Retail Inventory: Managing the Canary in the Coal Mine!

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Abstract

Retail inventory is a closely watched statistic by retailers as well as their investors, lenders and suppliers. Retailers not only benefit from inventory, but also bear the cost of excess inventory. Investors, lenders and suppliers interpret this statistic for signs of the retailer’s health, future sales prospects, and impending costs. This paper shows that inventory turnover, a commonly used metric, has shortcomings that reduce its utility for all these stakeholders. It presents a new metric, adjusted inventory turnover, which overcomes the drawbacks of inventory turnover and can be uniformly utilized by all stakeholders to assess whether a retailer is carrying too much or too little inventory. We explain applications of the metric with examples, and lay out prescriptions for retailers.

1. Introduction

Retailers often face a dilemma in deciding how much inventory to carry on their balance sheets. Among compelling reasons for increasing inventory levels despite the costs associated with additional inventory are to provide greater product variety and achieve higher fill rates. But these benefits to customers often represent a source of concern to others, such as equity investors and lenders, who tend to view rapid inventory growth like the canary in the coal mine, as a harbinger of trouble. Of particular importance to lenders is that inventory growth increases a retailer’s risk of bankruptcy. Even relatively small increases in inventory level or modest reductions in sales can substantially diminish a retailer’s cash flow.
Moreover, a retailer’s inventory is the primary asset that the lender can liquidate if needed to recover the money owed by the retailer.

Retailers and investors can resolve this dilemma by identifying a target or benchmark inventory level that is transparent to internal and external stakeholders. Using historical data from a large number of public retailers, this paper identifies the drivers of inventory level and derives a method for benchmarking the amount of inventory a retailer should carry. We show that deviations from this benchmark are predictive of a retailer’s future sales, earnings performance, and stock price.

2. Contrasting the Retailer, Equity Investor, and Lender Perspectives

Inventory has long been a topic of interest to retailers, investors, and lenders. Retailers need inventory to drive sales and profits. Equity investors, although they, too, care about sales and profits, worry that historical sales and profits might be overstated through the use of inventory. For lenders (including suppliers who sell on credit to retailers), retail inventory is a predictor of possible future cash flow problems and an asset that can be converted to cash in the event a retailer has to be liquidated.

2.1 The Retailer Perspective

Inventory is a retailer’s lifeblood. Every retailer understands that one can’t sell what one doesn’t have in stock, and that the availability of inventory is a significant driver of customers’ in-store experience and satisfaction. Not having the right product at the right location, time, and price typically costs a potential sale and the associated profit. But inventory also represents substantial investment. For the average US public investor in 2011, inventory was 21% of total assets, one of the largest items on most retailers’ balance sheets. A retailer unable to sell what it buys in one season will not only have less cash to buy fresh inventory for the next season, but also have to exert effort and incur expenses to dispose off leftover inventory.
To help them better manage inventory, retailers have invested in organizations (e.g., in departments called buying, merchandising, and merchandise planning) as well as in a variety of technological tools. But determining optimal inventory level, as textbooks in operations research have long noted, can be complicated. Optimal inventory level is affected by numerous variables including a product’s expected demand, demand uncertainty, gross margins, obsolescence and inventory carrying costs, lead-time for replenishment, and periodicity of review.

Managing retail inventory has become more complicated during the past few decades. Witness department store markdowns, which grew from 7% in the 1970s to more than 20% by the late 1990s,\(^i\) surveys that find stockouts rampant in most retail formats, and, for the industry as a whole,\(^ii\) inventory turns that have not increased substantially despite massive investments in technology.

Among many reasons for the increased complexity of retail inventory management is an explosion in product variety in most product categories. In men’s apparel, for example, the market share for white shirts has declined substantially\(^iii\). Concurrently, product lifecycles have shrunk in many categories. This is perhaps easiest to see in the context of certain technological products, for which the rate of innovation is so high that products in inventory lose value at 1% per week. The per chip cost of memory (RAM), for example, declined from $16 in 2000 to $4 only a dozen years later, even as storage capacity increased by 1,000 times. In other words, the per-unit cost of storage plummeted by 4,000 times over a 12-year period.

Increased variety and shorter lifecycles have made it more difficult to forecast demand for products. As we have shown in prior research, greater variety has also resulted in a variety of execution problems at the store level (inventory records, for example, become less accurate as inventory level goes up), and retail consolidation has complicated the task of tracking sales at the individual store and SKU level and stocking accordingly (the typical buyer might now be responsible for planning inventory for hundreds of SKUs at thousands of locations). With the growth of alternate channels (e.g., the Web), often
with their own rules governing pricing, taxes, and returns, retailers have been faced with the need to balance inventory across channels. The longer lead times often associated with the search for production sources with cheaper labor costs in many categories has further complicated inventory planning.

Due to these complexities, retailers must pay closer attention to inventory, and their investors and lenders use inventory as an indicator of quality of management.

2.2 The Investor Perspective

Equity investors, although they care about retail inventory for the very same reasons retailers do, also worry that growth in inventory might conceal weaknesses in a retailer’s ability to generate future sales and earnings. In other words, investors view inventory as the proverbial canary in the coal mine. Savvy professional investors we interviewed routinely track whether inventory growth exceeds sales growth, and challenge management to offer an explanation when it does.

Inventory affects future stock returns of retailers. Investor consideration of inventory is especially relevant because retail investment is characterized by frequent booms and busts. Consider, for example, Circuit City Stores, Inc. (“Circuit City”), a US-based retailer that sold consumer electronics primarily through big-box stores until it went out of business in March 2009. Investing $1,000 in 1968, when Circuit City went public as Wards Company, would have returned $515,000 by 2000. The same investment in Wal-Mart Stores, Inc. (“Wal-Mart”) in 1973, and in The Gap Inc. (“Gap”) in 1976, would have returned $1,116,000 and $572,000, respectively, by 2000. Downside changes in retail valuation can be equally abrupt, as evidenced by Circuit City’s experience from 2000 to 2008, by which time the company had been liquidated and investment in its stock was valueless. Circuit City’s is a more common retailing saga than many might think. During the past 20 years, more than 15% of public retailers have entered bankruptcy, and an additional 3.4% been liquidated.
Investor wariness of retailers “playing games” with inventory to inflate profits in certain quarters is summarized by David Berman, a hedge fund manager who focuses on retail stocks, thus. “This relationship [between inventory and stock price] is ASTOUNDINGLY powerful, but surprisingly few understand why. Most think it’s just a function of inventory risk. It’s not. It’s primarily a function of how the operating margins can be manipulated by management in the short term by playing around with inventories.”

To understand how inventory can be used to “play games” with profits, consider the following simple example of a retailer that purchases and sells a single product. Assume the purchase of 10 units of product at $1 per unit and sale of six units at $2 per unit, yielding revenue of $12 and four units of unsold inventory, the latter to be written off (i.e., to have zero value) at the end of the selling season. The retailer’s income statement would look like scenario A, below. Note that gross margin is $2, or 17% of revenue. (Insert Table 1 here)

In scenario B, in which the retailer values the leftover inventory at cost (i.e., at $4), the cost of sales drops to $6 (from $10) and the gross margin increases to $6 (from $2) and 50% (from 17%) of revenue. The retailer has overstated its gross margins in the current year by overvaluing its inventory, but future earnings will be depressed because the retailer will likely have to write off the excess inventory at some future date.

The foregoing example probably exaggerates retailer discretion relative to inventory valuation. It would be difficult for a retailer to value its entire obsolete inventory at cost, and such inventory might not be entirely worthless (i.e., it may have some residual value). Yet most observers to whom we have spoken judge retailers to enjoy considerable discretion in the value they assign to inventory. According to Berman, “Managements sign off on the inventories as being fairly valued, and the auditors pretty much rely on their word.” More important, management can choose when to write down the value of inventory, which substantially determines the timing of profits. Not surprisingly, investors punish retailers that have
unexpected inventory growth, especially if a retailer exhibits other signs of trouble. For example, we found in a study that the stock prices of retailers that miss analysts’ consensus earnings estimates drop by 8% in the nine-month period following the earnings announcement. The stock prices of retailers that miss their earnings estimates and report unexpected inventory growth, however, drop by 13% over the same period, whereas those that miss earnings without any unexpected inventory growth observe only a 2.6% decline in stock price. Clearly, investors see bad news in inventory growth as well as in missed earnings.

Inventory, and a retailer’s valuation thereof, has a substantial impact on profit because for most retailers inventory is substantially greater than pre-tax earnings. Consider, for example, Target Corporation (“Target), which in fiscal year 2012 had $7.9 billion in Inventory and pre-tax income of roughly $4.5 billion. A 10% difference in the valuation of its inventory could overstate Target’s pre-tax income by $790 million, or roughly 18%. Moreover, there is in some sectors considerable subjectivity in the valuation of inventory. For instance, whereas it is difficult to precisely value a retailer’s inventory of fashion apparel, much of the $3.8 billion in inventory held by consumer goods manufacturer Unilever PLC (“Unilever”) in fiscal year 2011 was probably fairly straightforward to value.

Inventory also affects a retailer’s expected future growth rate. Growth rate—specifically, “comp-store sales growth,” a metric that tracks year-on-year sales growth after controlling for store opening and closing sales growth—can affect a retailer’s valuation significantly. Consider a retailer with annual sales of $500 million, 40% gross margin, fixed expenses of $180 million, and, hence, net profit of $20 million (or 4% of sales) in a given year, denoted “year 1.” Ignoring, for simplicity, taxes, depreciation, and capital expenses that could cause earnings to differ from cash flow, the firm would have cash flow of $20 million in year 1. Now consider how investors would value this firm under two scenarios, (1) if it experienced zero growth, and (2) if its comp-store sales growth was 3% per year for twenty years. The higher growth rate in the second scenario has a significant impact on cash flow because the gross margin from the additional sales falls to the bottom line; in year 2, the retailer would have sales of $515 million, gross margin of $206 million, and cash flow of $26 million. In the first scenario, in contrast, cash flow in year 2
would have remained static at $20 million. Note that although sales increased by 3%, earnings and cash flow increased by 30%. Using a standard discounted cash flow model and discounting rate of 10% per year, the firm would be valued at $182 million at zero growth rate, and $625 million at 3% per year growth rate; the valuation increases by 243% because of the change in growth rate.

Savvy investors watch inventory levels closely to distinguish between two types of sales growth: persistent growth that stems from greater consumer demand for a retailer’s products or services, and temporary growth attributable to additional inventory and fewer stockouts. Investors reasonably expect greater demand for a retailer’s products and services in one quarter to be an indicator of future demand growth. Sales growth driven by higher inventory, however, does not imply greater consumer demand for a retailer’s products. Moreover, there are limits to the extent to which sales growth can be driven by inventory. Sales growth generated by increases in inventory levels, because it does not predict future sales growth, should thus not be rewarded as handsomely as sales growth generated by heightened consumer demand.

2.3 The Lender and Supplier Perspectives

Lenders and suppliers attend to inventory levels because growth can often predict future cash-flow problems and, in some cases, bankruptcy and liquidation. In the event of liquidation, inventory is often the primary vehicle by which lenders recover money from retailers.

To understand the relationship between inventory growth and cash flow, consider a retailer with annual sales of $100 that turns its inventory twice per year. Assume, quite reasonably, that gross margin is 50% and net profit 4% of sales (or $4, currently). In other words, fixed costs are $46 per year. Ignoring, for simplicity, taxes and non-cash expenses, the retailer’s cash flow will be $4. Inventory, which turns twice per year, at half the cost of sales, is valued at $25.

Anticipating 20% growth in aggregate sales in the subsequent year, the retailer increases its inventory by 20% over the previous year, to $30. What will happen to the retailer’s cash flow if gross
margin and fixed cost remain at the previous year’s level, but the anticipated sales growth does not materialize, in other words, if sales match the previous year’s level?

Assume, conservatively, that the extra inventory carried by the retailer does not lose value (i.e., can be valued at cost). (It will, of course, incur some inventory carrying cost, which we ignore for convenience.) In this case, the retailer’s profit will remain unchanged, at $4, but its cash flow will be -$1 as opposed to $4 in the previous year. This adverse impact of carrying excess inventory would be exacerbated if the additional inventory increased the obsolescence cost or we were to explicitly incorporate inventory carrying cost in our example.

Note that in this simple example, cash flow declined precipitously even though the retailer’s business held steady. The retailer incurred negative cash flow simply because it increased inventory in anticipation of forecasted sales growth that did not materialize. A retailer takes a risk every time it plans inventory in line with forecasted growth. If projected sales growth does not materialize, cash flow can be severely affected. Retailers with high inventory turns are less prone to this risk. A retailer with five inventory turns per year in the example above would have started with $10 in inventory, and 20% growth in inventory would have reduced cash flow by only $2 (from $4 to $2).

Lenders also pay close attention to the quality of inventory. Both quality and quantity of inventory largely determine the extent to which lenders are able to recover loans made to retailers that run into cash flow problems and are forced to liquidate. In many recent retail liquidations, banks with substantial loans have managed to recover all the money due them.

3. So what is the appropriate level of inventory for a retailer?

Retailers and external stakeholders need a benchmarking tool that can be used to determine appropriate levels of inventory. It is important that such a benchmark be derived from publicly available data so that the metric can be calculated as easily by equity investors and other external stakeholders as by managers.
The metrics most commonly used, not just by retailers, but much more widely, to assess inventory productivity have been inventory turns and the algebraic equivalent, days of inventory. That they are easily calculated and understood, and rely only on data available as well to external stakeholders through public financial statements, probably explains the longevity and popularity of these two metrics.

Inventory turns, however, is a generally coarse metric against which to benchmark inventory productivity. We explain below the challenges associated with using inventory turns as a benchmark, and develop an alternative, which we term *Adjusted Inventory Turns*. We then illustrate by means of a few examples the different insights that can be gleaned from inventory turns and adjusted inventory turns.

An overarching challenge to its use as a benchmark is that inventory turns varies widely across retailers, and even over time for a given retailer. For example, is it reasonable to conclude that because grocery chain Kroger (NYSE: KR) turned its inventory 14 times and apparel retailer Gap (NYSE: GPS) 5.7 times in 2011 that the former better managed its inventory? Even among retailers within the same segment inventory turns can vary widely, as evidenced, within the consumer electronics segment, by Best Buy (NYSE: BBY), which turns its inventory over six times, and Radio Shack Corporation (NYSE: RSH), which turns its inventory over fewer than four times, per year. Here, too, it would be wrong to conclude, based on inventory turns alone, that Best Buy is doing a better job than Radio Shack at managing its inventory. Even a given retailer can experience substantial variation, as evidenced, for example, by inventory turns at Family Dollar Stores (NYSE: FDO), which, over the two decades that spanned 1990-2010, fluctuated between 2.2 and 4.9 times per year.

What explains such variation in inventory turns? Our past research\(^vi\) has identified multiple drivers. We simplify the analysis in those papers to focus on the two drivers we have found to be most salient, gross margins and capital intensity.

Ceteris paribus, an increase in gross margin should be associated with a decrease in inventory turnover, and vice versa. There are several reasons to expect this negative correlation between inventory
turnover and gross margin. An increase in gross margin is associated with improved service levels, increased variety, a shift towards higher quality, slower moving products, or a reduction in markdowns. With each such change, inventory turnover generally decreases. Indeed, retailers often recognize an “earns versus turns tradeoff,” whereby, in order to be profitable, a high gross margin must be earned on each sale or inventory turned very fast. Retailers with low earns and low turns would be under pressure to improve their operations or eventually shut down. Retailers with high earns and high turns tend to be rare because of the difficulty of sustaining this advantage over a long period of time in a competitive marketplace.

Capital intensity, defined as the ratio of capital assets to total assets + capitalized leases, should be positively correlated with inventory turnover. Decisions that lead to an increase in capital intensity include setting up warehouses and investing in supply chain infrastructure and logistics. Such decisions should lead to an increase in inventory turnover by making it possible to use inventory more productively. Note that increasing numbers of stores will not increase capital intensity because both inventory and fixed assets will increase proportionately. If, however, stores were made more efficient through redesign and reformatting, capital intensity and inventory turnover would be expected to increase.

We define adjusted inventory turns for firm $i$ in year $t$ in terms of the following formula:

$$\text{Adjusted Inventory Turns}_{it} = (\text{Inventory Turns}_{it}) \times (1 - \text{GrossMargin}_{it})^{-1.48} \times \text{CapitalIntensity}_{it}^{-1.05}$$

alternatively stated as,

$$\log(\text{Adjusted Inventory Turns}_{it}) = \log(\text{Inventory Turns}_{it}) - 1.48 \times \log(1 - \text{GrossMargin}_{it}) - 1.05 \times \log(\text{CapitalIntensity}_{it})$$
where -1.48 and -1.05 are coefficients obtained from regressing historical inventory turns on gross margin and capital intensity (see the appendix for details of the methodology).

To understand the impact of these variables on a retailer’s inventory turns, consider the following example. Figure 1a plots inventory turns for all public retailers in 2011. Note the substantial range, from retailers like Men’s Wearhouse Inc. that turn inventory less than once, to retailers like Alimentation Couche-Tard Inc. that turn inventory as many as 10 times, per year. To understand the causes of this variation, look at figure 1b, which plots inventory turns against the gross margins realized in 2011. Note the strong (non-linear) relationship between the two variables. Figure 1c plots inventory turns against a weighted combination of gross margin and capital intensity, the weight chosen to maximize the strength of the relationship. Figure 1d plots the *adjusted inventory turns* (AIT), that is, the inventory turns adjusted for the variation in gross margin and capital intensity. Note that retailers with the same inventory turns may have different AIT values because of differences in their gross margin and capital intensity. (The appendix provides a technical description of our procedure.)

AIT is similar in concept to a commonly used performance metric termed as gross margin return on inventory (GMROI), which is defined as the gross margin earned per dollar invested in a firm’s inventory, and measured as the ratio of gross margin to inventory. Although it controls for the correlation of inventory turnover with gross margin, GMROI assumes that a 1% increase in gross margin must be compensated by a 1% decrease in inventory turnover. Such a fixed relationship does not have an economic basis and does not exist in practice. Moreover, GMROI does not adjust for the correlation of inventory turnover with capital intensity. AIT overcomes these drawbacks as it is derived from historical data on retailer performance.

To illustrate how inventory turns and adjusted inventory turns can offer different insights, we evaluate, using both metrics, the performance of two well-known retailers, Wal-Mart (NYSE: WMT) and Target (NYSE: TGT), over the years that spanned 1985-2007. Figure 2a shows the change in inventory
turns for both firms during this period. As shown in the figure, Wal-Mart’s inventory turns grew steadily, from fewer than four to nearly eight turns per year. Stated alternatively, the company went from carrying roughly 90 days to carrying roughly 45 days of inventory. Target’s inventory turns during the period changed less, rising from 4.5 to 6. Looking at that metric alone would suggest that during this period inventory management was improved substantially more by Wal-Mart than by Target.

Now compare how adjusted inventory turns evolved at each of these firms during this period. Both increased their adjusted inventory turns substantially, from around 11 in 1985 to roughly 16 in 2007. It is hard from the data to say if either firm outperformed the other on AIT during the entire period under discussion; a numerical count reveals that Wal-Mart’s AIT exceeded Target’s AIT for 11 of the 23 years that are represented in the figure 2b. Looking at adjusted inventory turns would lead us to conclude that there was essentially no difference in the firms’ inventory productivity.

Why do the insights derived from inventory turns and adjusted inventory turns differ so? It is useful to examine the 22-year period in three phases: 1985-1995; 1996-2002; 2003-2007. During 1985-1995, both firms’ inventory turns held reasonably steady; Target’s inventory turns exceeded Wal-Mart’s during the period but AIT was similar for the two firms. Why were inventory turns at Target higher than at Wal-Mart even though AIT was roughly tied at the two firms? During this period Wal-Mart’s capital intensity was usually lower than Target’s. In 1985 for example, capital intensity was roughly 60% at Wal-Mart, and roughly 70% at Target. In other words, capital assets accounted for 60% of Wal-Mart’s total assets and 70% of Target’s total assets.

From 1996-2002, Wal-Mart’s inventory turns grew rapidly from 4.5 (1996) to 7.5 (2002). In 2002, Wal-Mart’s inventory turns were roughly 24% higher than Target’s. AIT however told a different story; Wal-Mart’s AIT was only 3% higher than Target’s. Why were the AIT metrics for Target and Wal-Mart much closer than inventory turns? The answer lies in Target’s gross margins, which grew substantially during this period. By 2002 for example, Target’s gross margins had grown to 33%,
significantly higher than Target’s gross margins of 23-25% in the early 1990s and also substantially higher than Wal-Mart’s gross margins of 23% in 2002.

From 2003-2007, inventory turns at Wal-Mart and Target stayed largely flat. Wal-Mart averaged 7.5 inventory turns a year while Target averaged roughly 6 turns a year. Yet the average AIT was essentially identical. The answer once again lay in Target’s superior gross margins, which averaged 34%, as opposed to 25% for Wal-Mart.

Adjusted inventory turnover thus provides, by adjusting, on the basis of a statistical model, changes in inventory turnover to reflect simultaneous changes in gross margin and capital intensity, a method of benchmarking inventory productivity. This gives us a metric that supports comparisons, whether across firms in a retail segment or within a given firm over time.

4. What can be gleaned from a retailer’s adjusted inventory turns?

Is AIT a useful benchmark managerially, that is, is it a reliable indicator of changes in performance? Our research having shown this metric to be effective at gauging sales, earnings, and stock price, we suggest that managers, investors, and lenders ignore it at their peril.

Does AIT predict sales and earnings? In a word, yes. We preface with our findings in this regard a deeper discussion of the details of our methodology.

Our analysis of this phenomenon begins with an examination of the bias in analyst forecasts for over- and under-inventoried retailers. The logic of our methodology is as follows. If AIT is predictive of sales or earnings, AND if equity analysts fail to make sufficient adjustments for changes in inventory levels, their sales and earnings forecasts will be overly optimistic for “over-inventoried,” and overly pessimistic for “under-inventoried,” retailers. Hence, we employ this method with the caveat that it tests not only whether AIT is predictive of future performance, but also for equity analysts’ failure to adjust sufficiently for AIT’s predictive power.
We identify over- and under-inventoried retailers by their AIT rankings. We classify as under-inventoried retailers with an AIT in the top third of all retailers, and as over-inventoried retailers with an AIT in the bottom, 33rd percentile. Applying the formula for AIT stated earlier to Bombay Company, which in 2006 had inventory turns of 0.77, gross margins of .24, and capital intensity of 1.23, we arrive at an AIT of 0.92. This places Bombay Co in the 1st percentile and, hence, over-inventoried classification.

Figure 3a plots for retailers that were over- and under-inventoried at the end of the prior fiscal year the bias in equity analysts’ sales forecasts for the years 2002-2010. Analysts’ sales forecasts are seen to be overly optimistic for firms that were over-inventoried, and overly conservative for firms that were under-inventoried in the previous year. Examine first the forecasts made about a month after release of the previous fiscal year’s financial statements. Our method uses data from released financial statements to identify whether a retailer is over- or under-inventoried. In this time frame, analysts tend to over-estimate sales for over-inventoried retailers by 0.8%, on average. For a retailer with annual sales of $10 billion, this amounts to over-estimating sales by $80 million. Average sales growth during this period (2002-2010) across all retailers being 5%, over-estimating sales by 0.8% is equivalent to over-estimating sales growth by 16% for the average retailer. Sales of retailers that are under-inventoried tend to be underestimated by roughly 1.2%, which translates into under-estimating the growth rate for the average retailer by 24%. Although it declines over time, this bias persists, with analysts continuing to over-estimate sales for retailers that were over-inventoried, and under-estimate sales for retailers that were under-inventoried, for several months after the release of previous year’s financial statements.

Figure 3b plots for the same period the bias in analysts’ earnings forecasts, which, like their sales forecasts, tend to be overly optimistic for retailers that were over-inventoried, and overly pessimistic for retailers that were under-inventoried, the previous year. A month after the release of financial statement of previous fiscal year analysts over-estimated earnings for over-inventoried retailers by 10 cents per share; this bias persists several months into the fiscal year, with analysts over-estimating earnings for over-inventoried retailers by 4 cents per share after six months into the fiscal year. For under-inventoried
retailers, analysts under-forecast earnings by 6 cents per share one month after the release of financial statements for the previous fiscal year. Given that the average change in annual EPS for retailers is only 10 cents per share, overestimates of 6 cents per share for under-inventoried and 12 cents per share for over-inventoried retailers are economically salient.

**Does AIT predict changes in stock price?** Again, the answer is, in a single word, yes. We test if a portfolio based on AIT performs better than retail stocks in general. We form investment portfolios based on July 31st of each year using financial statements for fiscal year end dates by January 31st. Providing a minimum six-month lag between fiscal year end dates and the date of formation of portfolios is a standard practice that allows information contained in financial statements, which are typically filed with the SEC within one to three months after the fiscal year end date, to disseminate into the market. The AIT method of portfolio formation is conservative in also not using any metrics that might have been available before July 31st, such as earnings announcements for the first quarter of the current fiscal year.

Our methodology ranks retailers within each segment based on the adjusted inventory turns derived from their financial statements. On the basis of these AIT rankings, the retailers are then classified into five portfolios, from those in the lowest 20% to those in the highest 20%. For example, in the apparel and footwear segment in 2010, 43 retailers were classified into five portfolios based on their AIT, as can be seen in Table 2 below.

*(Insert Table 2 here)*

The lowest portfolio (which consists of retailers with the lowest AIT) had an annual excess return of 2.28%, the highest portfolio an annual excess return of 14.88%. The 12.6% per year difference between the two portfolios is statistically significant and managerially substantial. To understand the impact of such a difference, consider that a $100 investment over 10 years would, with an annual return of 2.28%, amount to $125, and with an annual return of 14.88%, amount to $400.
5. Addressing the Retailer’s Choice

What can retailers do to manage investors’ and lenders’, as well as their own, concerns about inventory? One, they should benchmark their adjusted inventory turns over time and against those of other retailers. As we have argued and shown above, this metric is a leading indicator of sales, earnings, and stock price. Two, they should be wary of significant changes in their inventory turns. Like it or not, many investors and lenders continue to rely on this metric, despite its weaknesses. Hence, retailers should manage the potential signals that might be communicated by changes in inventory turns.

Because improving AIT is equivalent to improving inventory productivity, retailers stand to benefit significantly from carefully tracking their adjusted inventory turns and taking appropriate actions. AIT is improved by having the right product in the right place at the right time. As we and others have argued elsewhere, retailers have at their disposal multiple levers for improving inventory productivity. These can be broadly categorized as levers for improving forecasting, responsiveness, and planning.

Retailers that improve their forecasting ability are better able to match supply with demand; more accurate forecasts that reduce the need for safety stock translate into improvements in inventory productivity. Forecast accuracy can be improved via a mix of technology and processes. Better forecasts are possible owing to the availability of large volumes of data and superior analytical technologies. Moreover, our past research has shown accuracy to improve dramatically when forecasts are based at least in part on early sales data. Dramatic improvements in inventory productivity have accrued to companies that have invested in capabilities that enable them to read early signals from the market and respond quickly with additional supplies (e.g., Zara) or well-planned price changes or other means of stimulating demand. Inventory planning is complicated by the numbers of stock-keeping units (SKUs) and stores that comprise a typical retail chain today. Even a medium-sized retailer will have tens of thousands of SKUs in each of hundreds of stores, yielding more than a million store-SKU inventory locations for which inventory needs to be planned. Recent advances in information technology are
nevertheless enabling retailers to substantially improve their planning approaches, and, in some cases, demonstrably improve gross margin and inventory turns concurrently.

A focus on managing AIT needs to be supplemented with attention to inventory turns. Problems with using inventory turns as a metric notwithstanding, many investors, as we point out above, still regard it in the manner of a canary in a coal mine. Observed highly-respected investor Peter Lynch\textsuperscript{xi}: “When I research a stock, I always check to see if inventories are piling up. . . . With a manufacturer or a retailer, an inventory buildup is usually a bad sign. When inventories grow faster than sales, it is a red flag.” Inventory growing faster than sales, Peter Lynch’s “red flag,” is mathematically equivalent to tracking inventory turns.

Retailers might have compelling reasons to slow their inventory turns, that is, to increase inventory at a faster rate than sales growth. But to allay investor concerns, such compelling reasons need to be communicated, ideally before inventory is increased. Consider the following example shared with us by a manager at a leading retailer with more than $1 billion in annual sales. “We were planning to announce new merchandise categories coming to our stores, and a significant SKU expansion,” the manager explained. The expanded assortment would, according to the manager, require “a significant inventory investment and a decline in turns for period of time.” The company was convinced that increasing inventory and reducing inventory turns was the right call. Observed the manager: “We were making a substantial planned investment in inventory to drive sales, broaden our assortment, and become more relevant to our customer. We needed higher inventory levels to drive higher sales per square foot. . . While inventories were going to be up a material amount by the end of the year, it was a fully planned and thought-through strategy by our teams.”

The manager advocated communicating the planned increase in inventory levels to investors at the upcoming earnings call. Other managers, although initially hesitant, came to view this as a worthwhile step, and in the subsequent earnings call, according to the manager, it was “loudly stated [that] inventory
per store will be up between 15%-20% by the end of our fiscal year.” Given a clear and compelling explanation *before* inventory was increased seemed to allay investor concern; “questions about inventory,” the manager observed, “have been at an absolute minimum from investors.”

This retailer’s experience illustrates the benefits and importance of managing investor perceptions of inventory levels. Retailers should, of course, make choices about what and how much to inventory with an eye towards long-term performance. AIT is a useful metric in this regard. But retailers also, recognizing that many investors still attend closely to inventory turns, need to ensure that any changes therein are explained *to*, before they are observed *by*, investors.

6. Conclusion

Although the costs associated with carrying inventory, especially inventory that becomes obsolete, can be substantial, inventory is vital to sales, absence of the right inventory at the right location often translating into lost sales. Moreover, investors and lenders, as we have pointed out, should and do view inventory levels as an indicator of future earnings, sales, and stock price. To get inventory levels “right” is thus a challenging task for retailers. This paper offers retailers guidance in balancing the different perspectives that are brought to bear on inventory, and, perhaps most important, develops a metric, which we term Adjusted Inventory Turns, that, when used to establish appropriate inventory levels, constitutes a superior indicator of sales, earnings, and stock price.
Appendix: Computation of Adjusted Inventory Turnover

The research presented in this paper builds on prior research that the three of us have conducted either together or with other co-authors. We have simplified the research methodology and constructed a new benchmarking metric that can be easily used in practice. The methods used in our prior research are technically more sophisticated but also a little harder to understand and explain. Readers interested in exploring technical and methodological details and more sophisticated econometric models should look at the papers cited.

Research Methodology: We obtained data for all public listed U.S. retailers (SIC codes ranging from 5200 to 5990) for the period 1984 to 2010. We excluded automotive dealers and service stations (all firms with two digit SIC 55) and eating and drinking places (firms with three digit SIC 581) from our analysis.

We collected data for the following variables, which are included in the annual financial statements of firms: Ending Inventory ($INV$), LIFO Reserve ($LIFR$), Property, Plant and Equipment Gross ($PPEG$), Rental commitments for the next five years ($MRC1..MRC5$), Total Assets ($TA$), Sales Revenue ($SALE$), and Cost of Goods Sold ($CGS$). We use the rental commitments ($MRC1..MRC5$) to capitalize operational leases. These five variables give us estimated cash outflows on operational leases for the next five years. We assume that rental commitments beyond five years will be equal to $MRC5$. Thus, we construct an infinite time series of rental commitments, and discount it to the present to compute capitalized leases.

Using these data, we construct the following metrics. In each formula, the index $i$ denotes the firm and $t$ denotes the year. Inventory Turnover ($IT$) is defined as the ratio of cost of goods sold to ending inventory. We adjust both $CGS$ and $INV$ for LIFO reserves by subtracting change in LIFO reserves from $CGS$ and adding LIFO reserve to $INV$ in order to do an apples-to-apples comparison across retailers with different ways of accounting for inventory. Ceteris paribus, the higher the value of $IT$, the more efficient
is a retailer at managing its inventory. One may replace ending inventory with the average of quarterly inventories of the firm during the year, but one must consistently use the same definition throughout.

\[ IT_{it} = \frac{CGS_{it} - LIFR_{it} + LIFR_{i,t-1}}{INV_{it} + LIFR_{it}} \]

Gross Margin (\(GM\)) is defined as the ratio of gross profit to sales revenue. In this computation, cost of goods sold is adjusted for change in LIFO reserves.

\[ GM_{it} = \left[ \frac{SALE_{it} - (CGS_{it} - LIFR_{it} + LIFR_{i,t-1})}{SALE_{it}} \right] \]

Capital Intensity (\(CI\)) is defined as the ratio of capital assets to total assets + capitalized leases, where capital assets is measured as gross property, plant and equipment + capitalized leases. It measures the fraction of a retailer’s assets invested in its stores, supply chain infrastructure, information technology, and other capital assets. The higher this ratio, the more capital intensive a retailer is. In computing this ratio, we capitalize operational leases and add them to both \(PPEG\) and \(TA\).

\[ CI_{it} = \frac{PPEG_{it} + CapitalizedLeases_{it}}{TA_{it} + CapitalizedLeases_{it}} \]

Here, capitalized leases are computed as described above.

In each year, we regress \(log IT_{it}\) on \(log (1-GM_{it})\) and \(log CI_{it}\) using segment-wise intercepts.

\[ log IT_{it} = a_{s(i),t} + b_{1t} log(1-GM_{it}) + b_{2t} log CI_{it} + random error \]

Here, \(s(i)\) denotes the SIC segment of firm \(i\), \(b_{1t}\) denotes the coefficient of \(log (1-GM_{it})\) in year \(t\) and \(b_{2t}\) denotes the coefficient of \(log CI_{it}\) in year \(t\). We use \((1-GM_{it})\) instead of \(GM_{it}\) because \((1-GM_{it})\) is always a positive number, which implies that we can take logarithms without having to exclude any observations.

We conduct this regression for each year from 1985 to 2010, omitting the data for 1984 because of lagged LIFO reserves. We find that the estimates of \(b_{1t}\) and \(b_{2t}\) are statistically significant in each year at 99% confidence. The average value of the estimate of \(b_{1t}\) is 1.482. A positive coefficient shows that
inventory turnover decreases as gross margin increases. The average value of the estimate of \( b_{2i} \) is 1.049. A positive coefficient shows that inventory turnover increases with capital intensity. 

We use the results of this regression analysis to construct the benchmarking metric Adjusted Inventory Turnover (AIT).

\[
\log AIT_{it} = \log IT_{it} - 1.482 \log(1 - GM_{it}) - 1.049 \log CI_{it}
\]

Or,

\[
AIT_{it} = IT_{it} \left(1 - GM_{it}\right)^{-1.482} \left(CI_{it}\right)^{-1.049}
\]

Intuitively, AIT may be thought of as the effective inventory turnover that is obtained after adjusting the raw inventory turnover for concomitant changes in gross margin and capital intensity. Hence, AIT can be used to benchmark inventory turnover performance because it is unaffected by changes in gross margin and capital intensity.

As noted earlier in this appendix, this paper builds on the authors’ prior research, where we present more theoretical analyses of the usefulness of inventory data and its correlation with other metrics. Gaur, Fisher and Raman\textsuperscript{xiv} test hypotheses regarding the correlation of inventory turnover with gross margin, capital intensity and sales surprise using a panel data model. The AIT metric in that paper is a little more sophisticated than the one we have presented in this paper. Kesavan, Gaur and Raman\textsuperscript{xv} construct a more sophisticated simultaneous equations model that expresses inventory, sales and gross margin as functions of each other and other independent covariates. They use their model to develop a modified metric Abnormal Inventory Growth (AIG) and to generate sales forecasts. These forecasts are shown to be more accurate than those from sell-side equity analysts. They find that analysts’ forecasts have lower accuracy primarily because of systematic biases in their forecasts that arise due to analysts ignoring information contained in reported inventory. Kesavan and Mani\textsuperscript{xvi} extend this analysis by showing that the inventory model can also be used to predict future earnings per share, as well. Finally, Alan, Gao, and Gaur\textsuperscript{xvii} use more than 20 years of data from the stock market to determine if inventory-based metrics (including the AIT metric) are predictive of future stock returns of U.S. retailers.
Notes


xiii Gaur, op. cit; Kesavan (2010), op. cit; Kesavan (2012), op. cit; and Alan, op. cit.

xiv Gaur, op. cit

xv Kesavan (2010), op. cit

xvi Kesavan (2012), op. cit

xvii Alan, op. cit.
Tables and Figures accompanying “Retail Inventory: Managing the Canary in the Coal Mine!”

Table 1. Scenarios illustrating the impact of a delay in inventory writedown on a retailer’s gross margin

<table>
<thead>
<tr>
<th></th>
<th>Scenario A</th>
<th></th>
<th>Scenario B</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unsold inventory is written down in the same period</td>
<td>Unsold inventory is carried at cost on the balance sheet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchased # of units</td>
<td>10</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Purchase cost ($)</td>
<td>$10</td>
<td></td>
<td>$10</td>
<td></td>
</tr>
<tr>
<td>Units Sold</td>
<td>6</td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Revenue</td>
<td>$12</td>
<td></td>
<td>$12</td>
<td></td>
</tr>
<tr>
<td>Unsold Units</td>
<td>4</td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Unsold Units (Value)</td>
<td>$0</td>
<td></td>
<td>$4</td>
<td></td>
</tr>
<tr>
<td>Cost of Sales</td>
<td>$10</td>
<td></td>
<td>$6</td>
<td></td>
</tr>
<tr>
<td>Gross Margin</td>
<td>$2</td>
<td></td>
<td>$6</td>
<td></td>
</tr>
<tr>
<td>Gross Margin (%)</td>
<td>17%</td>
<td></td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>Portfolio 1 Retailers with lowest AIT</td>
<td>Portfolio 2</td>
<td>Portfolio 3</td>
<td>Portfolio 4</td>
<td>Portfolio 5 Retailers with the highest AIT</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>------------</td>
<td>------------</td>
<td>------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Annual average excess return</td>
<td>2.28%</td>
<td>2.88%</td>
<td>10.32%</td>
<td>12.84%</td>
</tr>
<tr>
<td>Names and stock tickers of apparel and accessories firms in each portfolio in 2010</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syms Corp (SYMSQ)</td>
<td>Ascena Retail Group Inc (ASNA)</td>
<td>Cato Corp -Cl A (CATO)</td>
<td>Charming Shoppes Inc (CHRS)</td>
<td>Cache Inc (CACH)</td>
</tr>
<tr>
<td>Foot Locker Inc (FL)</td>
<td>Genesco Inc (GCO)</td>
<td>Limited Brands Inc (LTD)</td>
<td>Gap Inc (GPS)</td>
<td>Ann Inc (ANN)</td>
</tr>
<tr>
<td>Casual Male Retail Grp Inc (CMRG)</td>
<td>Ross Stores Inc (ROST)</td>
<td>TJX Companies Inc (TJX)</td>
<td>Nordstrom Inc (JWN)</td>
<td>Wet Seal Inc (WTSLA)</td>
</tr>
<tr>
<td>Mens Wearhouse Inc (MW)</td>
<td>DSW Inc (DSW)</td>
<td>Destination Maternity Corp (DEST)</td>
<td>Urban Outfitters Inc (URBN)</td>
<td>Christopher &amp; Banks Corp (CBK)</td>
</tr>
<tr>
<td>Finish Line Inc -Cl A (FINL)</td>
<td>Stein Mart Inc (SMRT)</td>
<td>American Eagle Outfitters Inc (AEO)</td>
<td>Talbots Inc (TLB)</td>
<td>Buckle Inc (BKE)</td>
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<tr>
<td>Shoe Carnival Inc (SCVL)</td>
<td>Delias Inc (DLIA)</td>
<td>Collective Brands Inc (PSS)</td>
<td>Hot Topic Inc (HOTT)</td>
<td>Pacific</td>
</tr>
<tr>
<td>Stage Stores Inc (SSI)</td>
<td>Bakers Footwear</td>
<td>Childrens Place Retail Strs (PLCE)</td>
<td>J Crew Group Inc (JCG)</td>
<td>Sunwear Calif Inc (PSUN)</td>
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<tr>
<td>Coldwater Creek Inc (CWTR)</td>
<td>Group Inc (3BKRS)</td>
<td>Fredericks Of Hollywood Grp (FOH)</td>
<td>New York &amp; Co Inc (NYW)</td>
<td>Chicos Fas Inc (CHS)</td>
</tr>
<tr>
<td>DSW Inc-Old (DSW.2)</td>
<td>Zumiez Inc (ZUMZ)</td>
<td></td>
<td>Lululemon Athletica Inc (LULU)</td>
<td>Abercrombie &amp; Fitch -Cl A (ANF)</td>
</tr>
<tr>
<td></td>
<td>Citi Trends Inc (CTR)</td>
<td></td>
<td></td>
<td>Aeropostale Inc (ARO)</td>
</tr>
</tbody>
</table>

Note: Excess return of a stock is calculated by subtracting the risk-free rate of return from the stock return. The risk free rate is available in the Fama-French Portfolios and Factors database in WRDS. The annual average excess return for each portfolio comprises of all firms in that portfolio for the 26 year period from 1985 to 2011 across all SIC categories listed in the appendix. Please see Alan et al. (2012) for details.
Figure 1a: Plot of annual inventory turns of all public U.S. retailers in 2011

Wide variation in inventory turns across retailers

Figure 1b: Plot of inventory turns versus gross margin of all public U.S. retailers in 2011

Retailers with higher gross margin have lower inventory turns

Figure 1c: Plot of inventory turns versus a weighted combination of capital intensity and gross margin for all public U.S. retailers in 2011

Variation in inventory turns explained by gross margin and capital intensity
Figure 1d: Plot of adjusted inventory turns against inventory turns for all public U.S. retailers in 2011

Figure 2a: Time series plot of inventory turnover of Wal-Mart Stores (WMT) and Target Corp. (TGT) for the period 1985-2007
Figure 2b: Time series plot of adjusted inventory turnover of Wal-Mart Stores (WMT) and Target Corp. (TGT) for the period 1985-2007

Figures 3a-3b: Change in Wall Street analysts’ sales and earnings forecast bias with time

Note: Time periods 1, 2, and 3 refer, respectively, to 1, 4, and 7 months after the release of previous fiscal year’s financial statements. OI and UI refer to over-inventoried and under-inventoried retailers.