

DRIVERS OF SHORT-TERM OVERPRODUCTION: EXCESS CAPITAL INVESTMENT AND PRODUCTION DECISIONS BASED ON PAST INFORMATION

Haihong He

Haihong He (hhe@calstatela.edu) is Professor of Accounting at College of Business and Economics, California State University, Los Angeles, 5151 State University Dr., Los Angeles, CA 90032.

Abstract

This research examines internal causes of overproduction in manufacturing firms. Using a sample of manufacturing firms (SIC codes 2000-3999) in the US from 2006 to 2015, we find that firms' overproduction is positively related to excess fixed assets investment in current period and sales in past periods. We attribute our findings to the fact that the noise in the internal accounting information used in financial and operating decisions can drive the mismatch between production and demand. The current literature on overproduction mostly focuses on external financial accounting incentives, whereas this study adds evidence of internal accounting information driving overproduction as another explanation.

Keywords: Overproduction, fixed assets investment, sales

Data Availability: Data used in this study are available from public sources

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INTRODUCTION

This research examines internal causes of overproduction in manufacturing firms. Overproduction results in higher inventory holding costs, future inventory value drops due to obsolesce, and loss of cash flow available for potential investment opportunities (Hendricks & Singhal, 2009). Thus, researchers are interested in explaining why some firms recklessly choose to do so.

Previous studies on inventory overproduction mostly focus on external financial reporting incentives – absorption accounting required by the US GAAP (Gupta, Pevzner, & Seethamraju, 2010; Young, Peng, Chien & Tsai, 2014) and earnings management to meet profit targets (Roychowdhury 2006; Gunny 2006; Cook, Huston, & Kinney, 2012). Absorption accounting requires allocation of fixed manufacturing overhead to inventory costs. Under SFAS 151, which currently describes the inventory accounting, “allocation of fixed production overheads to the costs of conversion is based on the normal capacity of production facilities. In periods of abnormally high productions, the amount of fixed overhead allocated to each unit of production is decreased so that inventories are not measured above cost.” Thus, high volume production will result in lower inventory cost per unit while low volume production will result in higher inventory cost per unit.

When firms have incentives to manage earnings, overproduction can be employed to meet or even beat earnings targets. Because of the nature of absorption accounting in which both variable and fixed manufacturing costs are used to determine inventory values, the excess production in an accounting period can allocate higher fixed manufacturing costs to the

ending inventory on the balance sheet and lower fixed manufacturing costs to the income statement to increase current period earnings. Thus, overproduction in absorption accounting can be used opportunistically to bias earnings upward temporarily.

Different from prior research, our research attempts to explain how an internal accounting system can drive decisions that lead to overproduction. Overproduction could be a result of management incapability in identifying sales needs and scheduling production accordingly, and the internal accounting system and information used in decision-making and control plays a vital role in influencing noises in inventory production decisions. Using a sample of US manufacturing firms from 2006 to 2015, we find that firms' overproduction is positively related to excess fixed assets in the current period, as well as positively related to the past period sales. Our results suggest that managerial accounting information could drive overproduction when there is concurrently mismatched financial investment and undue reliance on the past period sales in production scheduling. Our research adds new findings to the overproduction literature in both accounting and operations management.

LITERATURE REVIEW

There have been many studies on the consequences of inventory levels. Rumyantsev and Netessine (2007a) showed that inventory levels are positively associated with more uncertain demand, longer lead time, and further related problems. Chen, Murray and Wu (2005) showed that firms with abnormally high levels of inventory have poor long-term stock market performance; firms with low, but not extremely low levels of inventory have unusually good long-term stock performance; but, firms with the lowest levels of inventory have only ordinary performance. Rumyantsev and Netessine (2007b) showed that superior earnings are associated with responsiveness in inventory management, which is defined as inventory change relative to sales change. Thus, inventory management is associated with firm value.

As overproduction results in higher inventory holding costs, future inventory value drops due to obsolesce, and loss of cash flow available for potential investment opportunities (Hendricks & Singhal 2009; Chen, et al.,2005), we should observe less overproduction in firms that make rational, profit-maximizing decisions. Much of the research attempts to explain overproduction from a financial reporting and earnings management perspective (Gupta et al., 2010; Cook et al., 2012; Young et al., 2014), and suggests that overproduction is driven by external financial reporting incentives.

Very few studies examine how internal management and control factors can lead to overproduction. The study by Bruggen, Krishnan, & Sedatole (2011), to our knowledge, is the only study that directly attempts to explain overproduction decisions from a non-financial reporting perspective. Bruggen et al. (2011) uses field study in an auto manufacturer to show that manager's overemphasis on short-term costs and benefits in performance measure leads to excess production. Bruggen et al. (2011) also found an association between excess capacity and excess production, which suggests suboptimal capacity investment and production decisions. Indirectly, Jiambalvo, Noreen, and Shevlin (1997) found that the stock market reacts positively to overproduction, and their study implicitly suggests that inventory overproduction is a reflection of firms' inventory build-ups in expectation of higher future sales. Attempting to distinguish whether overproduction is driven by external financial reporting or internal decision-making, Gupta et al. (2010) introduced fixed costs in examining the association between firms' overproduction and accounting and stock performance, and their results do not suggest that firms overproduce as a result of managerial inability to adjust inventory levels.

Overall, prior research suggests the existence of inventory build-ups or imperfect production decision management but with no consensus on the causes. Although earnings management has often been offered as a plausible explanation for overproduction, there is a possibility that inventory management fails to align production and sales due

to the managers' inability to respond to the demand change, or due to miscalculation. However, very few researchers have explored this possibility. Our research attempts to directly explain overproduction from this view – how internal accounting information systems may hinder a manager's ability to decide the correct amount of production according to the sales needs. Toward this, research hypotheses are represented in the next section.

RESEARCH HYPOTHESIS AND QUESTION

Overproduction and Excess Capital Investment

A few accounting studies have examined whether fixed manufacturing costs provide opportunities for firms to manipulate earnings through inventory production change. Jiambalvo et al. (1997) found that inventory change is positively associated with stock returns after controlling for the industry level fixed manufacturing costs, and they view overproduction as a leading indicator of future sales. Gupta et al. (2010) further controlled the cross-sectional firm level fixed manufacturing costs and studied the overproduction and accounting and market performance in high-fixed-costs firms. Although findings in the study by Gupta et al. (2010) do not support that firms with higher fixed manufacturing costs have lower flexibility to adjust their production level on short notice and are more prone to “production adjustment” delay, they did find that higher levels of fixed costs provide greater incentives for opportunistic overproduction to increase contemporaneous return on assets. Similarly, Cook et al. (2012) also found that firms with high fixed-cost ratios are more likely to manipulate inventory.

Prior studies all focus on the level of fixed manufacturing costs. Our research is different from prior research in that we focus on the change in investment in the fixed manufacturing costs compared to the industry average. Moreover, all prior research attempts to examine whether fixed costs provide opportunities for firms to manage inventory to achieve

earnings goals, whereas our research focuses on the effect of suboptimal financial decisions of fixed assets investment on the operational decisions of production.

Production is normally an operation manager's decision, while capital investment is often financial officer's decision. Xu and Birge (2004) suggested that a firm's financing decisions on investment and production decisions should be made jointly to improve firm performance. Accounting information serves for both functions. When there is excess capital investment, manufacturing firms are required by SFAS 151 to report the unused capacity (fixed) costs as a period charge. In an experimental study, Buchheit (2003) showed that explicit capacity cost reporting can lead to managerial decisions cutting unused capacity resources and therefore affect the production, unable to meet the demand when demand exhibits a positive trend.

Following this, when there is a misalignment between resource planning and uncertain demand, overproduction or underproduction could arise. We argue that when firms have excess change in capital investment, they are more likely to overproduce because of committed resources and a perception of high demand. When firms have made a poor projection of the capacity needed for the production, idle capacity becomes an issue. Firms with idle capacity are more likely to overproduce.¹ This leads to our first hypothesis:

H1: Firms with excess capital investment in current and previous years are more likely to overproduce.

Overproduction and Production Decisions to Meet Sales Demand

In business management, inventory production decisions should reflect demand change. The demand change is dynamic and achieving demand-supply match normally considers the demand change in the past period, the current period, and the future period. Essentially, production changes should respond to sales changes, and firms could either employ projected

sales or rely on historical sales to gauge current period sales (demand) trend.

According to Zimmerman (2013), there is a trade-off between information for decision management and information for control. Decision management emphasizes the relevance of future-oriented information, while control intends to reduce agency conflicts and hence prefers verifiable past information. Many management accounting choices, particularly those regarding inventory production, are a reflection of such consideration and balance. For example, when the goal is to control, managers budgeting on inventory are likely to adopt a top-down approach and rely more on verifiable past information. On the other hand, when the goal is to make better decisions regarding management, their budgeting is more likely to adopt a bottom-up approach and incorporate future information provided by the lower-level managers, who often have the special business knowledge to make better projections (Zimmerman 2013). In summary, use of future information is more relevant for decision-making but less verifiable. Use of past information is less relevant in decision-making but more verifiable.

When firms are leaning more towards decision management, they are more likely to use relevant forward-looking information to align production with sales demand and hence reduce or even eliminate overproduction. In contrast, if firms are more concerned with control, they are more likely to use past information, which is more verifiable but less useful for the inventory production decisions. In this case, overproduction or underproduction might occur.²

Thomas and Zhang (2002) documented some inventory patterns, though they could not find evidence to support their three proposed explanations. For example, they found that firms with inventory increases experience higher profitability, growth, and stock returns over the prior five years, but those trends reverse after the extreme inventory change. They conjectured “firms with prior increases (decreases) in profitability and demand are projected to continue that trend, but for some of these

firms actual demand may fall short of (exceed) projected demand, which causes an imbalance between sales and production/purchases that results in inventory increases (decreases).” Thus, demand shift from past to future is not fully recognized by the firm and market.

The association between the inventory change and past or future sales are indirectly reflected in some prior research on overproduction and earnings management. For example, Jiambalvo et al. (1997) showed that overproduction is positively correlated with current period stock returns, and they argued that investors generally consider inventory growth to be a positive signal. This is, however assuming that the company expects sales to increase in future periods and is thus stockpiling inventory to meet future demand. Jiambalvo et al. (1997) found that the stock market generally reacts positively to overproduction, thus viewing overproduction as a leading indicator of future sales. Gupta et al. (2010), however, found no empirical evidence to support that “observed inventory overproduction could also be the result of managers’ delayed reactions (or inability to respond) to negative demand shocks for a firm’s products.”

Therefore, based on the above discussion, we examine whether inventory overproduction is associated with the use of past or future information in managing inventory production. Since the direction of such relationship is unclear, we state research question instead of hypothesis as follows:

Research Question 1: Are firms using past information in inventory production management more likely to overproduce than firms using future forward-looking information in inventory production management?

METHODOLOGY

Our key variable is overproduction. Following Jiambalvo et al. (1997), we proxy excess quantity of production using Change in Percentage of

Production Added to Inventory (CPAI), which is calculated as $\Delta INV_t / (COGS_t + \Delta INV_t) - \Delta INV_{t-1} / (COGS_{t-1} + \Delta INV_{t-1})$. In the expression, ΔINV_t and ΔINV_{t-1} represent a firm's annual inventory change in years t and $t-1$, respectively, and they are calculated based on total (absorption-costing based) inventory value (COMPUSTAT DATA#3). COGS represents a firm's cost of goods sold (COMPUSTAT DATA#41), adjusted upward for depreciation expense (Compustat DATA#14).

We design the following model to test H1:

$$CPAI_t = \alpha_0 + \alpha_1 \Delta FA_t + \alpha_2 \Delta FA_{t-1} + \alpha_3 \Delta FA_{t-2} + \text{ControlVariables} + \varepsilon_t \quad (1)$$

In the above equation, ΔFA_t is excess production capacity in year t , which is computed as change in gross fixed assets scaled by total assets minus the corresponding industry mean based on two digit SIC code. Similarly, we calculate ΔFA_{t-1} and ΔFA_{t-2} in years $t-1$ and $t-2$, respectively. We expect that there is a positive association between CPAI and ΔFA variables. The control variables used are natural logarithm of total assets to proxy for business size (Log(AT)), Tobin's Q calculated as (market value of equity + total liability)/total assets to proxy for business risk, and the mean of industry sales changes to proxy for the industry business growth (Industry Growth).

To test research question 2, we design the following model to examine whether firms schedule production based on future or past period sales information:

$$\text{Prod}_t / TA_{t-1} = \alpha_0 + \alpha_1 (1 / TA_t) + \alpha_2 (\text{Sales}_{t-1} / TA_{t-1}) + \alpha_3 (\text{Sales}_t / TA_{t-1}) + \alpha_4 (\text{Sales}_{t+1} / TA_{t-1}) + \varepsilon \quad (2)$$

In the above equation, Prod_t / TA_{t-1} is the sum of cost of goods sold and change in inventory during the year scaled by total assets at the beginning of the year, $\text{Sales}_t / TA_{t-1}$ is total sales scaled by total assets at the beginning of the year, $\text{Sales}_{t-1} / TA_{t-1}$ is prior year sales scaled by total assets at the beginning of the year, and $\text{Sales}_{t+1} / TA_{t-1}$ is future

year sales scaled by total assets at the beginning of the year. In this model, production is associated with past period sales, current period sales and/or expected future sales (proxied by actual sales in year $t+1$). We expect that overproduction firms have α_2 significantly positive and α_4 not significantly positive. We will run the above equation for each quartile of CPAI in our sample.³

PREVIEW COMPLETE

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CITATION INFORMATION

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NOTES

1. Similarly, Gupta, Pevzner, & Seethamraju (2010) point out that capacity idles as firms sink into the stagnant state of their life cycle and managers of stagnant firms have stronger incentives to produce in excess to avoid any idle capacity expense.
2. This study focuses on overproduction. For firms using past information, we also suspect that they are more likely to underproduce.
3. The quartile with lowest values are under production firms. We are interested in the first quartile with highest values, the overproduction firms.