Excess Inventory and Long-Term Stock Price Performance

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Abstract

This paper estimates the long-run stock price effects of excess inventory using nearly 900 excess inventory announcements made by publicly traded firms during 1990-2002. It examines the stock price effects starting one year before through two years after the excess inventory announcement date. Statistically significant abnormal returns are observed during the year before the announcement and on announcement. There is no evidence of statistically significant abnormal return during the two years after the announcement. I estimate that the mean (median) abnormal return due to excess inventory during the year before the announcement and on announcement is -37.22% (-27.03%). Negative abnormal returns are observed across industries, calendar time, firm size, and actions taken to deal with excess inventory. The evidence suggests that the stock market partially anticipates excess inventory situations, firms do not recover quickly from the negative effect of excess inventory, and the negative effect of excess inventory is economically and statistically significant.

Key Words: Excess inventory, Empirical analysis, Abnormal stock returns

1. Introduction

Recently many practitioners and academicians have cited examples of firms suffering from excess inventory to discuss issues related to supply chain management (Fisher et al. 2000, Lakenana et al. 2001, Barnes-Schuster et al. 2002, Bellington et al. 2002, Chopra and Sodhi 2004, Narayanan and Raman 2004). Although excess inventory is likely to have a negative effect on firm performance, the literature provides little rigorous evidence of the magnitude and nature of these effects. Much of the evidence is anecdotal in nature and often based on a few well publicized examples. However, these examples may not necessarily be representative of a wide range of firms, and as a result, the performance implications of excess inventory are not clear. This lack of rigorous evidence is surprising given the central role of inventory management in operations management research and practice.

This paper provides empirical evidence of the effect of excess inventory on long-run stock price performance. The evidence is based on an analysis of nearly 900 excess inventory announcements made by publicly traded firms during 1990-2002. These announcements are a clear and unambiguous acknowledgement by a firm that it is suffering from excess inventory. Examples of such announcements include instances of production curtailment, temporary shutdowns, price markdowns and promotion to liquidate inventory, and inventory write-offs to deal with excess inventories. I estimate benchmark-adjusted stock price changes (abnormal returns) starting one year before and ending two years after the announcement of excess inventory. By focusing on long-run stock price effects I provide a more complete picture of the economic implications of excess inventory. Moreover, I shed light on the time pattern of stock price performance in terms of when the effect of excess inventory starts to show in stock prices, how long the effect lasts, and whether or not firms recover quickly from the negative effects of excess inventory. I also provide evidence of how the effect of excess inventory varies by whether the excess inventory is at the firm or at the firm's customers, actions taken to deal with excess inventory, industry, calendar time when excess inventory occurred, and firm size.

The evidence presented in this paper is important for a number of reasons. Excess inventory indicates a supply-demand mismatch. Although it is widely accepted that supply-demand mismatches

have a negative impact on performance (Raman 1997, Fisher 1997, Lee et al. 1997, Radjou 2002) objective evidence on the magnitude of the performance effects of supply-demand mismatches is just beginning to emerge. Hendricks and Singhal (2003, 2004, and 2005) analyze the stock price and profitability effects of production and shipment delays. They focus on supply-demand mismatches when supply is less than demand. When supply is more than demand, firms carry the burden of excess inventory. By documenting the effect of excess inventory on stock prices I add to the current body of evidence on the economic consequences of supply-demand mismatches. Furthermore, in matching supply with demand firms need to balance the risk of oversupply with the risk of shortages. The evidence in this paper along with that in Hendricks and Singhal (2003, 2004, and 2005) provides a basis for comparing the economic consequences of excess supply against supply shortfalls.

This paper also provides evidence on how the stock price performance of the upstream unit (for example a supplier) is affected when the downstream unit (for example, a retailer) has excess inventory. This evidence is important for a number of reasons. First, driven by the need to meet end-of-quarter sales targets or earnings expectations of analysts and investors, some firms practice "channel stuffing" or "trade loading" where the upstream unit attempts to stuff the downstream unit with inventory. While much has been written against these practices in the popular press, there is little empirical evidence on the negative performance effects of such practices on the upstream unit. Hence, upstream units may have little incentives to refrain from such practices. Second, poor forecasting ability of the downstream unit; lack of information sharing, coordination, and collaboration; inaccurate inventory records; misaligned incentives, and lack of trust among supply chain partners could lead to inventory buildup at the downstream unit. If inventory buildup negatively affects the performance of all supply chain partners, then supply chain partners have economic incentives to work collaboratively and cooperatively to avoid excess inventory. Finally, there is a large body of analytical research that has identified contracting mechanisms and policies that lead to more efficient sharing of risks between supply chain partners (see Cachon (2003) for a review of this work). Much of this research is based on single-period optimization models with one-to-one supply chain structures. Although this research offers many prescriptions and solutions for the

optimal sharing of risks, there is a dearth of empirical validation (Cachon 2003). The evidence in this paper may motivate researchers to consider alternate modeling frameworks that better reflect the dependencies among supply chain partners particularly when decisions have implications over multiple periods.

This paper also contributes to the empirical literature on the link between inventory and firm performance. Earlier work examines the relationship between Just-In-Time (JIT) implementation and financial performance (Huson and Nanda 1995, Balakrishnan et al. 1996, Lieberman and Demister 1999, Fullerton et al. 2003). Roumiantsev and Netessine (2005) and Gaur et al. (2005) identify drivers of inventory levels. Rajagopalan and Malhotra (2001), Chen et al. (2005) examine trends in inventory levels, and Cachon et al. (2005) examine whether the bullwhip effect really exists. Shin and Wood (2004) use industry level data to study the relationship between inventory turnover, information technology investment, and profitability. Chen et al. (2005) examine the relationship between inventory turnover and stock returns. They find that firms with high inventories relative to industry peers have poor long-run stock returns whereas firms with low inventories relative to industry peers have average stock returns. The evidence in this paper adds to the literature on the link between inventory and financial performance of firms.

The next section discusses the effect of excess inventory on cash flows and therefore stock prices. Section 3 describes the sample collection. Section 4 describes the methods used to estimate abnormal stock price performance. Section 5 presents the empirical evidence. Section 6 provides additional descriptive results. The final section summarizes the paper.

2. Excess inventory and the cash flows of the firm.

Excess inventory will adversely affect the net cash flows of the firm. On the cost side, most obvious are the cost of holding inventory, which include the capital cost (interest or opportunity) and the physical cost (storage costs, insurance, taxes, spoilage, losses etc.). The magnitude of other costs depends on the industry and the actions taken to deal with excess inventory. In industries where technology changes are rapid and product life cycles are short, component prices can drop rapidly. For firms with

excess inventories of components and parts in such industries, the drop in value is part of the cost of holding excess inventory. Similarly the cost of providing price protections and accepting product returns increases with excess inventory. Calloni et al. (2005) discuss various inventory-driven costs using a case study at Hewlett-Packard.

Firms can reduce inventory through curtailing production, temporarily shutting down facilities, inventory write-offs, and liquidations and/or markdowns. Curtailing production or temporarily shutting down facilities can increase the cost per unit as most of the fixed costs are still incurred. Curtailing production can cause unfavorable manufacturing variances because of under-absorbed overhead. In some situations firms might incur one-time costs for closing and restarting facilities. The cost of inventory write-offs is obvious – all the money tied up in inventory has little value and has to be scrapped or sold at bargain prices. In addition, inventory write-offs could involve additional costs for disposing of the inventory. If excess inventory results in liquidations and markdowns, profit margins are squeezed. Furthermore, liquidations or markdowns may involve additional marketing, distribution, and selling costs, all of which further depress margins. Overall excess inventory reduces revenues, increases costs, and reduces profitability.

There also are some indirect consequences of excess inventory that can affect stock prices. With excess inventory a firm may have limited pricing power, giving customers the upper hand. Excess inventory may limit the resources and funding avenues available to a firm, which may affect the firm's ability to respond to new business opportunities. Furthermore, a firm's ability to introduce new products may be hampered because of the need to clear the distribution channel of excess inventory. In addition, excess inventory can lead to incremental rather than radical innovations particularly if parts and components used to make the current products must be depleted before ordering new components.

Excess inventory may reflect poorly on the ability and competence of the firm's management team as well as on the effectiveness of the firm's supply chain processes. Excess inventory is an indication that some of the basic processes are not working smoothly. It can indicate lack of coordination and collaboration among supply chain partners as well as a lack of flexibility and agility to adjust to

sudden demand shifts. The inability to execute basic supply chain processes can negatively affect the reputation of the firm. It can also be damaging from the standpoint of investor confidence. Excess inventory can raise concerns about the quality of earnings by increasing the uncertainty about future earnings and their growth prospects. Investors may be skeptical about the firm's future prospects and may value the firm at a lower price-earnings ratio when compared to similar firms. Overall, excess inventory will have a negative effect on a firm's stock price.

3. Sample selection and description

Using a preliminary set of key words I collected a small sample of excess inventory announcements from different publications. I read these announcements to identify additional phrases and words that are commonly used to announce excess inventory and the proximity of the key words in the announcements. The final set of key words include inventory or inventories close to words such as obsolete, excess, glut, buildup, reduce, bloated, charge, write-off, write-down, liquidate, accumulate, or revalue. I used these key words to search and download the full text of all announcements that appeared in the Wall Street Journal and the Dow Jones News Service during 1990-2002. I read the full text of each announcement to judge whether the announcement should be included in the sample or not.

To be included in the sample, the announcement must be about a firm experiencing an excess inventory situation. In cases where the same news information is reported in several announcements, only the earliest announcement is included. This could happen when both the Wall Street Journal and the Dow Jones News Service carry the same news. Follow-up announcements of a specific excess inventory situation are excluded. An example is an earnings announcement that refers to an earlier excess inventory announcement. To be included in the sample, the firm mentioned in the announcement must have stock returns information on the Center for Research on Security Prices (CRSP) database. Based on the above criteria, the sample consists of 1022 announcements.

If the firm mentioned in an announcement made other excess inventory announcements during the three years after the announcement date of the first excess inventory announcement, then subsequent announcements are excluded from the final sample. This requirement is imposed to avoid overlapping

time periods. As discussed later, for each excess inventory announcement I examine the performance starting one year before through two years after the announcement date. Thus, including excess inventory announcements that occurred within three years of each other would cause overlapping time periods, with the performance during the overlapping period being counted more than once in the overall averages, which could potentially bias the results. 111 out of the 1022 the announcements are followed by another excess inventory announcement within three years of the first announcement. Excluding these announcements results in the final sample of 911 announcements. Examples of some announcements are:

"Jabil Circuits announces that customer inventory reductions will hurt for the next few quarters and that excess inventories with customers is going to reduce demand as OEMs correct inventory levels that they have in the channel" Dow Jones News Service, March 18, 1998.

"Champion International Corp said it plans to curtail production at two of its paper mills to reduce its office-paper inventory" Wall Street Journal, August 4, 1998.

"Eastman Kodak Co., said that it is cutting 15% to 20% of the prices of older formulations photographic film in a fourth-quarter promotion to liquidate inventory" Wall Street Journal, September 30, 1997.

"Intel said that the inventory write-down related to purchased components reduced net income by 6 to 8 cents a share in the latest fourth quarter" Dow Jones News Service, January 16, 1996.

The 911 announcements are from 829 distinct firms, 758 with a single announcement, and 71 firms with multiple announcements that are at least three years apart. The sample firms are in 183 different three-digit standard industrial classification (SIC) codes. Figure 1 presents the distribution of the market value of equity of the sample firms. The sample exhibits considerable dispersion in size with nearly 40% of the sample firms reporting market value of equity below $100 million and nearly 24% reporting above $1 billion. Table 1 gives the number of announcements by year. Nearly 17% of the announcements are made during 1990-1994, 47% during 1995-1998, and nearly 36% during 1999-2002.

Excess inventory announcements often provide information about who is holding the excess inventory, the actions taken to deal with excess inventory, and the reasons for excess inventory. Out of the 911 announcements, 261 announcements (29% of the sample) indicated that the customers of the

announcing firm have excess inventory. The remaining 650 announcements indicated that the announcing firm had excess inventory. 94 out of 911 announcements did not provide any information about the actions taken by the firm to deal with excess inventory. For the remaining announcements, 158 mentioned that customers are taking some actions to reduce inventory. Other major actions include charges against earnings in the form of inventory write-offs, write-downs, revaluation, adjustments, and reserves (534 announcements); production curtailment or temporary shutdown of plants (103 announcements); and liquidation of inventory through markdowns and promotions (76 announcements). 600 announcements (nearly 66% of the sample) did not give any reason for the buildup of excess inventory. Of the announcements that did give some reasons, the primary reasons are sluggish sales (134 announcements), obsolete and discontinued inventory (61 announcements), price declines (29 announcements), and discontinued products (23 announcements).

4.0 Methods for estimating abnormal returns

An abnormal return is the difference between the return on a stock and the return on an appropriate benchmark, where the benchmark is chosen to control for factors that can explain stock returns. The idea is that after controlling for these factors, whatever is unexplained is considered abnormal and can be attributed to the event under study. In this section I discuss the key details of the methodology for estimating abnormal returns including a) the choice of period over which abnormal returns are measured, b) the benchmark used to estimate abnormal returns, and c) the tests to judge the statistical significance of the abnormal returns.

4.1 Setting the time period for measuring abnormal returns

I estimate the abnormal returns before the announcement (pre-announcement period), on announcement, and after the announcement (post-announcement period). The reason for estimating abnormal returns during the pre-announcement period is that the market may partially anticipate the excess inventory situation, and hence may have incorporated part of the economic impact of excess inventories in stock prices before the announcement. Excess inventory situations could be partially anticipated by observing the inventory levels of the firm and its supply chain partners, discussion with a

firm's suppliers and customers, press releases, articles in business press, research reports from analysts, analysis of past decisions and actions taken by the firm, and various industry and macro-economic data. A review of excess inventory announcements suggests that most announcements refer to the fact that the firm is already suffering from excess inventory. Furthermore, such announcements are sometime made as part of earnings pre-announcements or announcements, suggesting that firms typically delay the release of information about excess inventory. Since partial anticipation is probable, an issue is choosing the period before the announcement to capture the effect of partial anticipation. The existing literature provides little guidance on this issue. Following the discussion in Hendricks and Singhal (2005), I examine the stock price performance starting one year before the excess inventory announcement.

The actual announcement removes any uncertainty about whether the firm has excess inventory. The announcement can also provide additional details that can help the stock market revise its assessment of the economic impact of the excess inventory relative to what the market has anticipated and incorporated into the share valuation during the pre-announcement period. Hence, it is important to estimate the abnormal returns on the announcement date. Consistent with the approach used in most event studies, I use a two-day announcement period to account for the possibility that information about excess inventory could have been publicly released the day before the publication date of the announcement.

To get a full estimate of the economic impact of the excess inventory situation, it is also important to examine the stock price performance during the post-announcement period as recent research has documented statistically significant long-run stock price effects subsequent to event announcements (see Fama (1998) for a summary of this evidence). This body of research suggests delayed stock market reaction to new information, which in itself is a sufficient reason for examining the post-announcement stock-price effects of firms that have announced excess inventory. However, in the case of excess inventory another reason for examining the stock price performance in the post-announcement period is that excess inventory may continue to negatively affect performance even after the announcement as customers and suppliers react to the situation. Since such effects should be part of any attempt to estimate

the full economic impact of excess inventory, I examine the stock price performance during the post-announcement period. There is little guidance in the literature on the appropriate period for examining post-announcement performance. As in Hendricks and Singhal (2005), I examine the stock price performance during the two years after the announcement. Overall, I examine the stock price performance for the three year period starting one year before through two years after the excess inventory announcement.

4.2 Estimating abnormal returns

I estimate buy-and-hold abnormal returns (BHARs) using daily return data. To compute BHARs the raw returns of the sample firm and its benchmark are first compounded across the period of interest. The abnormal return is then the difference between the compounded returns of the sample firm and its benchmark. More specifically, BHARs are calculated as

$$BHAR_i = \prod_{t=1}^{T}(1 + R_{it}) - \prod_{t=1}^{T}(1 + R_{bt}),$$

where $BHAR_i$ is the buy-and-hold abnormal return for stock i, R_{it} is the rate of return for stock i on day t, R_{bt} is the rate of return for the benchmark for stock i, and T is the number of days in the period of interest.

There is considerable debate in the literature on the appropriate methodology for computing long-run abnormal returns (Lyon et al. 1999, Fama 1998, Barber and Lyon 1997, Kothari and Warner 1997), and the factors that should be controlled for (Fama and French 1996, Cahart 1997, Jegadeesh and Titman 1993). Matching portfolios with bootstrapping and one-to-one matching are two approaches that are currently being used in the literature. Since I use both these approaches in my analysis, I briefly describe each below.

4.3 Matched portfolios with bootstrapping

The matched portfolio method is an elaborate procedure where every month all firms on CRSP are assigned to one of nearly 200 portfolios formed on the basis of size (measured by the market value of equity), ratio of market value of equity to book value of equity (a proxy for growth opportunities), and prior performance. Each sample firm is assigned to an appropriate portfolio based on its announcement

month, and the remaining firms in that portfolio serve as benchmarks for the sample firm. The abnormal return is the difference between the return on the sample firm and the average return on the remaining firms in the sample firm's portfolio. By basing statistical inferences using bootstrapping techniques, the portfolio approach avoids the possible misspecification of traditional parametric test statistics due to cross-sectional dependencies because of overlapping time periods among sample firms that usually exist in long-run stock price studies. Lyon et al. (1999) and Hendricks and Singhal (2005), among others, provide details of implementing this approach.

The matched portfolio approach has a number of limitations. First, it has data requirements which can prevent sample firms from being included in the analysis. For example, sample firms are excluded if they have negative book value of equity or if they do not have sufficient returns to compute prior performance. Furthermore, book value of sample firms may be missing in COMPUSTAT, the primary source of this data. In fact, I lose nearly 22% of the sample firms because of the data needed for the matched portfolio approach. Second, the matched portfolio approach can result in positively skewed long-run abnormal returns (Cowan and Sergeant (2001)), which can inflate the mean abnormal returns and result in biased test statistics. This happens because long-run buy-and-hold returns of individual stocks show substantial positive skewness, while long-run buy-and-hold returns of portfolios are less skewed since they represent averages of many stocks. Third, since the distribution of BHARs in the portfolio approach is not symmetric under the null hypothesis, non-parametric tests such as the Wilcoxon signed-rank test cannot be used to test the statistical significance of abnormal returns. Finally, the portfolio approach does not require any type of control for industry. While this may not be important in many studies, it is important in this study as some of the sample firms attribute excess inventory to sluggish or slow demand. Sluggish sales are likely to lead to lower stock prices irrespective of whether it results in excess inventory or not. For example, a firm operating on JIT basis or build-to-order mode will also experience the negative effects of sluggish sales. To the extent that sluggish sales is an industry-wide phenomena, controlling for industry can help separate the effect of excess inventory from sluggish sales.

4.4 One-to-one matching

The one-to-one matching approach is simpler than the matched portfolio approach and less stringent in terms of data requirement. In this approach, each sample firm is matched to one benchmark firm. Generally, the characteristics used for matching are firm size and industry (SIC Codes). Industry matching controls for the effect of industry wide factors on stock price performance. Since firms in the same industry are likely to experience similar prior performance and growth opportunities, matching on industry may to some extent control for the additional factors used in the portfolio approach. Speiss and Affleck-Graves (1995) and Hendricks and Singhal (2001) among others, use the one-to-one matching with size and industry as control factors.

A limitation of the one-to-one matching approach is that the traditional parametric tests statistics may be biased because of the positive cross-sectional dependency that exists due to overlapping time periods among sample firms that usually exists in long-run stock price studies. Ignoring this dependency may lead to too many rejections of the true null hypothesis. On the other hand, under the null hypothesis of zero abnormal returns, the one-to-one matching does not have positively skewed long-run abnormal returns as is the case with portfolio matching approach. Furthermore, since the distribution of BHARs in the one-to-one matching is symmetric under the null hypothesis, non-parametric tests such as the Wilcoxon signed-rank test can be used to test the statistical significance of abnormal returns. Finally, because the data requirement is less stringent than the matched portfolio approach, fewer sample firms are excluded from the analyses.

Both approaches of estimating abnormal returns have their own strengths and weaknesses. I report most of my results using the one-to-one matching approach as I lose very few sample points (less than 2%) when compared to the portfolio matching approach where I lose nearly 22% of my sample points. However, as a sensitivity analysis, I also estimate the results using the portfolio matching approach. The results from both approaches are very similar.

4.5 Testing the statistical significance of abnormal returns

I report the mean and median abnormal returns as well the percent of sample firms with negative abnormal returns. I use the standard t-test (Wilcoxon sign rank test) to test whether the mean (median)

abnormal return is significantly different from zero, and the binomial sign test to test whether the percent of sample firms with negative abnormal returns is significantly different from 50%. Consistency between the parametric t-test and non-parametric tests (Wilcoxon sign rank and the binomial sign tests) would indicate that outliers are not driving the results. I measure the significance of results conservatively by reporting two-tailed tests of significance.

To pool observations across time, for each firm in the sample, I translate calendar time to event time as follows. The announcement date is day 0 in event time, the next trading date is day 1, and trading day preceding the announcement day is day -1, and so on. A year typically has 250 trading days. The pre-announcement period spans days -251 to -2, the announcement period spans day-1 and 0, and the first (second) year after the announcement spans days 1 to 250 (days 251 to 500).

5.0 The long-run stock price effects

5.1 Results using one-to-one matching

Table 2 presents the abnormal return using the one-to-one matching approach. To generate this matching, for each sample firm I first identify all firms with at least the same two-digit SIC code as the sample firm. From this set of firms I choose the firm that is closest to the sample firm on size (measured by the market value of equity at the end of the calendar year in which the announcement is made), with the constraint that the sample and matched firms are within a size factor of 10. I also require that the matching firm has data at least over the same period as that used to compute the buy-and-hold returns for a sample firm.

I matched 895 out of the 911 (nearly 98%) sample firms. 16 sample firms are not matched because 14 firms did not have size information (stopped trading for various reasons or stock return data is missing) and 2 sample firms did not have matching firms that met the size and SIC code matching requirements. The mean (median) market value of the sample firms is $3.09 billion ($171.8 million), very close to $3.40 billion ($171.0 million), the mean (median) of the matched firms. Nearly 18% of the

sample firms are matched at the four-digit SIC level, 15% at the three-digit level, and 67% at the two-digit level.

Table 2 shows that during the year before the excess inventory announcement (days -251 to -2, column 2), sample firms fared poorly relative to the matched firms. The mean abnormal return is -32.42%, significantly different from zero (p-value $\leq$ 0.01). Outliers are not driving the negative mean abnormal returns in the year before the announcement. The median abnormal return is -23.76%, significantly different from zero (p-value $\leq$ 0.01). Of the 895 sample firms, nearly 68% of the sample firms have negative abnormal return. If for a given sample firm the probability of its abnormal return being negative equals 0.5, then the probability of observing nearly 68% or more negative abnormal returns out of a sample of 895 is less than 1%.

The abnormal returns during the announcement period (days -1 and 0, column 3) are negative and statistically significant. The mean (median) abnormal return is -6.09% (-4.27%), significantly different from zero (p-value $\leq$ 0.01). Nearly 67% of the sample experience negative abnormal returns, significantly different from 50% (p-value $\leq$ 0.01). The stock market reaction during the announcement period indicates that even though excess inventory situations are partially anticipated, actual announcements still convey additional information that affects the market's assessment of the economic consequences of excess inventory. Starting a year before the announcement to the announcement day (days -251 to 0, column 4), the mean (median) abnormal return is -37.22% (-27.03%), significantly different from zero (p-value $\leq$ 0.01), and nearly 71% of the sample experience negative abnormal returns, significantly different from 50% (p-value $\leq$ 0.01).

The post-announcement stock price behavior is very different from that observed during the pre-announcement and announcement periods. The mean and median abnormal returns in the first and second year after announcements (columns 5 and 6, respectively) are insignificantly different from zero. Although the mean and median abnormal returns in the two-year post-announcement period (days 1 to 500, column 7) are negative (-6.78% and -2.31%, respectively), they are insignificantly different from zero. 51.85% of sample firms experienced negative abnormal returns in the two-year post-announcement

period, which is insignificantly different from 50%. Basically, there is no abnormal performance in the post-announcement period. More importantly, the results of the post-announcement period show that firms do not recover (no evidence of positive abnormal returns) from the negative abnormal stock price performance that they experienced in the pre-announcement and announcement periods.

Given the different patterns of abnormal returns during the pre-announcement, announcement, and post-announcement periods, one must be careful in making conclusions about the overall effect of excess inventory on stock prices. The pre-announcement and announcement periods (days -251 to 0) mean abnormal return is -37.22%. When the post-announcement period is also included (days -251 to 500, column 8), the abnormal return over the three year period is -56.51%, nearly 19 percent points more negative than that observed for the pre-announcement and announcement periods together. This may appear odd because the abnormal returns in the post-announcement are not that different from zero, and one would expect that including this period should not have much affect on the overall abnormal returns. The reason that abnormal returns increase in magnitude with the inclusion of the post-announcement period is that buy-and-hold abnormal returns can grow with time due to compounding even when there is no abnormal return after the initial period (Fama (1998)), a pattern that is observed in this paper. Hence, one must be careful in making inferences about the overall economic impact of an event. In my view it is more appropriate to use the abnormal returns during the pre-announcement and announcement periods as an estimate of the overall impact of excess inventory.

To ensure that the results of the pre-announcement periods itself are not driven by the growth in abnormal return with the time period bias mentioned above, I estimate abnormal returns over various six-month intervals. Over the period that begins 12 months before and ends 6 month before the announcement (days -251 to -127) the mean (median) abnormal return is -9.79% (-8.61%), significantly different from zero (p-value $\leq$ 0.01). In the six month period before the announcement (days -126 to -2) the mean (median) abnormal return is -22.28% (-18.70%), significantly different from zero, (p-value $\leq$ 0.01). I also estimate the abnormal return during the period that begins 18 months before and ends 12 month before the announcement, and find that the abnormal returns are insignificantly different from

zero. The abnormal returns in each of the four six-month periods in the post-announcement period are insignificantly different from zero.

5.2 Discussion

Abnormal returns are concentrated in the pre-announcement and the announcement periods. Partial anticipation is not surprising as there are leading indicators of excess inventories that can lead the market to partially anticipate excess inventories. Partial anticipation has been documented in many studies (see Alciatore et al. 1998, Fama 1998) and is observed in recent research on supply shortfalls by Hendricks and Singhal (2005). Depending on the nature of the announcement, these studies have observed partial anticipation starting anywhere from 6 to 24 months before the announcement date. I briefly compare the results of Hendricks and Singhal (2005) with the results of this paper.

In both cases, the market partially anticipates supply-demand mismatches, although the mean abnormal return is higher in magnitude in the case of excess inventory (-32.42%) as compared to supply shortfalls (-13.68%). Announcements of supply-demand mismatches provide additional information as evident by the market reaction during the announcement period of -6.09% for excess inventory versus -7.17% for supply shortfalls. There is no statistically significant reaction after the announcement of excess inventory. However, the market continues to react negatively after the announcement of supply shortfalls (abnormal return is -10.45% in the first year after the announcement). Although the pattern of stock price behavior is somewhat different for excess supply and supply shortfall situations, in both cases firms that experience supply-demand mismatches underperform their benchmarks on average by more than 30% over a three-year period.

One could raise the issue that for some sample points underperformance may be due to some systematic industry factors such as sluggish demand or competitive threats. While such factors do influence stock prices, I have attempted to control for this by matching on industry. Furthermore, different firms have different abilities to react to changes in demand and the environment. A less agile and less flexible firm may not be able to react to changes quickly and thus could end up with excess inventory, thereby faring worse than a more agile and flexible firms. Similarly a firm operating on a JIT

mode or build-to-order model or with lower lead times may be able to deal with sluggish demand without excess inventory. To shed more light on this issue, I estimate the abnormal returns for the set of firms that mention sluggish sales as the reason for excess inventory. The mean (median) abnormal return for the pre-announcement to announcement period (days -215 to 0) for 128 such announcements is -37.62% (-27.16%), very similar to the mean (median) abnormal return for the full sample.

Finally, it is important to note that even if one focuses only on the announcement period abnormal return, a mean abnormal return of -6.09% is on the high end in terms of the magnitude of abnormal returns when compared to those observed in many other corporate announcements (Hendricks and Singhal (2003), Table 4, page 512). However one looks at the evidence, the basic conclusion is that the stock price underperformance in the face of excessive inventory is economically and statistically significant.

Given the observed pattern of abnormal returns, I simplify the reporting of subsequent results by reporting results for the pre-announcement period (days -251 to -2), announcement period (-1 to 0), pre-announcement to announcement period (days -251 to 0), and post-announcement period (days 1 to 500). I do not report the results of the three-year period that includes the pre-announcement, announcement, and post-announcement periods, as this just amplifies the magnitude of abnormal returns due to compounding and can give wrong impressions of the overall impact.

5.3 Sensitivity analyses to corroborate the evidence presented in Table 2

I examine the sensitivity of the results in three different ways. First, I use the following alternate matching criteria:

1. At least a two-digit SIC code match with a size factor of 5. This allows the matching on size to be tighter. I matched 893 firms.

2. At least a three-digit SIC code match with a size factor of 10. This allows for closer matches on SIC codes. I matched 866 firms.

3. At least a four-digit SIC code match with a size factor of 10. This allows for closer matches on SIC codes. I matched 742 firms. The reason only 80% of the sample firms are matched is that in large samples it is often hard to achieve four-digit SIC code matches for all sample firms.

The results from the above three methods (available on request from the author) are very similar to that reported in Table 2.

Second, I examine whether survivorship bias, initial public offerings (IPOs) bias, and simultaneous earning announcement bias are driving the results of Table 2.

Survivorship bias: In computing the results of Table 2, no constraints are imposed on the amount of data availability during the period of interest. If the sample firm has any data over a particular period of interest, its abnormal return is computed using all available data. Thus, the abnormal return of a firm computed using 20 days of data gets the same weight as that of a firm whose abnormal return is computed using 250 days of data. This raises the possibility that firms with insufficient data, and/or the firms that did not survive, may be driving the results. To explore this issue further, I estimate abnormal returns of firms that had complete data over three year period that is from day -251 to 500 (752 days). 75% of the sample firms had full data. Panel A of Table 3 gives the results for this subsample.

Initial public offerings (IPOs) bias: Ritter (1991) and Loughran and Ritter (1995), among others, have documented that IPOs stocks underperform their benchmarks during their first three years of trading. Given that firms with excess inventory significantly underperform their benchmark in the year before the excess inventory announcement, I test whether the underperformance in my sample is driven by the fact that many of my sample firms went through an IPO a few years before the announcement. To test this I create a subsample of sample firms that is unlikely to have an IPO bias by identifying firms that have been trading at least for four years before the excess inventory announcement. 640 out of the 911 firms (70% of sample) met this criterion. Panel B of Table 3 gives the results for this subsample.

Simultaneous earnings announcement bias: Nearly 42% of the excess inventory announcements are accompanied by simultaneous earnings announcements. There is an extensive body of literature that documents post-earnings announcement drift (Ball and Brown 1968, Bernard and Thomas 1990). These

studies document that the market's adjustment to bad news takes several months. This suggests market underreaction and subsequent gradual adjustment to the information in earning announcements. To remove the effect of post-earnings announcement drift, I estimate the abnormal returns for excess inventory announcements without simultaneous earnings announcements (Panel C of Table 3).

The results in all three panels of Table 3 are very similar to that of Table 2. I observe statistically significant abnormal returns during pre-announcement and announcement periods, and statistically insignificant abnormal returns in the post-announcement period. The magnitude of abnormal returns during the pre-announcement to announcement period is similar to that of Table 2.

Finally, I examine the sensitivity of the results using alternate methods of estimating abnormal returns. Recall that I discussed the matched portfolio method using firm size, market-to-book value of equity, and prior performance as a basis of forming benchmark portfolios. Prior performance is based on the stock returns starting 24 months before and ending 12 months before announcement (day -501 to -252). That is I match sample firms to firms that had similar stock price performance during the second year before the excess inventory announcement. Panel A of Table 4 describes the results of the matched portfolio method using the approach outlined in Hendricks and Singhal (2005). Note that the results are based on a sample of 711 out of the 911 firms. Thus, I lose nearly 22% of my sample because the matched portfolio method requires that firms have sufficient prior data to compute prior performance, data on book value of equity that can be missing in COMPUSTAT, and that the book value of equity must be positive.

Since non-parametric tests are not well specified in the matched portfolio method, I use a modified one-to-one matching approach on the matched portfolio method. In the matched portfolio method, all firms in a portfolio are similar in size, prior performance, and market-to-book value of equity. For each sample firm, I chose from its portfolio the firm that is closest to it in terms of prior performance. I repeat the process but now chose as benchmark the firm that is closest to the sample firm on market-to-book value of equity. Thus, I create two one-to-one matched samples, which are well matched on size,

prior performance, and market-to-book value of equity. These results are presented in Panels B and C of Table 4.

The results in all three panels of Table 4 are very similar to that of Table 2. Matching on prior performance is an important sensitivity analysis as it shows that prior performance biases (good or bad) are not driving the results of Table 2. By matching on prior performance I compare sample firms to firms that had similar performance prior to the pre-announcement period. I observe statistically significant abnormal returns during the pre-announcement and the announcement periods, and statistically insignificant abnormal returns in the post-announcement period. Overall, the results in Table 2 are robust to alternate matching criteria, potential adjustment of possible sample biases, and alternate methods of estimating abnormal returns.

6.0 Descriptive results

This section provides descriptive results on how the effect of excess inventory varies by who holds the excess inventory (the announcing firm itself or the announcing firm's customers), actions taken to deal with excess inventory, industry, calendar time when excess inventory occurred, and firm size. Although I present results for four different periods, I will mainly highlight the results during the pre-announcement to announcement period (days -251 to 0).

Many announcements indicate that the announcing firm has excess inventory whereas others indicate that the customers of the announcing firms have excess inventory. Table 5 reports abnormal returns for these two subsamples of announcements. When excess inventory is held at the announcing firm (Panel A), the mean (median) abnormal return during the pre-announcement to announcement period (days -251 to 0, column 4) is -34.06% (-22.53%), significantly different from zero (p-value $\leq$ 0.01). When excess inventory is at the announcing firm's customers (Panel B), the mean (median) abnormal return is -44.97% (-30.34%), significantly different from zero (p-value $\leq$ 0.01). Although the mean abnormal return is more negative when customers hold excess inventory as compared to when the announcing firm has excess inventory, the difference in mean is not statistically significant (t-value = 1.29). Note that although the post-announcement period mean abnormal return in Panel B is -29.42%, it

is not statistically significant. Furthermore, the non-parametric tests for the post-announcement period are statistically insignificant, suggesting that the mean abnormal return of -29.42% is probably driven by a few outliers.

Channel stuffing by upstream units; inaccurate forecasting by customers, over-ordering by customers, optimistic demand projections by customers, inventory buildup to hedge against future shortages and price increases, and lack of information sharing among supply chain partners could be some reasons why customers have excess inventory. A key implication from the results of Table 5 is that firms can pay a steep price even if excess inventory buildup is in other parts of the supply chain. Such negative economic impacts should provide an incentive for various supply chain partners to collaborate and co-operate to avoid excess inventory in supply chains and refrain from practices that cause inventory buildups.

Table 6 presents results by different actions taken to deal with excess inventory. These results are based on only those announcements where a particular action is the only action taken by the firm. For example, if a firm curtails production and uses markdowns to reduce inventory, this announcement is not included in the results of Table 6.

More than half the sample firms dealt with excess inventory by charges against earnings in the form of write-offs, write-downs, revaluation, and reserves to deal with excess inventories. I group these together and call it the inventory write-offs subsample. For this subsample, the mean (median) abnormal return during the pre-announcement to announcement period (days -251 to 0, column 4) is -33.49% (-26.04%), significantly different from zero (p-value $\leq$ 0.01). Some announcements that mention inventory write-offs also mention write-offs of other assets. To ensure that the inventory write-offs results are not driven by these types of announcements I compute inventory write-offs as a percent of total write-offs. I could not compute this for 278 announcements as information about the amount of inventory write-offs or total write-offs or both is not indicated in the announcement. For the 220 announcements where this information is available, inventory write-offs as a percent of total write-offs averaged 81%. The mean (median) abnormal return for announcements where inventory write-offs as a percent of total

write-offs are greater than 50% (190 announcements) is -37.13% (-28.40%), significantly different from zero (p-value ≤ 0.01). When the sample is restricted to those announcements where inventory write-offs equals the total write-offs (143 announcements), the mean (median) abnormal return is -36.10% (-29.37%), significantly different from zero (p-value ≤ 0.01).

Much of the research that has analyzed the association between stock prices and write-offs has examined write-offs of long-lived assets (Alciatore et al. (1998) provides a comprehensive review of this evidence). An exception is Francis et al. (1996) who analyze the effect of discretionary write-offs announced during 1989-1992 and identify a subsample of announcements that had inventory write-offs. They focus on short-term stock market reaction (day -1 and day 0), and find that the stock market reaction is negative for inventory write-offs. Studies that have examined the stock price behavior before the announcements of write-offs of long-lived assets report negative abnormal returns before write-off announcements, suggesting that the stock market partially anticipates write-offs. This is consistent with what I document in the case of inventory write-offs. Furthermore, some studies report negative abnormal return after the announcement of write-offs of long-lived assets (Elliot and Shaw 1988, Bartov et al. 1998). This pattern of stock price behavior is not observed for inventory write-offs.

Some have argued that inventory write-offs may be used as a mechanism to manipulate earnings by making future earnings looks more favorable in comparison to the earnings in the year of inventory write-offs (Thurm and Weil 2001, Drucker 2002). While addressing such incentive issues is beyond the scope of this paper, I note that the abnormal returns in the post-announcement period are insignificantly different from zero, suggesting that earnings manipulation, if any, does not influence the market. An alternative explanation is that earnings manipulation using inventory write-offs may not be that widespread.

In the case of actions taken by customers, the mean (median) abnormal return during pre-announcement to announcement period (days -251 to 0, column 4) is -46.68% (-26.51%), significantly different from zero (p-value ≤ 0.01). When the announcing firm indicates that it is going to curtail production or temporarily shut down plants to draw down inventories, the mean (median) abnormal return

is -27.34% (-23.39%), significantly different from zero (p-value ≤ 0.01). The mean (median) abnormal return for firms using markdowns to reduce inventories is -74.89% (-50.01%). Since the size of the markdown subsample is very small, these results must be interpreted very cautiously. Although the mean abnormal returns for the various subsamples reported in Table 6 are different, pair-wise comparisons show that the difference in means between the inventory write-offs, customer reduction of inventory, and production curtailment subsamples are not significantly different from each other.

I next report the effect of excess inventory for different industry groups. Based on the primary SIC code of the sample firms, I assigned the sample firms to one of eight broadly defined industry groups. Table 7 presents results for four of the eight industry groups, those with at least 30 observations:

Process Industry - primary SIC codes between 2000-2999 (food, tobacco, textiles, lumber, wood, furniture, paper, and chemicals)

Batch Manufacturing – primary SIC codes between 3000-3569 or 3580-3659 or 3800-3999 (rubber, leather, stone, metals, machinery, equipment, other)

High Technology – primary SIC codes between 3570-3579, 3660-3699 or 3760-3789 (computers, electronics, communications, defense)

Wholesale and retailing - primary SIC codes between 5000-5999.

The mean (median) abnormal returns during the pre-announcement to announcement period (days -251 to 0, column 4) are negative across all four industry groups and significantly different from zero (p-value ≤ 0.01). The abnormal returns are more negative for the high technology and the wholesale and retailing sector when compared to the process industry and batch manufacturing sectors. There is some weak evidence to suggest that the negative stock price performance in the wholesale and retailing sector continues after the announcements of excess inventory. Pair-wise multiple comparisons for the four industry groups show that the high technology as well as the wholesale and retailing sectors have significantly more negative mean abnormal returns than the process and batch manufacturing sectors.

It is plausible that the abnormal returns that I estimate are mainly driven by announcements during certain periods. For example, much has been written about the recent meltdown in high

technology industries and the excess inventory woes of firms in the telecommunication and electronics industry. To explore this issue further, I estimate abnormal returns separately for three distinct periods. Table 8 presents these results. Note that 1990-1994 includes some years where the US economy was in a recession, 1995-1998 was generally a high growth period for the US economy, and 1998-2002 spans the meltdown of the high technology sector and generally was a period where the US economy grew very slowly or perhaps even contracted. The results indicate that the mean (median) abnormal returns during the pre-announcement to announcement period (days -251 to 0, column 4) are negative across all three periods and significantly different from zero (p-value $\leq$ 0.01). Interestingly, the pair-wise multiple comparisons show that the mean abnormal normal return of -43.83% during 1995-1998 (the high economic growth period) is significantly more negative than -30.15% during 1999-2002 (the low economic growth period). This should alleviate any concerns that the abnormal returns from excess inventory are driven by time periods where demand is sluggish.

Finally, I examine whether firm size has any affect on abnormal returns. Table 9 presents abnormal returns by size quartiles formed on the basis of the market value of equity. The mean (median) abnormal returns during the pre-announcement to announcement period (days -251 to 0) are negative across all size quartiles and significantly different from zero (p-value $\leq$ 0.01). It seems that during this period the abnormal returns for the 2nd and 3rd quartile are higher than the other two quartiles. Also note that in the case of the first quartile (the smallest firms), the post-announcement abnormal returns are negative and statistically significant.

7.0 Summary

Based on an analysis of more than 900 excess inventory announcements made by publicly traded firms during 1990-2002, I document that firms that experience excess inventory situations substantially underperform a sample of matched firms from the same industry and of similar size. I estimate that the mean (median) abnormal return due to excess inventory is -37.22% (-27.03%). During the year before the excess inventory announcement the mean (median) abnormal return is -32.42% (-24.76%). The mean (median) abnormal return on announcement is -6.09% (-4.27%). There is no evidence of abnormal

performance during the two years after the announcement, indicating that the firms do not recover quickly from the negative effects of excess inventory. The negative abnormal returns persist under alternate methods of estimating abnormal returns. Furthermore, negative abnormal returns are observed across industries, calendar time, firm size, and actions taken to deal with excess inventory.

The evidence presented in this paper has a number of important implications. First, it highlights the need for firms to be fully aware of what is happening in their supply chain. The evidence indicates that even when the inventory buildup is at a downstream unit (customers), the upstream unit (supplier) pays a steep cost for this buildup in terms of poor share price performance. This suggests the need for visibility into the internal operations of supply chain partners, so that inventory buildups can be avoided or dealt with earlier rather than later. Second, if the need to meet quarterly earnings targets results in "channel or trade stuffing", then one must keep in mind that such practices can lead to inventory buildups at the customer, with resulting negative economic consequences for the upstream units. Essentially, with "channel or trade stuffing", a firm may report better profits for the near-term, which may raise Wall Street's expectations about future earnings. However, inventory buildups at customers will ultimately require corrective actions and prevent firms from meeting these expectations, leading in turn to erosion in share price. Third, excess inventory is an indication of demand-supply mismatches. Many experts have argued that the probability of such mismatches can be significantly reduced if supply chain partners work collaboratively and cooperatively, share information with each other, and build relationships based on trust. Others have expressed frustration with the slow pace of adoption of these practices. The economic consequences of excess inventory could be a catalyst in bringing about the desired behavioral changes. Finally, the evidence underscores the importance of accurate forecasting and lower lead times as poor performance on these dimensions can lead to excess inventory.

There are a number of directions for future research. It could be useful to build an understanding of some of the underlying drivers of excess inventory and whether the negative effect of excess inventory varies by these drivers. It would also be useful to gain a deeper understanding of the operating and organizational characteristics of firms that have excess inventory situations. While many of the

traditional operations management frameworks might be useful to study this issue, it may be interesting to see to what extent managers' incentives to manipulate short-term earnings causes excess inventory. Finally, given the stock-price underperformance, it would be critical to examine whether the firms with excess inventory suffer from poor operating performance. This would provide additional evidence to corroborate the stock price underperformance that I have documented. It might also be useful to see whether analysts revise their forecasts and recommendations in anticipation of an excess inventory situation.

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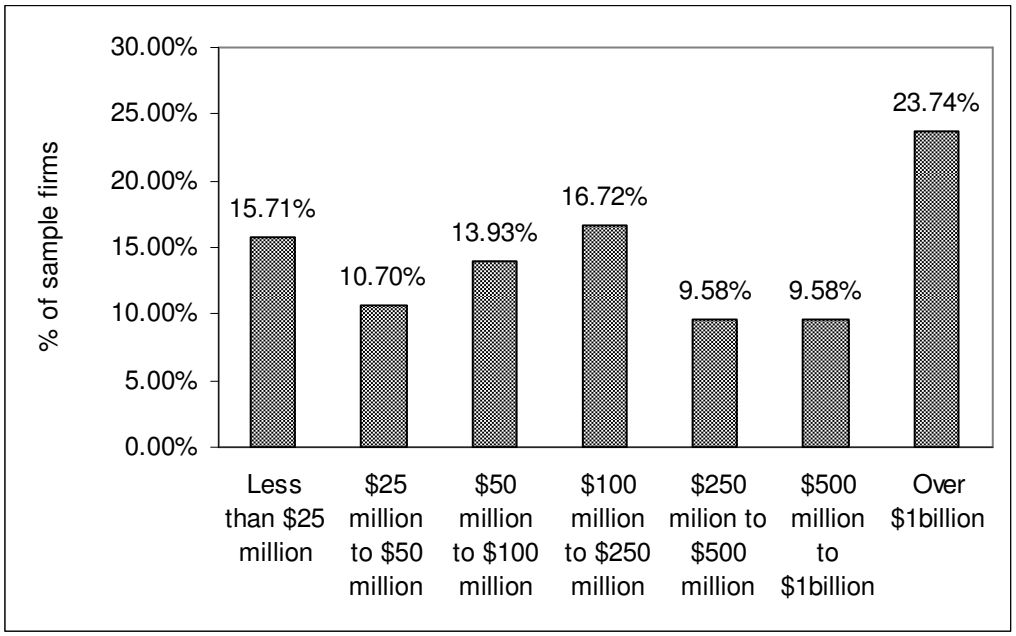

Figure 1: Distribution of the market value of equity of sample firms at the end of the announcement year.

Table 1: Distribution of the announcement year for the 911 announcements of excess inventory.

Year	Number of Announcements	% of Announcements
1990	36	3.95%
1991	19	2.08%
1992	20	2.19%
1993	32	3.51%
1994	50	5.48%
1995	76	8.34%
1996	136	14.92%
1997	82	9.00%
1998	138	15.14%
1999	106	11.63%
2000	66	7.24%
2001	117	12.84%
2002	33	3.62%
1990-2002	911	100.00%

Table 2: Buy-and-hold abnormal returns of firms that have announced excess inventory. Abnormal returns are computed using one-to-one-matching where each sample firm is matched to a firm with at least a two-digit SIC code match that is closest in size as measured by the market value of equity to the sample firm, with the constraint that the sample and matched firms sizes are within a factor of 10. Abnormal performance is calculated as the difference between the buy-and-hold return for the sample firm and the matched firm.

	Time Period						
Performance Statistics (1)	Year before announcement (days -251 to -2) (2)	Announcement period (days -1 to 0) (3)	Year before announcement through announcement period (days -251 to 0) (4)	1st year after announcement (days 1 to 250) (5)	2nd year after announcement (days 251 to 500) (6)	1st and 2nd year after announcement (days 1 to 500) (7)	Year before announcement through two years after announcement (days -251 to 500) (8)
Number of observations	895	893	895	893	829	893	895
Mean abnormal return (%)	-32.42%	-6.09%	-37.22%	-2.78%	2.85%	-6.78%	-56.51%
t-statistics	-10.94 a	-13.03 a	-12.09 a	-0.70	0.59	-0.86	-6.16 a
Median abnormal return (%)	-23.76%	-4.27%	-27.03%	-1.75%	-2.38%	-2.31%	-27.48%
Wilcoxon-signed rank Z-statistic	-13.28 a	-12.60 a	-15.10 a	-0.73	-0.62	-0.93	-9.90 a
% of sample firms with negative abnormal returns	68.27%	67.19%	71.84%	50.94%	51.51%	51.85%	65.14%
Sign test Z-Statistic	-10.93 a	-10.27 a	-13.04 a	-0.59	-0.92	-1.19	-9.05 a

a denotes significantly different from zero (50% in the case of % of sample firms with negative abnormal returns) at the 1% for two-tailed tests.

Table 3: Buy-and-hold abnormal returns of subsamples of firms with no survivorship bias (Panel A), no initial public offerings bias (Panel B), and no simultaneous earnings announcement bias (Panel C). Abnormal returns are computed using one-to-one-matching where each sample firm is matched to a firm with at least a two-digit SIC code match that is closest in size as measured by the market value of equity to the sample firm, with the constraint that the sample and matched firms sizes are within a factor of 10. Abnormal performance is calculated as the difference between the buy-and-hold return for the sample firm and the matched firm.

	Time Period			
Performance Statistics	Year before announcement (days -251 to -2)	Announcement period (days -1 to 0)	Year before announcement through announcement period (days -251 to 0)	1st and 2nd year after announcement (days 1 to 500)
(1)	(2)	(3)	(4)	(5)
Panel A: Subsample of firms with no survivorship bias				
Number of observations	679	679	679	679
Mean abnormal return (%)	-32.64% (-9.06) a	-4.75% (-10.12) a	-36.77% (-9.81) a	-3.48% (-0.41)
Median abnormal return (%)	-23.76% (-11.55) a	-3.44% (-9.79) a	-27.21% (-12.98) a	-1.91% (-0.52)
% of sample firms with negative abnormal returns	67.90% (-9.32) a	65.25% (-7.95) a	70.70% (-10.79) a	51.55% (-0.81)
Panel B: Subsample of firms that have no intial public offereings bias				
Number of observations	640	640	640	640
Mean abnormal return (%)	-29.17% (-10.84) a	-4.99% (-9.67) a	-33.21% (-12.04) a	-10.68% (-1.25)
Median abnormal return (%)	-22.42% (-10.72) a	-3.10% (-9.39) a	-25.11% (-12.04) a	1.11% (-0.13)
% of sample firms with negative abnormal returns	66.25% (-8.22) a	65.16% (-7.67) a	69.69% (-9.96) a	49.69% (-0.16)
Panel C: Subsample of firms with no simultaneous earnings announcements bias				
Number of observations	514	514	514	514
Mean abnormal return (%)	-30.91% (-10.30) a	-8.08% (-12.87) a	-36.81% (-12.24) a	-7.33% (-0.81)
Median abnormal return (%)	-24.43% (-10.57) a	-5.85% (-12.33) a	-28.61% (-12.40) a	-3.27% (-1.21)
% of sample firms with negative abnormal returns	69.85% (-9.06) a	73.55% (-10.68) a	74.71% (-11.20) a	52.53% (-1.15)

a denotes significantly different from zero (50% in the case of % of sample firms with negative abnormal returns) at the 1% for two-tailed tests.

Table 4: Buy-and-hold abnormal returns of firms experiencing excess inventory situations using the matching portfolio approach where each sample firm is assigned to one of the 210 benchmark portfolios formed on the basis of size, market-to-book ratio, and prior performance, and using the using the one-to-one matching approach where each sample firm is matched to a firm from its assigned portfolio.

Performance Statistics	Time Period			
	Year before announcement (days -251 to -2)	Announcement period (days -1 to 0)	Year before announcement through announcement period (days -251 to 0)	1st and 2nd year after announcement (days 1 to 500)
(1)	(2)	(3)	(4)	(5)
Panel A: Results from using the portfolio method				
Number of observations	711	711	711	711
Mean abnormal returns (%)	-30.91%	-5.35%	-35.01	4.01%
p-value based on the rank in the empirical distribution	0.001	0.001	0.001	0.181
Median abnormal returns (%)	-33.44	-3.38%	-37.28	-21.41
% of sample firms with returns less than its portfolio median	79.36% (-14.59) a	65.97% (-8.52) a	80.88% (-16.46) a	53.34% (-1.87)
Panel B: Results from one-to-one matching on performance				
Number of observations	711	711	711	711
Mean abnormal return (%)	-28.18% (-10.87) a	-5.47% (-11.01) a	-31.99% (-12.65) a	6.56% (1.22)
Median abnormal return (%)	-20.66% (-11.62) a	-3.97% (-10.97) a	-24.54% (-13.43) a	-4.31% (-0.89)
% of sample firms with negative abnormal returns	67.52% (-9.34) a	68.36% (-9.81) a	72.48% (-11.97) a	52.19% (-1.17)
Panel C: Results from one-to-one matching on Market to book value of equity				
Number of observations	711	711	711	711
Mean abnormal return (%)	-29.89% (-11.93) a	-5.41% (-10.48) a	-33.73% (-13.68) a	7.08% (1.25)
Median abnormal return (%)	-27.22% (-12.19) a	-3.83% (-10.98) a	-30.86% (--13.61) a	-7.84% (-1.10)
% of sample firms with negative abnormal returns	70.19% (-10.77) a	67.52% (-9.34) a	72.72% (-12.12) a	54.01% (-2.13) c

a, b, and c denote significantly different from zero (50% in the case of % of sample firms with negative abnormal returns) at the 1%, 2.5%, and 5% for two-tailed tests.

Table 5: Buy-and-hold abnormal returns of subsamples of firms where announcing firm hold excess inventory (Panel A) and where customers of announcing firms hold excess inventory. Abnormal returns are computed using one-to-one-matching where each sample firm is matched to a firm with at least a two-digit SIC code match that is closest in size as measured by the market value of equity to the sample firm, with the constraint that the sample and matched firms sizes are within a factor of 10. Abnormal performance is calculated as the difference between the buy-and-hold return for the sample firm and the matched firm.

	Time Period			
Performance Statistics	Year before announcement (days -251 to -2)	Announcement period (days -1 to 0)	Year before announcement through announcement period (days -251 to 0)	1st and 2nd year after announcement (days 1 to 500)
(1)	(2)	(3)	(4)	(5)
Panel A: Subsample where announcing firm holds excess inventory				
Number of observations	636	634	636	634
Mean abnormal return (%)	-30.19% (-10.65) a	-5.48% (-9.82) a	-34.06% (-11.76) a	2.46% (0.27)
Median abnormal return (%)	-23.53% (-10.70) a	-3.44% (-9.33) a	-25.93% (-11.91) a	-1.81% (-0.26)
% of sample firms with negative abnormal returns	67.93% (-9.07) a	64.20% (-7.15) a	70.45% (-10.31) a	50.79% (-0.51)
Panel B: Subsample where announcing firm's customers have excess inventory				
Number of observations	259	259	259	259
Mean abnormal return (%)	-37.89% (-5.04) a	-7.57% (-8.95) a	-44.97% (-5.69) a	-29.42% (-1.89)
Median abnormal return (%)	-23.85% (-7.91) a	-6.06% (-8.64) a	-30.34% (-9.37) a	-5.60% (-1.34)
% of sample firms with negative abnormal returns	69.12% (-6.15) a	74.52% (-7.89) a	74.91% (-8.02) a	54.45% (-1.43)

a denotes significantly different from zero (50% in the case of % of sample firms with negative abnormal returns) at the 1% for two-tailed tests.

Table 6: Buy-and-hold abnormal returns of subsamples of actions taken to deal with excess inventories. Abnormal returns are computed using one-to-one-matching where each sample firm is matched to a firm with at least a two-digit SIC code match that is closest in size as measured by the market value of equity to the sample firm, with the constraint that the sample and matched firms sizes are within a factor of 10. Abnormal performance is calculated as the difference between the buy-and-hold return for the sample firm and the matched firm.

Time period	Year before announcement (days -251 to -2)				Announcement period (days -1 to 0)				Year before announcement through announcement period (days -251 to 0)				1st and 2nd year after announcement (days 1 to 500)			
(1)	(2)				(3)				(4)				(5)			
	Obs	Mean	Median	% Neg.	Obs	Mean	Median	% Neg.	Obs	Mean	Median	% Neg.	Obs	Mean	Median	% Neg.
Actions taken																
Inventory write-offs	498	-29.70%	-23.78%	68.08%	497	-5.61%	-3.77%	63.18%	498	-33.49%	-26.04%	69.68%	497	10.19%	0.35%	49.90%
		(-8.91) a	(-9.03) a	(-8.07) a		(-8.62) a	(-8.19) a	(-5.88) a		(-9.86) a	(-10.03) a	(-8.78) a		(0.89)	(0.08)	(-0.04)
Customers reducing inventory	148	-39.96%	-19.89%	67.57%	148	-7.29%	-6.48%	71.67%	148	-46.68%	-26.51%	71.67%	148	-17.50%	0.72%	49.33%
		(-9.56) a	(-5.49) a	(-4.27) a		(-5.86) a	(-5.84) a	(-5.26) a		(-3.68) a	(-6.63) a	(-5.26) a		(-1.35)	(-0.29)	(-0.16)
Curtail production	76	-23.84%	-18.66%	69.84%	82	-3.79%	-2.27%	65.79%	76	-27.34%	-23.39%	72.37%	76	-76.18%	-14.97%	57.90%
		(-4.11) a	(-3.84) a	(-3.44) a		(-4.07) a	(-3.69) a	(-2.75) a		(-4.56) a	(-4.25) a	(-3.90) a		(-2.61) a	(-2.06) c	(-1.38)
Markdowns	26	-67.49%	-44.31%	76.93%	26	-7.01%	-5.25%	80.77%	26	-74.89%	-50.01%	84.62%	26	-1.28%	8.17%	46.14%
		(-4.33) a	(-3.81) a	(-2.74) a		(-3.05) a	(-3.00) a	(-3.14) a		(-4.37) a	(-4.03) a	(-3.53) a		(-0.04)	(0.53)	(-0.39)

a, b, and c denote significantly different from zero (50% in the case of % of sample firms with negative abnormal returns) at the 1%, 2.5%, and 5% for two-tailed tests.

Table 7: Buy-and-hold abnormal returns of abnormal returns from excess inventories for different industry groups. Abnormal returns are computed using one-to-one-matching where each sample firm is matched to a firm with at least a two-digit SIC code match that is closest in size as measured by the market value of equity to the sample firm, with the constraint that the sample and matched firms sizes are within a factor of 10. Abnormal performance is calculated as the difference between the buy-and-hold return for the sample firm and the matched firm.

Time period	Year before announcement (days -251 to -2)				Announcement period (days -1 to 0)				Year before announcement through announcement period (days -251 to 0)				1st and 2nd year after announcement (days 1 to 500)			
(1)	(2)				(3)				(4)				(5)			
	Obs	Mean	Median	% Neg.	Obs	Mean	Median	% Neg.	Obs	Mean	Median	% Neg.	Obs	Mean	Median	% Neg.
Industry																
Process Industry	173	-17.28%	-14.64%	63.90%	173	-3.84%	-2.76%	60.70%	173	-21.02%	-19.34%	70.53%	173	-17.77%	5.55%	46.83%
		(-4.41) a	(-4.99) a	(-3.66) a		(-3.80) a	(-3.97) a	(-2.53) b		(-4.99) a	(-5.83) a	(-5.41) a		(-1.18)	(0.38)	(-0.83)
Batch Manufacturing	227	-24.55%	-21.15%	63.00%	226	-5.37%	-4.13%	65.93%	227	-28.91%	-24.51%	66.08%	226	-2.91%	-0.68%	50.89%
		(-4.79) a	(-4.90) a	(-3.93) a		(-6.20) a	(-5.91) a	(-4.79) a		(-5.45) a	(-5.80) a	(-4.85) a		(-0.28)	(0.35)	(-0.26)
High Technology	247	-47.91%	-34.15%	76.12%	247	-7.55%	-6.41%	70.45%	247	-53.43%	-38.53%	77.74%	247	12.34%	0.35%	49.40%
		(-5.93) a	(-8.71) a	(-8.21) a		(-7.91) a	(-7.64) a	(-6.43) a		(-9.07) a	(-9.57) a	(-8.72) a		(0.70)	(0.42)	(-0.18)
Wholesale & retailing	128	-38.42%	-24.36%	70.32%	128	-6.51%	-3.99%	68.75%	128	-43.04%	-29.55%	75.79%	128	-7.24%	-29.32%	59.38%
		(-6.38) a	(-6.16) a	(-4.59) a		(-5.14) a	(-4.83) a	(-4.24) a		(-7.27) a	(-6.76) a	(-5.84) a		(-0.44)	(-1.79)	(-2.12) c

a, b, and c denote significantly different from zero (50% in the case of % of sample firms with negative abnormal returns) at the 1%. 2.5%, and 5% for two-tailed tests.

Table 8: Buy-and-hold abnormal returns from excess inventories over different time periods. Abnormal returns are computed using one-to-one-matching where each sample firm is matched to a firm with at least a two-digit SIC code match that is closest in size as measured by the market value of equity to the sample firm, with the constraint that the sample and matched firms sizes are within a factor of 10. Abnormal performance is calculated as the difference between the buy-and-hold return for the sample firm and the matched firm.

	Time Period			
Performance Statistics	Year before announcement	Announcement period	Year before announcement through announcement period	1st and 2nd year after announcement
(1)	(2) (days -251 to -2)	(3) (days -1 to 0)	(4) (days -251 to 0)	(5) (days 1 to 500)
Panel A: Announcements made during 1990-1994				
Number of observations	153	152	153	152
Mean abnormal return (%)	-29.41% (-5.91) a	-5.92% (-5.29) a	-33.62% (-6.82) a	17.15% (1.11)
Median abnormal return (%)	-25.73% (-5.59) a	-4.11% (-5.62) a	-28.33% (-6.50) a	1.11% (-0.29)
% of sample firms with negative abnormal returns	64.71% (-3.64) a	69.84% (-4.88) a	73.21% (-5.74) a	50.66% (-0.16)
Panel B: Announcements made during 1995-1998				
Number of observations	424	423	424	423
Mean abnormal return (%)	-38.66% (-7.27) a	-5.96% (-9.42) a	-43.82% (-7.89) a	-12.34% (-0.92)
Median abnormal return (%)	-25.74% (-10.26) a	-4.47% (-8.95) a	-30.71% (-11.39) a	-2.08% (-0.51)
% of sample firms with negative abnormal returns	72.17% (-9.14) a	67.14% (-7.05) a	74.77% (-10.21) a	50.87% (-0.34)
Panel C: Announcements made during 1999-2002				
Number of observations	318	318	318	318
Mean abnormal return (%)	-25.54% (-7.00) a	-6.34% (-7.42) a	-30.15% (-7.96) a	-10.82% (-1.02)
Median abnormal return (%)	-18.14% (-11.55) a	-4.24% (-6.99) a	-22.38% (-7.54) a	-3.52% (-1.25)
% of sample firms with negative abnormal returns	64.78% (-5.27) a	66.04% (-5.72) a	66.99% (-6.06) a	53.78% (-1.35)

a denotes significantly different from zero (50% in the case of % of sample firms with negative abnormal returns) at the 1% for two-tailed tests.

Table 9: Buy-and-hold abnormal returns from excess inventories by firm size quintiles. Market value of equity is used to form the size quartiles. Abnormal returns are computed using one-to-one-matching where each sample firm is matched to a firm with at least a two-digit SIC code match that is closest in size as measured by the market value of equity to the sample firm, with the constraint that the sample and matched firms sizes are within a factor of 10. Abnormal performance is calculated as the difference between the buy-and-hold return for the sample firm and the matched firm.

Time period	Year before announcement (days -251 to -2)				Announcement period (days -1 to 0)				Year before announcement through announcement period (days -251 to 0)				1st and 2nd year after announcement (days 1 to 500)			
(1)	(2)				(3)				(4)				(5)			
	Obs	Mean	Median	% Neg.	Obs	Mean	Median	% Neg.	Obs	Mean	Median	% Neg.	Obs	Mean	Median	% Neg.
Firm Size ($millions) Quartiles																
First Quartile (Smallest)	211	-28.48%	-16.01%	63.51%	209	-6.62%	66.51%	58.17%	211	-32.89%	-20.44%	66.83%	209	-40.31%	-25.91%	58.38%
Firm Size < 43.04		(-5.47) a	(-5.17) a	(-3.92) a		(-5.42) a	(-4.77) a	(-4.70) a		(-6.09) a	(-5.99) a	(-4.89) a		(-1.94)	(-2.79) a	(-2.42) b
Second Quartile	228	-36.29%	-32.14%	71.06%	228	-7.25%	-5.15%	68.43%	228	-41.73%	-34.24%	75.00%	228	12.86%	1.85%	49.57%
43.04 ≤ Firm size < 165.88		(-4.29) a	(-7.01) a	(-6.36) a		(-8.31) a	(-7.39) a	(-5.57) a		(-4.72) a	(-7.96) a	(-7.55) a		(0.93)	(0.61)	(-0.16)
Third Quartile	228	-36.87%	-26.93%	71.06%	228	-6.87%	-4.31%	70.18%	228	-43.04%	-32.33%	74.13%	228	15.85%	-0.42%	50.44%
165.88 ≤ Firm size < 908.77		(-7.97) a	(-7.87) a	(-6.36) a		(-7.23) a	(-7.05) a	(-6.09) a		(-9.03) a	(-9.01) a	(-7.29) a		(0.99)	(0.08)	(0.16)
Fourth Quartile (Largest)	226	-27.78%	-18.95%	66.82%	226	-3.61%	-2.13%	63.28%	226	-30.93%	-20.54%	70.36%	226	-18.51%	0.35%	49.44%
908.77 ≤ Firm size		(-6.26) a	(-6.27) a	(-5.06) a		(-5.62) a	(-5.43) a	(-3.99) a		(-6.81) a	(-6.99) a	(-6.11) a		(-1.60)	(0.55)	(-0.16)

a, b, and c denote significantly different from zero (50% in the case of % of sample firms with negative abnormal returns) at the 1%, 2.5%, and 5% for two-tailed tests.