves to explain different aspects of the data and therefore have their own unique purpose. One cannot replace the other, as the information provided is completely different. In a way, this is helpful to investors because the balance sheet and income statement keep each other accountable. Managers can try to manipulate the data to look a certain way, but cannot

manipulate both the income statement and balance sheet at the same time. If managers care more about the income statement reflecting current inventory prices, then they will use LIFO. However, this means that their balance sheet will reflect older prices. If they want the balance sheet to reflect current prices, then the income statement will reflect older prices in the cost of goods sold. Managers must decide what they think is the most important financial statement to reflect current information.

RESEARCH

The first step to conducting research was to determine what data was needed in order to compute formulas and then analyze them. I focus on companies that used either FIFO or LIFO inventory methods. I believe this would lead to the most straightforward results, eliminating any small differences. I use Compustat data from 2000 to 2021 because it provides over twenty years of data to analyze. I did not focus on the companies individually, but the industries and years as a whole. Companies dissolve and form all the time. Because of the number of observations available, I did not have to worry about these small changes in the industry because it was insignificant in comparison to the amount of companies that exist.

I decided that one of my main focuses would be on the type of industry that a company falls in and if it has any correlation with the inventory valuation method that is being used. I found the industry code for all of the companies in my dataset. I used the Fama-French industry codes numbered from 1 to 17 where each number represents a category such as “Food” or “Cloths, Textiles, Apparel, & Footwear.” These industry codes can be broken down into even farther subcategories, but broad categories will suffice for the information I would like to examine. Having options on the broadness of industries is helpful because researchers can decide what is the most relevant to their specific data. They can be specific if they need to be, but are not forced

to. I believe that it is interesting to look at any correlations within industry groups because the type of inventory that a company has can be wildly different. Whether looking at the perishability of inventory, how much physical space that it takes up, or what the typical number of items ordered are, it is clear that these differences could play a factor in the inventory valuation method that makes the most sense for a company. For example, I would expect food items to be treated differently than automobiles. However, when looking at financial statements they could look exactly the same to outside parties.

Table 1 presents the inventory methods that different industries are the most likely to use. Most of my analysis focuses on FIFO and LIFO inventory methods, but I also included the average cost method as it is another popular inventory method for managers to use as a happy medium between FIFO and LIFO. Two cells in the FIFO column for industries fourteen and sixteen appeared to be obvious outliers compared to the other FIFO percentages at first. In all of the other industries besides these two, companies using FIFO made up a significant portion. After looking more into the data, I saw that these two percentages appeared as outliers because industries had many more companies without inventory than the other industries. Recognizing that these industries are “Utilities” and “Banks, Insurance Companies, & Other Financials,” these numbers make much more sense. Service-related companies do not often have much physical inventory to sell and therefore, will not have to make the decision between FIFO and LIFO. It is interesting to note that in all industries, a greater percentage of companies use FIFO to value their inventory than LIFO. Like stated in previous research, this suggests that companies are valuing something other than LIFO tax benefits to make their decisions. This mindset clearly spans across industry groups. It is not unique to one type of inventory. The industry that favors FIFO the most is the “Drugs, Soap, Perfumes, & Tobacco” industry (number seven). I think for this industry in particular, it

makes a lot of sense to use the FIFO method because most of these products are perishable (or at least are better when they are fresher). This idea is supported by the fact that only 6.42% of companies in this industry use LIFO. Industry nine (“Steel Works, etc.”) has the largest number of companies using LIFO with 26.52%, and it is almost equal to the number of companies in that industry using FIFO. This could be due to the size and nature of the inventory that they are selling.

TABLE 1 : INVENTORY METHODS BY INDUSTRY						
INDUSTRY	# OBSERVATIONS	FIFO	LIFO	AVG COST	OTHER	NO INVENTORY
1 Food	3468	54.30%	8.39%	28.49%	8.74%	0.09%
2 Mines, Mining, & Minerals	2216	12.00%	7.76%	72.61%	7.63%	0.00%
3 Oil & Petroleum Products	3599	21.28%	10.98%	44.26%	23.48%	0.00%
4 Cloths, Textls, Apparel, & Footwear	1803	66.00%	9.32%	18.75%	5.93%	0.00%
5 Consumer Durables	2730	64.21%	11.43%	18.68%	5.57%	0.11%
6 Chemicals	2607	50.21%	16.76%	29.92%	2.84%	0.27%
7 Drugs, Sop, Perfumes, & Tobacco	4501	66.03%	6.42%	19.00%	8.53%	0.02%
8 Construction & Construction Materials	3478	40.14%	10.09%	23.95%	25.76%	0.06%
9 Steel Works, etc.	1610	33.73%	26.52%	32.48%	7.20%	0.06%
10 Fabricated Products	855	58.48%	22.92%	12.16%	6.43%	0.00%
11 Machinery & Business Equipment	15290	61.56%	5.26%	18.99%	14.14%	0.05%
12 Automobiles	1832	57.75%	18.94%	15.34%	7.97%	0.00%
13 Transportation	4005	49.01%	2.40%	37.08%	11.51%	0.00%
14 Utilities	5232	1.61%	0.54%	5.05%	0.88%	91.93%
15 Retail Stores	6475	46.56%	10.87%	32.80%	9.76%	0.00%
16 Banks, Insurance Companies, & Other Financials	14931	3.29%	0.12%	1.18%	19.84%	75.57%
17 Other	32889	49.23%	3.60%	20.54%	16.38%	10.25%
TOTALS	107521	43.26%	10.14%	25.37%	10.74%	10.49%

The analysis in Table 1 spanned across twenty-two years (2000 to 2021). I decided the next step in analyzing would be determining if there were any years in which FIFO and LIFO inventory methods more significantly differed than others. This will help to eliminate any years with extraordinary circumstances where all EPS predictions were thrown off. I analyzed the industries grouped together, but divided by year. I decided to look at years 2000 through 2020 since not all 2021 data is currently available. The first step that I took to analyze the data by year was to determine what percentage of companies used FIFO or LIFO each year. I thought it would be interesting and very telling to see if there were any significant shifts over the years. This could indicate that leaders of companies felt swayed by something (investors, competition pressure,

compensation plans, etc.) to change the way that they had been valuing their inventory. Beginning in 2000, far more companies used FIFO compared to the number of companies with a LIFO inventory method. Nearly 50% of companies valued their inventory based on FIFO, while less than 10% valued theirs using LIFO. Since 2000, both inventory methods have decreased to almost half of what they used to be. This suggests that managers are discarding these traditional ways of valuing inventory for different ones. The average cost method inventory method steadily increases throughout this time period. In 2020, 25.63% of companies were valuing their inventory using average cost. Twenty years earlier, only 14.36% were. The switches that managers are making are clearly not from FIFO to LIFO or vice versa, but from FIFO or LIFO to average cost or something else completely. Many companies now are choosing to use standardized inventory management software. Because of this, average cost is often the default method used. Perhaps this trend will lead to an even greater rise in the average cost method and it soon overtaking the number of companies using FIFO. Beginning in 2000, 13.89% of companies were not using FIFO, LIFO, or average cost. In 2020, 14.64% were using something else. This further solidifies the idea that the average cost method is what is making up for decreasing numbers of FIFO and LIFO. In only three years did the number of companies using FIFO increase and in four years did the number of companies using LIFO increase.

TABLE 2 : INVENTORY METHODS BY YEAR						
YEAR	# OBSERVATIONS	FIFO	LIFO	AVG COST	OTHER	NO INVENTORY
2000	6832	49.03%	8.15%	14.36%	13.89%	14.56%
2001	6408	48.24%	7.83%	15.26%	13.19%	15.48%
2002	6157	47.38%	7.54%	15.69%	13.42%	15.98%
2003	5915	46.56%	7.35%	16.25%	13.66%	16.18%
2004	5718	46.14%	6.82%	17.49%	13.69%	15.86%
2005	5545	45.66%	6.42%	18.45%	13.45%	16.01%
2006	5358	44.51%	5.97%	19.37%	13.92%	16.22%
2007	5142	43.06%	5.48%	20.75%	13.91%	16.80%
2008	5030	40.82%	5.29%	22.31%	13.92%	17.67%
2009	4954	40.23%	5.13%	22.71%	13.44%	18.49%
2010	4851	39.17%	5.05%	23.09%	13.69%	19.01%
2011	4751	38.41%	5.09%	23.09%	14.17%	19.24%
2012	4760	38.24%	4.87%	23.34%	13.95%	19.60%
2013	4753	38.31%	4.73%	23.19%	14.54%	19.23%
2014	4640	37.87%	4.83%	23.21%	14.59%	19.50%
2015	4450	37.28%	4.85%	23.26%	14.49%	20.11%
2016	4284	36.95%	4.97%	24.18%	14.12%	19.77%
2017	4168	36.95%	4.77%	24.57%	14.18%	19.53%
2018	4021	37.60%	4.53%	24.94%	14.10%	18.83%
2019	3970	37.18%	4.33%	25.31%	14.76%	18.41%
2020	3879	37.30%	4.20%	25.63%	14.64%	18.23%
TOTALS	105586	41.28%	5.63%	21.26%	13.99%	17.84%

EPS is a common descriptor of a company's performance in relation to its stocks. EPS is described as the profit of the company per share of stock and is a widely shared and relied on figure. From the IBES database on WRDS, I was able to obtain the actual EPS for companies in the years 2000 to 2021, as well as what analysts forecasted the EPS to be for that year. This is where the first step of analysis came in. I subtracted the expected from the actual, and determined how large or small of a difference there was between those two numbers. I broke the data down into industries and determined if there was anything noteworthy when looking at the difference between actual and expected EPS for LIFO firms versus FIFO firms. In nine out of the seventeen different industry groups, the average EPS was lower than the expected in firms using both FIFO and LIFO. In only one industry did both FIFO and LIFO firms report a higher EPS than they expected to. The remaining seven industries were divided - the companies using FIFO had a lower average EPS than expected and the companies using LIFO had a higher average EPS than

expected. The industries that this took place in were “Oil and Petroleum Products,” “Chemicals,” “Drugs, Soap, Perfumes, & Tobacco,” “Fabricated Products,” “Machinery & Business Equipment,” “Transportation,” and “Other.” It is interesting to note that when FIFO and LIFO disagreed on a lower or higher actual EPS, FIFO always had an EPS lower than expected and LIFO always had an EPS higher than expected. This analysis suggests that companies that use the FIFO method of keeping track of inventory have an outlook that is too positive, and investors of FIFO firms are more likely to be disappointed based on the EPS prediction that had been given to them. These results could also suggest that analysts have a more difficult time predicting the performance of LIFO firms than they do FIFO firms. The chart below shows these initial findings, grouped by industry and inventory valuation method. The largest difference between LIFO and FIFO averages that we see is in industry sixteen, “Banks, Insurance Companies, and Other Financials.”

TABLE 3 : AVERAGE ACTUAL EPS - EXPECTED EPS				
INDUSTRY	FIRST IN FIRST OUT		LAST IN FIRST OUT	
	AVG EPS DIFFERENCE	___ THAN EXPECTED	AVG EPS DIFFERENCE	___ THAN EXPECTED
1	-0.0477	LOWER	-0.0306	LOWER
2	-0.0310	LOWER	-0.0485	LOWER
3	-0.0310	LOWER	0.0312	GREATER
4	-0.0724	LOWER	-0.0636	LOWER
5	-0.0418	LOWER	-0.0430	LOWER
6	-0.0445	LOWER	0.0003	GREATER
7	-0.0281	LOWER	0.0171	GREATER
8	-0.0335	LOWER	-0.0139	LOWER
9	-0.0542	LOWER	-0.0238	LOWER
10	-0.0315	LOWER	0.0072	GREATER
11	-0.0237	LOWER	0.0157	GREATER
12	-0.0832	LOWER	-0.0308	LOWER
13	-0.0439	LOWER	0.0092	GREATER
14	0.0029	GREATER	0.0438	GREATER
15	-0.0359	LOWER	-0.0042	LOWER
16	-1.4122	LOWER	-6.9933	LOWER
17	-0.2089	LOWER	1.5499	GREATER

Another way to look at this data is to see if companies in each year and inventory method had an actual EPS that was at least as high as its expected EPS (or greater). This is whether the company met or beat the forecasted earnings. I calculated the proportion of companies in each industry that met or beat the expected EPS. Investors would like to see these percentages as close to 100% as they can be. A higher percentage of meeting or beating expected EPS could indicate either that firms using a specific inventory method have superior performance or that analysts predict lower earnings for different inventory methods. In fourteen of the seventeen inventory groups, a higher percentage of firms using LIFO met or beat the expectation. A lot of these percentages were fairly close to each other, six of them were within five percent of each other. This demonstrates that although a difference exists between the two methods, it is not incredibly significant. In the “Cloths, Textiles, Apparel, & Footwear” industry, 69.03% of FIFO companies meet or beat expectations, while 54.87% of LIFO companies do - a difference of 14.17%. FIFO beating LIFO is clearly rarer, but when it does happen it is often by a much more significant amount. In industry sixteen, FIFO beat LIFO by 6.21%. In the “Automobiles” and “Transportation” industries the difference in percentages was also above ten percent. However, these two industries favored LIFO over FIFO.

TABLE 4 : PERCENTAGE OF COMPANIES THAT MEET OR BEAT EXPECTATIONS				
INDUSTRY	FIRST IN FIRST OUT	LAST IN FIRST OUT	HIGHER PERCENTAGE	DIFFERENCE IN %
1	57.16%	66.49%	LIFO	-9.33%
2	51.32%	50.00%	FIFO	1.32%
3	51.53%	56.42%	LIFO	-4.89%
4	69.03%	54.87%	FIFO	14.17%
5	61.39%	65.69%	LIFO	-4.29%
6	58.49%	63.77%	LIFO	-5.28%
7	64.26%	73.17%	LIFO	-8.91%
8	59.35%	59.70%	LIFO	-0.35%
9	55.70%	61.74%	LIFO	-6.04%
10	67.72%	72.38%	LIFO	-4.66%
11	66.50%	71.81%	LIFO	-5.31%
12	57.83%	71.02%	LIFO	-13.20%
13	57.00%	69.44%	LIFO	-12.45%
14	55.74%	62.50%	LIFO	-6.76%
15	65.72%	68.50%	LIFO	-2.77%
16	59.55%	53.33%	FIFO	6.21%
17	62.42%	68.16%	LIFO	-5.74%

Two more ways of looking at the data are ROA and profit margin (i.e., return on sales). ROA uses the assets of the company in its formula and ROS uses the company's sales. A company's ROA tells investors how much profit the company is making from its assets. That same company's profit margin tells investors how much of a profit is being made on their sales. Both are important and both are also affected by the inventory valuation method that a company chooses to use. In fourteen industries, LIFO firms have a higher average ROS. Similarly, LIFO firms have a higher ROA in fourteen industries. This data seems to be consistent with with the EPS data. If investors were solely looking at these formulas to determine where to invest, they would likely choose a LIFO company. Considering the majority of companies do not use LIFO, this is interesting to see. The average ROA is negative in only three industries groups and only in FIFO. These industries are "Drugs, Soap, Perfumes, & Tobacco," "Fabricated Products," and "Other." In

five FIFO industry groups is the average ROS negative (“Oil & Petroleum Products,” “Drugs, Soap, Perfumes, & Tobacco,” “Fabricated Products,” “Machinery & Business Equipment,” and “Other.”

TABLE 5 : AVERAGE RETURN ON ASSETS & RETURN ON SALES						
INDUSTRY	FIFO AVG ROA	LIFO AVG ROA	HIGHER ROA %	FIFO AVG ROS	LIFO AVG ROS	HIGHER ROS %
1	4.47%	5.85%	LIFO	2.88%	6.07%	LIFO
2	4.11%	2.08%	FIFO	4.45%	0.03%	FIFO
3	1.30%	6.23%	LIFO	-3.61%	3.19%	LIFO
4	4.97%	2.05%	FIFO	3.03%	0.95%	FIFO
5	1.57%	3.28%	LIFO	0.66%	2.01%	LIFO
6	2.79%	4.87%	LIFO	2.30%	4.79%	LIFO
7	-1.89%	6.47%	LIFO	-3.12%	7.95%	LIFO
8	2.65%	4.97%	LIFO	1.44%	4.84%	LIFO
9	1.66%	3.62%	LIFO	1.30%	0.86%	FIFO
10	-3.58%	4.77%	LIFO	-3.25%	3.74%	LIFO
11	0.40%	5.38%	LIFO	-1.44%	4.49%	LIFO
12	1.64%	5.75%	LIFO	1.41%	4.15%	LIFO
13	1.72%	7.03%	LIFO	1.20%	4.53%	LIFO
14	2.30%	4.27%	LIFO	10.98%	19.32%	LIFO
15	2.14%	3.62%	LIFO	0.36%	1.58%	LIFO
16	3.18%	2.99%	FIFO	5.19%	11.92%	LIFO
17	-1.74%	4.40%	LIFO	-4.91%	3.71%	LIFO

CONCLUSIONS

Based on research gathered from previous studies and the analyses that I have conducted during this project, I am able to reach a couple of conclusions. Because of the research that I did for this thesis and what I have learned in prior accounting classes, I expected FIFO and LIFO to dominate inventory methods. This, however, is not the case. Whether you look at the data by year or by industry, LIFO averages a lower percentage of firms than average cost and the combination of all other methods. FIFO, on the other hand, comes out with the greatest average. This supports the idea that managers want the balance sheet to reflect current inventory prices and that they value

other aspects of FIFO enough to disregard the tax benefits from LIFO. To further research this topic with this data, I would suggest determining how many companies switched specifically from FIFO to LIFO or vice versa. Analyzing in what industries or years this is more likely to happen could give some insight as to managers' thought processes compared to what was happening in the economy as a whole during these periods. Based on the analysis that I have done so far, I do not think it is likely that many of these FIFO/LIFO switches would exist. Perhaps managers are looking to use inventory methods that are less extreme one way or the other and therefore have begun the migration to average cost.

When investors look at EPS predictions, they are always going to hope that the company that they chose to invest in will end up having a higher EPS than what is expected. I would expect FIFO firms to report a higher net income than LIFO firms because the cost of goods sold would appear lower when using FIFO. Knowing this, it is interesting that in eight industries LIFO firms reported a greater expected EPS (compared to FIFO's one firm). In sixteen out of the seventeen different industries, companies that use FIFO ended up reporting a lower EPS than what was expected. Although this does not inherently indicate a worse performance than LIFO firms, it certainly affects how investors view the success of the company. It is for this very reason that managers need to take into account how the inventory valuation will affect investors' perceptions of their company. The decision does not affect success, but perceived success. It would be interesting to dig deeper into how much investment money that companies receive and what inventory valuation that they use. My hypothesis is that LIFO firms would receive more outside investment because they appear to be more favorable.

Knowing the way that a company values inventory should be a priority of investors. They should be aware of how it could skew their perception of the company. At the end of the day,

managers and investors do not always have the same goals. Investors should keep this in mind and do everything in their power to know and understand the company that they are investing in. Informed decisions are the only kind of decisions that are worth making.

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