Implications of Production-Sales Differentials for Profitability and Market Valuation

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Abstract

Prior research, based on U.S. firms, has studied the effect of inventory changes on current and future profitability and market valuation (Bernard and Noel, 1991; Lev and Thiagarajan, 1993; Jiambalvo, Noreen, and Shevlin, 1997; Gupta, Pevzner, and Seethamraju, 2010). Because inventory changes equal the difference between production and sales, this research effectively studies the implications of the difference in the dollar cost of production and sales. Our analysis complements and extends this work by employing a unique data set of annual units produced and sold at the segment level for a broad sample of Indian manufacturing firms. Besides the quantity data that is explicitly disclosed, we are also able to impute the values of average per unit costs and selling prices. Consequently, we are able to perform a more detailed component-wise analysis of the information contained in firm production, selling, costing, and pricing decisions.

We find that the ratio of units produced to units sold contains useful information related to costs, selling prices and margins. Its increase is associated with reduction in costs and an inexplicable increase in selling prices and hence a net improvement in contemporaneous margins and profitability. However, these effects are short-lived. An increase in P/S ratio results in an increase costs in the next year (though not significant) and in declining selling prices and margins. Thus, a high production-to-sales ratio is a negative leading indicator for future profitability.

We also document that information on the ratio of units produced to units sold has incremental information content for stock prices and returns (over and above net profit and book value of equity). Firms that produce in excess of sales are valued negatively by investors. Because overproduction temporarily boosts short-term earnings, one interpretation of this result is that investors view increases in the production-to-sales ratio as an indicator of poor earnings quality. A second interpretation is that, even absence earnings manipulation, high production-to-sales ratio is viewed as a signal of a negative demand shocks. More research on the relative importance of these alternate explanations is a promising area for future research.

1. Introduction

In this paper, we investigate whether information about the difference between production and sales quantities is correlated with profitability and firm values. Because of absorption costing, the production-sales quantity differential can influence cost per unit of the products sold by firms in both current and future periods. Additionally, this differential is also an indicator of firms' ability to generate sales. Production exceeding sales could suggest that the firm is having difficulty selling its products. In this case, the firm would experience declining selling prices, as its managers discount products to offload inventories. Further, excess production could result in higher inventory holding costs and precipitate inventory write-downs. Alternately, production in excess of sales could represent a deliberate and planned decision taken to fulfill known future sales. Thus, production-sales differentials can influence costs and selling prices and are also an indicator of future sales growth.

Prior research has examined the information content of change in inventories or unexpected inventories, relative to sales growth or the cost of production. Because the difference between production and sales equals the change in inventories, our study is related to this body of work. In general, the evidence indicates that inventory changes are negatively related to one-year-ahead change in earnings (Bernard and Noel, 1991; Abarbanell and Bushhee, 1997; Thomas and Zhang, 2003). Evidence on the relation between inventory changes and contemporaneous stock returns is somewhat mixed. Lev and Thiagarajan (1993) and Abarbanell and Bushee (1997) find that the difference between percentage change inventories and percentage change in sales is negatively related to stock returns. In contrast, Jiambalvo, Noreen, and Shevlin (1997) and Gupta, Pevzner, and Seethamraju (2010) find that change in 'inventory accrual scaled by cost of production' is positively related to stock returns.

Prior research provides interesting results on the implications of the differential between the dollar value of inventory growth and sales growth (excess production). We extend this research by exploiting a unique set of segment-level disclosures on production and sales quantities that Indian manufacturing firms are required to report in their annual reports. In addition to quantity data, the disclosures allow us to infer the average selling prices and cost per unit at the segment level. Because we have information on the quantity as well as per unit costs and selling prices (unavailable elsewhere in the world), we are able to provide a *more detailed analysis* of the components which cause excess production to influence profitability and valuation.

Our sample is a panel dataset of over two thousand manufacturing firms for the years 1996-2010. To analyze current and future profitability, we estimate regressions for changes in cost per unit, changes in selling prices per unit, changes in gross margin per unit, growth in sales quantities, and change in profitability. Our primary independent variables in these regressions are the current and lagged ratio of units produced to units sold. To study value implications, we estimate regressions of market capitalization and share prices (stock returns) on the level of (difference in) the production-to-sales ratio and control variables. In all our regressions we control for firm, year, and industry fixed effects and adjust standard errors for two-way clustering.

Our findings are as follows. We find that the ratio of units produced to units sold contains useful information related to costs, selling prices and margins. Its increase is associated with reduction in costs and an inexplicable increase in selling prices and hence a net improvement in contemporaneous margins and profitability. However, these effects are short-lived. An increase in P/S ratio results in an increase costs in the next year (though not significant) and in declining selling prices and margins. Thus, a high production-to-sales ratio is a negative leading indicator for future profitability.

We also document that information on the ratio of units produced to units sold has incremental information content for stock prices and returns (over and above net profit and book value of equity). Firms that produce in excess of sales are valued negatively by investors. Because overproduction temporarily boosts short-term earnings, one interpretation of this result is that investors view increases in the production-to-sales ratio as an indicator of poor earnings quality. A second interpretation is that, even absence earnings manipulation, high production-to-sales ratio is viewed as a signal of a negative demand shocks. More research on the relative importance of these alternate explanations is a promising area for future research.

We contribute to the literature in three ways. First, ours is the first study to provide direct large sample evidence on absorption costing – changes in cost per unit are significantly negatively related to production-sales differentials. Second, prior research show that excess inventories are associated with declines in future profitability. We add to this research by showing that the mechanism by which profit declines is lower selling prices. Third, the use of dollar costs of unexpected inventories relative to sales growth by prior research combines information on cost per unit, selling prices, and production and sales quantity into one aggregate measure. Our unique dataset enables us to separately measure these components and then analyze their implications for valuation and profitability.

The rest of the paper is organized as follows. In section 2, we discuss the regulations that mandate quantity disclosures for production, sales, and inventories in India. We develop hypotheses in section 3 and describe our research design in section 4. Sample selection and description are contained in section 5 and we present our findings in section 6. Conclusions are provided in section 7.

2. Legal background for Quantity Disclosures and Inventory Accounting

For our sample period (1996-2011), the major financial reporting rules in India are contained in the Companies Act, 1956 and in the Accounting Standards (AS) issued by the Institute of Chartered Accountants of India. In this section, we briefly discuss the portions of these regulations that are most relevant to this study.

Schedule VI of the Companies Act, 1956 provides the format of the annual balance sheet and profit and loss account (income statement) for Indian firms. It also contains a list of additional information that firms are required to report in schedules (notes) to the financial statements. Appendix I reproduces select provisions from Schedule VI that are relevant to this study.[1] As per these provisions, manufacturing firms are required to provide data on the units and value of sales for each class of goods (segment) in the annual report to shareholders. Further, the number of units produced (but not cost) for each segment is a required disclosure. In addition to sales and production data, manufacturing firms are also required to provide segment-level disclosure on the cost of and number of units of beginning and ending finished goods inventories. By dividing the value of the sales by units sold, we can compute average selling prices at the segment level. Similarly, by dividing the cost of finished goods inventories by the corresponding number of units, we can compute cost per unit at the segment level at the beginning and the end of the year.[2]

In February 2011, the Ministry of Corporate Affairs (MCA) significantly revised the disclosure requirements of Schedule VI. In particular, segment-level disclosure of units produced was no longer required for financial statements prepared after April 1st 2011. Additionally, quantity disclosures for sales and inventories were simplified and replaced with the disclosure of "broad heads" only. Thus, the last fiscal year for which data on quantity disclosures of both sales and production is available in India is 31st March 2011.

[1] The disclosure of quantity information was first mandated in 1973 through notification no. GSR 494 (E) dated 30th October, 1973.

[2] As described in Appendix I, firms are also required to disclose information on installed capacity in units. Unfortunately, this variable has missing values for a majority of our sample firms in our data source, the Prowess Database. Hence, we do not analyze capacity disclosures.

Accounting standards issued by the Institute of Chartered Accountants of India (ICAI) constitute GAAP in India and listed companies have to comply with these standards. Given our focus, the standard that is most relevant is AS-2 on Inventories. Appendix II reproduces the text of the standard that relates to absorption costing. Interestingly, the standard recommends that fixed overhead allocated to inventories be reduced when production levels are abnormally high. Consequently, the reduction in cost of goods sold expense through over-production is constrained by the standard and it limits firms' ability to boost earnings by producing abnormally high quantities. However, because the standard does not define "abnormal," in practice, firms are not constrained in their ability to boost profits through over-production.

To the best of our knowledge, India is the only country that requires segment-level quantity disclosures of sales, production, and inventories. The unique data on quantities coupled with the implied data on selling prices and per unit costs allows us to conduct a study on how production decisions influence costs, selling prices, and profitability. Further, we are also able to evaluate the effect of these disclosures on stock prices and returns.

3. Hypothesis Development

We expect that the difference between production and sales levels influences various components of current and future profitability. First, production-sales differentials influence current and future cost per unit because of absorption costing. Second, these differentials could be indicative of either current or future demand. Consequently, they could affect the price at which a firm's product is sold in the current and future periods. Third, changes in production levels are likely to be associated with changes in out-of-pocket costs such as storage and finance charges. Fourth, production that is unsold in the face of poor demand is likely to precipitate inventory write-downs. In the rest of this section, we expand on these

linkages. In addition, we also articulate how production-sales differentials will influence stock prices and returns.

Absorption costing distorts profitability when units produced during a reporting period differ from units sold in that period (Revsine, Collins, Johnson, and Mittelstaedt, 2012). As this difference increases, a greater fraction of fixed manufacturing overhead costs is absorbed by inventories, lowering cost of goods sold expense. Thus, increasing production above sales can temporarily boost gross margins. The opposite is expected when production falls below sales. In subsequent periods, however, when inventory that absorbed the fixed overhead is sold, cost of goods sold expense increases, resulting in a reversal of profits. This effect has led researchers to hypothesize that firms will boost profits by over-producing in response to short-term incentives to manage earnings upward (Roychowdhury, 2006; Gunny, 2009).

Tests of production-based earnings management are typically based on estimates of abnormal production – defined as the difference between the actual and expected dollar cost of production. To compute expected cost of production, Roychoudhury (2006) and others model the *dollar cost of production* as a linear function of sales, sales growth, and lagged sales growth. Industry-year regressions of this model are used to estimate the expected cost of production for each firm-year.

Our concern with using dollar cost of production to measure abnormal production is that its use potentially misclassifies firms that over-produce as "under-producers" and vice-versa. To see this, note that the dollar cost of production equals the product of cost per unit and units produced. Because these two components are negatively related, a firm that overproduces will have a lower cost per unit and one that under-produces will have higher cost per unit. Consequently, both firms could potentially have very similar values of dollar cost of production although one firm is managing earnings upward, and the other is managing earnings downward. Thus, unambiguous sorts of firms based on the degree of over-

production are not possible when dollar cost of production is used to measure abnormal production.

Our dataset of Indian manufacturing firms enables us to redress this shortcoming and provides a more powerful test of the absorption costing effect. Because actual units produced and sold are mandated annual disclosures and cost per unit can be inferred, we are able to separate the driver of earnings management (production levels) from its consequence (cost per unit). To set the stage, we hypothesise that the effects of absorption costing is measurable in our data. Specifically, we correlate the ratio of units produced to units sold with cost per unit and predict that:

H1: Cost per unit is negatively related to the ratio of units of produced to units sold (P/S ratio).

Because absorption costing effects reverse, cost per unit in any year is influenced not only by contemporaneous production-sales differentials, but also by previous year differentials. Lower cost per unit associated with an increase in PS ratio should reverse in the next year when inventory that absorbed the fixed overhead is sold; this would cause cost of goods sold expense to increase. Therefore, we predict that:

H2: Cost per unit is positively related to the lagged P/S ratio.

A word about the rationale for our use of the ratio of units produced to units sold would be helpful. Indian firms disclose units produced and sold at the segment level. Because units of measurement differ considerably across products (kilograms, litres, numbers, etc.), we have to create a measure of over / under-production that is comparable across segments. To do so, we compute the ratio of units produced to units sold for each firm-segment year, rather than the difference between the two numbers. This ratio is a dimension-free number that captures production-sales differentials, but does not depend on the units of measurement.

In H1 and H2, we focus on the accounting effects of over-production. Over-production could have real economic effects as well. If a firm's production exceeds sales, it could reflect sluggish demand and hence cause firms to lower selling prices to push out their products. A competing explanation for observed over-production is that firms produce in response to sales orders that will convert into realized sales in the future. In this scenario, overproduction is less likely to be associated with lower selling prices.[3] In addition to lowering selling prices, firms that are unable to sell all of their production could also write-down inventories in anticipation of lower selling prices in the future. Overall, an increase in P/S ratio has three possible effects on contemporaneous gross margins: absorption costing effects (positive), impact on selling prices (ambiguous), and write-downs (negative). Given the opposing and ambiguous nature of these effects, we do not formulate a hypothesis linking P/S ratio to gross margins; rather, we provide descriptive evidence on this relation.

Over/ under production can also influence operating profits through out-of-pockets costs. With over-production, higher inventory levels increase inventory holding costs (storage costs and risk of obsolescence or spoilage). Further, to the extent additional production is funded by borrowings, it would be associated with higher interest expense. The difference between the impact of over (under)-production on gross margins and on inventory and financing costs is an empirical issue. Therefore, again, we present exploratory evidence on this issue by correlating net profit before extraordinary items and the P/S ratio.

Next, we turn to how P/S ratio can influence future profits. In addition to the absorption costing reversal effect under H2, we consider two other effects: the sale of excess production and effect on future selling prices. Because most firms are likely to have days inventories of less than one year, firms that produce in excess of sales will be able to sell their

[3] As discussed in section 2, firms report both the value of goods sold at the segment level and the units sold. This enables us to compute average selling prices at the segment level.

inventories.[4] Therefore, we predict that PS ratio will be positively correlated with future sales growth in units:

H3: One-year ahead sales growth in units is positively associated with P/S ratio, when P/S ratio is greater than 1.

P/S ratio would also influence future profits via its impact on selling prices. As with contemporaneous selling prices, the effect of higher production on future selling prices depends on the demand for the firms' products. When demand is sluggish, firms would have to lower their selling prices to move inventories. This would imply a negative relation between P/S ratio and changes in future selling prices per unit. On the other hand, if there is excess demand for a firm's products, it is possible that P/S ratio is positively related with future selling prices. In our empirical work, we provide descriptive evidence on the correlation between P/S ratio and future change in average selling prices to assess which of the two states (low or high demand) predominates, on average. We also correlate P/S ratio with future margins and net profit to empirically assess the collective impact of absorption costing reversal (negative), changes in selling prices (ambiguous), and out-of-pocket costs (negative) on future profits.

Next, we discuss the expected relation between production-sales differentials and stock prices and returns. P/S ratio can be viewed either as a positive signal or as a negative signal by the market. High values of P/S ratio could be interpreted as a sign of planned increase in production in anticipation of future demand. Therefore, higher P/S ratios would be associated with higher valuations. Alternatively, an increase in P/S ratio could be viewed negatively by the market for two reasons. First, because managers can overproduce to temporarily boost profits, an increase in P/S ratio can be interpreted as an indicator of opportunistic manipulation. That is, a high P/S ratio is a signal of low earnings persistence

[4] Exceptions would be perishable goods and damaged goods that would have to scrapped or discarded.

and quality. Second, an increase in P/S ratio can also be interpreted as a sign that the firm is having trouble selling its products. Viewed in this way, a high P/S ratio would be an indicator that firm would lower selling prices in the future and record profit declines.

Our tests of the relation between P/S ratio and current and future profitability provides us with priors on how the market would respond to the P/S ratio. For example, if we find that P/S ratio is negatively related to future profits, then we expect to find a negative relation between stock prices and P/S ratios. The assumption implicit in this prediction is that the market correctly processes information in quantity disclosures. Thus, our empirical strategy consists of two steps: (a) evaluate the relation between P/S ratio and current and future profitability and (b) correlate stock prices and P/S ratio and assess if market pricing of P/S ratio is consistent with P/S ratio-profitability relations.

4. Empirical Design

Our first hypothesis is that absorption costing causes cost per unit and P/S ratio to be negatively related. In our second hypothesis, we predict that negative relation between cost per unit and P/S ratio reverses in the future. Empirically, cost per unit as well as its change varies considerably across products (for example, compare electric equipment and soaps). Thus, even though our hypotheses are framed in terms of cost per unit, to obtain manageable levels of variation in the dependent variable, we use percentage changes. Our test for absorption costing is based on the following firm-segment-year regression:

$$\%\Delta CPU_{ijt} = \alpha_0 + \alpha_1(P/S)_{ijt} + \alpha_2(P/S)_{ijt-1} + \alpha_3(\%\Delta CPU)_{ijt-1} + \alpha_4(\%\Delta PROD)_{ijt} + \varepsilon_{ijt} \quad (1)$$

where $\%\Delta CPU_{ijt}$ is the percentage change in average cost per unit of firm *i*, segment *j*, and year *t*, P/S is the production to sales ratio, and $\%\Delta PROD$ is the percentage change in units produced. Cost per unit is defined as the cost of closing stock of finished goods divided by the number of units of the same.

We include both the contemporaneous and lagged P/S ratio to account for originating and reversing absorption costing effects. We expect α_1 to be negative and α_2 to be positive. The lagged value of the dependent variable is included to account for time-series dependence in the dependent variable that obtains after controlling for absorption costing effects. Lastly, if production technology in a particular industry is subject to economies of scale, then the unit cost of production would decrease when output increases (Varian, 1992). Therefore, we include the percentage change in production per unit as an additional regressor; we expect its coefficient to be negative.

In our third hypothesis, we predict that P/S ratio will be positively related to one-year-ahead growth in sales quantities. Unsold production at the end of the year is likely to be sold within a year, unless firms face obsolescence or spoilage, or very poor market conditions obtain. We test for this relation with the following regression:

$$\%\Delta SQTY_{ijt} = \alpha_0 + \alpha_1 (P/S)_{ijt-1} + \alpha_2 \%\Delta SQTY_{ijt-1} + \varepsilon_{ijt} \quad (2)$$

where $\%\Delta SQTY$ is the percentage change in units sold for firm *i*, segment *j*, and year *t*. We include lagged sales growth to account for time-series dependence in sales growth.

We next define our empirical models for the relation between P/S ratio and selling prices, margins, and net profits. As with unit costs, we attempt to explain percentage change in selling prices instead of the level of selling prices in view of the high level of cross-segment heterogeneity in the latter. Our model for selling prices is:

$$\%\Delta SPU_{ijt} = \alpha_0 + \alpha_1 (P/S)_{ijt} + \alpha_2 (P/S)_{ijt-1} + \alpha_3 (\%\Delta SPU)_{ijt-1} + \alpha_4 (\%\Delta SQTY)_{ijt} + \varepsilon_{ijt} \quad (3)$$

where $\%\Delta SPU_{ijt}$ is the percentage change in average selling price per unit of firm *i*, segment *j*, and year *t*. Recall that the selling price is computed by dividing the value of sales by the number of units sold. Our inclusion of both current and lagged P/S values is motivated by the fact the selling prices might be adjusted concurrently with *or* slowly to demand shocks. If a

high P/S ratio is indicative of a negative demand shock, we expect that the coefficients on α_1 and α_2 to be negative for firms that produce in anticipation of future demand. On the other hand, if a firm's P/S ratio is high because it has produced in response to a certain future sales, then the impact of P/S ratio on selling prices is ambiguous. Lagged growth in selling prices is included to account for possible time series dependence in the dependent variable. Further, contemporaneous growth in sales quantities is included as a control for price-elasticity; we expect its coefficient to be negative if the market for firm products is competitive.

To assess the net effect of P/S ratio on profitability because of both absorption costing and selling price effects, we correlate it with the percentage change in margin per unit. Margin per unit is defined as the difference between selling price per unit and cost per unit. The regression model for gross margin is:

$$\%\Delta MPU_{ijt} = \alpha_0 + \alpha_1 (P/S)_{ijt} + \alpha_2 (P/S)_{ijt-1} + \alpha_3 (\%\mathrm{M}PU)_{ijt-1} + \alpha_4 (\%\Delta SQTY)_{ijt} + \varepsilon_{ijt} \quad (4)$$

where $\%\Delta MPU_{ijt}$ is the percentage change in margin per unit for firm *i*, segment *j*, and year *t*.

In all our regressions, we account for unobserved heterogeneity across firms, industries, and years by including firm, industry, and year fixed effects. Further, we compute standard errors that are adjusted for correlation across firms within a year and within a firm over time (two-way clustered standard errors). Because prior research on over-production / abnormal inventories has examined only firm-level data, for comparability, we average all the variables in Eq. (1) – (4) over segments and estimate these equations at the firm-year level as well.

Increases in P/S ratio can affect costs that are not reflected in gross margin such as storage and financing costs and inventory downs. Therefore, we also estimate the relation between P/S ratio and the percentage change in bottom-line profitability. Profitability is

defined as profit after taxes but before extraordinary items (PATEI). Because PATEI is available only at the firm level, we use P/S ratios averaged over segments as regressors:

$$(\Delta\text{PATEI/S})_{it} = \alpha_0 + \alpha_1(P/S)_{it} + \alpha_2(P/S)_{it-1} + \alpha_3(\Delta\text{PATEI/S})_{it-1} + \varepsilon_{it} \quad (5)$$

where *ΔPATEI/S* is change in firm level profit after taxes but before extraordinary items, deflated by sales for firm *i* and year *t*.

To evaluate the effect of P/S ratio on firm value, we employ both a levels and changes specification. Most empirical papers on the value-relevance of accounting numbers are based on the Ohlson (1995) framework and use regression models of the market value of equity on net profit and book value of equity. Accordingly, for the levels specification, we estimate the following firm-year equation:

$$\text{MCAP}_{it} = \alpha_0 + \alpha_1(P/S)_{it} + \alpha_2(PATEI)_{it} + \alpha_3(BV)_{it} + \alpha_4(SHR)_{it} + \varepsilon_{it} \quad (6)$$

where

MCAP = Market capitalization measured four months after the fiscal year end of year t;

PATEI = Profit after tax but before extraordinary items for year t;

BV = Book value of equity at the end of year t; and

SHR = Shares outstanding at the end of year t.

Consistent with prior research, we measure market capitalization four months after the fiscal year end (Barth, Landsman, Young, and Zhang, 2013). Our main variable of interest is the firm-level P/S ratio, which is computed as an average across segments. We expect that the sign on P/S ratio in the valuation equation would be consistent with its sign in the change in profit forecasting equation, Eq. (5). For example, if P/S ratio is a negative leading indicator of future changes in profitability, we predict that $\alpha 1$ in Eq. (6) will be negative. Barth and Kallapur (1996) find that including a scale proxy as an independent variable is more effective than deflation at mitigating coefficient bias. Therefore, we include shares outstanding at the end of year t on the right hand side. As a robustness check, we exclude

SHR from Eq. (6) and estimate the following equation, with all variables deflated by shares outstanding at the end of year t:

$$\text{PRC4}_{it} = \alpha_0 + \alpha_1(P/S\_PS)_{it} + \alpha_2(EPS)_{it} + \alpha_3(BVPS)_{it} + \varepsilon_{it} \quad (7)$$

where

PRC4 = Price per share measured four months after the fiscal year end of year t;

P/S_PS = Firm-level average P/S ratio divided by shares outstanding at the end of year t;

EPS = Basic earnings per share before extraordinary items for year t; and

BVPS = Book value of equity per share at the end of year t.

A concern of the levels specification is that it potentially excludes correlated variables that do not vary over time. Therefore, as a second robustness test, we also estimate a changes specification where percentage change in price per share is regressed on appropriately deflated change in P/S ratio per share, and first-differenced values of *EPS* and *BVPS*. As with levels specification, our main variable of interest is the change in P/S ratio. Percentage change in price per share is defined as the difference between price per share four months after the fiscal year end date (PRC4) and the price twelve months before that date (*LAGPRC4*), divided by *LAGPRC4*. To ensure that deflators are consistent on both sides of the equation, all right hand side variables are deflated by LAGPRC4.

$$\%\Delta PRC4_{it} = \alpha_0 + \alpha_1\Delta(P/S\_PS)/LAGPRC4_{it} + \alpha_2(\Delta EPS/LAGPRC4)_{it} + \alpha_3(\Delta BVPS/LAGPRC4)_{it} + \varepsilon_{it} \quad (8)$$

%Δ*PRC4* = Percentage change in price per share over the 12 months ending four months after the fiscal year end of year t;

Δ(P/S_PS) = Change in P/S Ratio divided by shares outstanding at the end of year t;

Δ*EPS* = Change in basic earnings per share before extraordinary items for year t;

Δ*BVPS* = Change in book value of equity per share at the end of year t; and

LAGPRC4 = Price per share measured twelve months before the date of measurement of PRC4.

To gain more insight into the value relevance of the quantity disclosures, we estimate additional regressions that examine the separate effects of production and sales quantity data. In particular, in Eq. (8), we replace the change in P/S ratio with percentage change in production quantities and percentage change in sales quantities. Recall that firms disclose information that allows investors to infer segment-level average margin per unit, selling price, and cost per unit. Hence, we also examine how investors price each of these three drivers of profitability. We do so by augmenting Eq. (8) with the average percentage change in margin per unit, percentage change in selling price per unit, and percentage change in cost per unit.

5. Sample and Data Description

5.1 Sample Selection

We collect annual financial statement data, stock prices, and quantity disclosures from the Prowess Database of CMIE Private Limited. Quantity disclosures are available for sufficiently large sample of firms only from 1996. As discussed earlier, the last fiscal year for which mandated disclosure of quantity data was required was 31st March, 2011. In light of this and because some of our tests predict future values of selling prices, costs, and profitability, the last year in our sample period is March 31st 2010.

We start with the sample of all manufacturing firms in the Prowess Database for the years 1996-2010 (34,203 firm-years). We exclude firm-years with fiscal year changes (n=2,173) and those with missing financial statement data (n=3,927), missing stock price data (n=9,797), and missing quantity data (n=1,087). We also exclude a relatively small set of firm-years with P/S ratios greater than two (n=199); we do so because we suspect that these represent data errors. Our final sample consists of 2,079 firms spanning 16,980 firm-years and 49,626 segment-firm-years. While the valuation model using a levels specification is

based on this sample, other analyses uses smaller samples because of more restrictive data requirements. For example, the analysis of unit selling price and cost data requires data for three consecutive years for all variables. Table 1 contains our sample selection process.

{Insert Table 1 about here}

5.2 Data Description

We provide descriptive statistics in Table 2. All variables used in the regressions are winsorized at the 1st and 99th percentiles. The mean (median) market capitalization is INR 7,337 Million (INR 243.4 Million), suggesting significant right skewness. Mean (median) book value of equity is INR 2,618.2 Million (INR 300.4 Million), yielding a mean (median) market-to-book ratio of 2.1 (0.7). As a benchmark, mean (median) market-to-book ratio for U.S. firms for 1962-2007 is 2.4 (1.6) (McNichols, Rajan, and Reichelstein, 2010). Sample firms are profitable on average, with mean (median) PATEI of INR 395.2 Million (INR 18.1 Million) and mean (median) return on assets of 2.3% (2.9%). Darrough and Ye (2007) report mean (median) ROA of 2.2% (4.2%) for all U.S. firms for the years 1975-2002.

{Insert Table 2 about here}

Mean and median of firm-level average P/S ratio is close to 1 and ranges from 0.27 to 1.46. The number of segments for which the average P/S ratio is calculated ranges from one to thirteen, with an average of 2.9. In general, production and sales quantities are growing over the sample period, with sales growing faster than production. Mean percent change in production quantities is 2.9 percent and that of sales quantities is 3.8 percent. Selling prices and per unit costs are also growing in our sample period, with mean growth for the former being 2.0 percent and that for the latter being 2.3 percent. Consequently, mean growth in margin per unit is negative at -0.3 percent.

6. Empirical Results

We report the results of estimation of the determinants of percentage changes in cost per unit, selling price per unit, margin per unit, and units sold in Table 3. Panel A contains the results where a firm-segment-year is the unit of observation and Panel B contains the results where a firm-year is the unit of observation. The data for firm-year regressions are computed by averaging all variables across segments within each firm-year. As discussed in section 4, all regressions include firm, year, and industry fixed assets and standard errors are adjusted for two-way clustering – in Panel A, clustering is across firm-segments and years and in Panel B it is across firms and years. All regression variables are winsorized at the 1% and 99% levels.

{Insert Table 3 about here}

We first discuss the firm-segment level results in Panel A. In the percentage change in cost regression, the coefficient on P/S ratio is negative and significant consistent with absorption costing effects. A one percent increase in P/S ratio is associated with a 0.28 percent decrease unit change in costs. The coefficient on the lagged P/S ratio is positive, as predicted, but not statistically significant at the 10% level. Thus, our evidence on absorption costing related reversals is somewhat weak. Consistent with the idea that economies of scale can be associated with lower costs, we find that an increase in percent change in production is associated with declines in per unit cost changes (t-statistic = -2.29). Interestingly, the coefficient on the lagged percent change in cost is negative and significant, indicating that changes in costs are highly transitory. An increase in costs in one year is associated with declines in the following year.

An increase in P/S ratio has a significant negative effect on future selling prices, with a one percent increase in the former in year t being associated with a 0.22 percent decline in the latter. Thus, in general, firms that produce in excess of sales are forced to lower their

selling prices in the future to "push out" inventory. Surprisingly P/S ratio is positively and significantly associated with contemporaneous sales prices changes. The coefficient on quantity sales growth is negative and significant; this suggest that, on average, sample firms face negative price elasticity and are able to sell more only by lowering prices. As with costs, selling price changes are highly transitory.

The results of the effect of P/S ratio on changes in margin per unit combine the effects of absorption costing and selling price changes. P/S ratio has a positive effect on contemporaneous margin changes and a negative effect on future margin changes. A one percent increase in P/S ratio is associated with a 0.36% increase in current margins (t-statistic = 7.8) and a 0.21% decline in future margins (t-statistic = -4.8). Thus, overproduction can serve well as a short-term earnings management tool, with predictable one-year-ahead reversals. We also find that growth in units sold has a negative impact on margin changes (t-statistic = -3.08)

The last column in Panel A contains the results for percent growth in quantity sold. As expected, an increase in P/S ratio is positively related with future growth in sales; firms are able sell production in excess of sales within a year. Further, sales growth changes are highly transitory. For U.S. firms, Chan, Karceski, and Lakonishok (2003) document that growth in dollar value of sales is rapidly mean-reverting. Hence, our Indian evidence on sales growth and selling prices is consistent with the U.S. evidence.

The firm-level results in Panel B broadly mirror those in panel A. Consistent with absorption costing effects, increases in P/S ratio are associated with declines in contemporaneous change in cost per unit. The effect of P/S ratio on future cost changes is positive but not significant at the 10% level. P/S ratio is associated with significant declines in future selling prices, suggesting that it is an indicator of negative demand shocks. Increasing P/S ratio improves contemporaneous margins, but leads to declines in future

margin changes. In particular, a one percent increase in P/S ratio is associated with a 0.14% increase in firm-level margin changes in the same year (t-statistic = 3.11) and 0.07% decline in future firm-level margin changes (t-statistic = -1.75). The last column in Panel B, reports the effect of P/S ratio on current and future bottom-line profitability, measured as change in PATEI deflated by sales. Consistent with the effect on margins, P/S ratio positively influences current profitability (t-statistic = 2.55) and is a negative leading indicator of future profitability (t-statistic = -2.62). Surprisingly, in contrast to the segment-level results, growth in units sold has a *positive* impact on margin changes (t-statistic = 2.03).

Overall, P/S ratio contains useful information related to costs, selling prices and margins. Its increase is associated with reduction in costs and an inexplicable increase in selling prices and hence a net improvement in margins and profitability. However, these effects are short-lived. An increase in P/S ratio results in an increase costs in the next year (though not significant) and in declining selling prices and margins. Thus, a high P/S ratio is a negative leading indicator for future profitability.

In Table 4, we report the results on the effect of P/S ratio on market capitalization and share prices. In Panel A, we present the market capitalization regression. Of primary interest to us is the negative coefficient on P/S ratio (t-statistic = -1.95). Consistent with the idea that an increase in P/S ratio is a negative leading indicator of firm profits, investors appear to negatively value over-production. Consistent with research on U.S. stocks, both net income (PATEI) and book value of equity load positively in the market capitalization regression. Panel B reports the results when all variables are deflated by shares outstanding as a robustness check. Again, P/S ratio has a negative effect on share prices (t-statistic = -2.38).

{Insert Table 4 about here}

Table 5 contains the results of the association between percentage change in share prices and the change in P/S ratio. By using a first difference specification we reduce the

impact of time-invariant omitted variables. Consistent with the results for the levels model, the change in P/S ratio is negatively associated with stock returns (t-statistic = -1.77); investors are pessimistic about firms that experience increases in P/S ratio. Changes in earnings per share are positively associated with stock returns. However changes in book value per share do not influence stock returns. Because book value changes represent a combination of share issues share repurchases, profits, and dividends, further analysis is needed to understand the reasons for the lack of association.

{Insert Table 5 about here}

In the remaining columns in Table 5, we examine the impact of growth in units produced and sold separately. Further, we evaluate how the market interprets data on changes in average selling prices and costs per unit. While percentage change in units produced is negatively associated with stock returns (t-statistic = -2.13), change in units sold is viewed as appositive signal by the market (t-statistic = 1.96). When we add the percent change in margin per unit as an explanatory variable, we find that it is not significantly related to stock returns. Recall that we find that changes in margin per unit are transitory in Table 3, with increases in margins resulting in subsequent reversals. The valuation of the margin changes by the market appears to be consistent with its viewing margin changes as transitory. The last column indicates that changes in selling prices are also not considered as value-relevant by investors (t-statistic = 1.17); this is consistent with the transitory nature of these changes. However, surprisingly, we find that percentage changes in cost per unit is positively and significantly related to stock returns (t-statistic = 1.68). We intend to investigate this anomalous result in future research.

To summarize, our market capitalization and stock return regressions suggest that investors view an increase in P/S ratio as a negative signal. Because increases in P/S ratio can temporarily boost short-term earnings, one interpretation of this result is that investors

view increases in P/S ratio as an indicator of poor earnings quality. A second interpretation is that, even absence earnings manipulation, a high P/S ratio is viewed as a signal of a negative demand shock. More research on the relative importance of these alternate explanations is a promising area for future research.

7. Conclusion

Prior research, based on U.S. firms, has studied the effect of inventory changes on current and future profitability and market valuation (Bernard and Noel, 1991; Lev and Thiagarajan, 1993; Jiambalvo, Noreen, and Shevlin, 1997; Gupta, Pevzner, and Seethamraju, 2010). Because inventory changes equal the difference between production and sales, this research effectively studies the implications of the difference in the dollar cost of production and sales. Our analysis complements and extends this work by employing a unique data set of annual units produced and sold at the segment level for a broad sample of Indian manufacturing firms. Besides the quantity data that is explicitly disclosed, we are also able to impute the values of average per unit costs and selling prices. Consequently, we are able to perform a more detailed component-wise analysis of the information contained in firm production, selling, costing, and pricing decisions.

We find that the ratio of units produced to units sold contains useful information related to costs, selling prices and margins. Its increase is associated with reduction in costs and an inexplicable increase in selling prices and hence a net improvement in margins and profitability. However, these effects are short-lived. An increase in P/S ratio results in an increase costs in the next year (though not significant) and in declining selling prices and margins. Thus, a high production-to-sales ratio is a negative leading indicator for future profitability.

We also document that information on the ratio of units produced to sold has incremental information content for stock prices (over and above net profit and book value of equity). Firms that produce in excess of sales are valued negatively by investors. Because overproduction temporarily boosts short-term earnings, one interpretation of this result is that investors view increases in production-to-sales ratio as an indicator of poor earnings quality. A second interpretation is that, even absence earnings manipulation, high production-to-sales ratios is viewed as a signal of a negative demand shock. More research on the relative importance of these alternate explanations is a promising area for future research.

Our research raises other interesting questions for further study. Do managers manipulate production levels to boost short-term earnings? How do governance and ownership by promoters and institutions influence the incentive to over-produce? We intend to explore these questions in future research.

Appendix I

Mandated Disclosures for production, sales, and opening and ending inventories under Schedule VI of the Companies Act, 1956

Item #3 (relevant provisions italicized):

The profit and loss account shall set out the various items relating to the income and expenditure of the company arranged under the most convenient heads; and in particular, shall disclose the following information in respect of the period covered by the account:

(i)

(a) The turnover, that is, the aggregate amount for which sales are effected by the company, giving the amount of sales in respect of each class of goods dealt with by the company, and indicating the quantities of such sales for each class separately.

(b) Commission paid to sole selling agents within the meaning of section 294 of the Act.

(c) Commission paid to other selling agents

(d) Brokerage and discount on sales, other than the usual trade discount.

(ii)

(a) In the case of manufacturing companies, -

(1) The value of the raw materials consumed, giving item-wise break-up and indicating the quantities thereof.

(2) The opening and closing stocks of goods produced, giving break-up in respect of each class of goods and indicating the quantities thereof.

Item # 4C

In the case of a manufacturing companies, the profit and loss account shall also contain, by way of a note in respect of each class of goods manufactured, detailed quantitative information in regard to the following, namely :-

(a) the licensed capacity (where license is in force);

(b) the installed capacity; and

(c) *the actual production.*

Appendix II

Relevant portion of AS-2, Accounting Standard on Inventories, issued by the Institute of Chartered Accountants of India

AS-2 was issued in June 1981, and revised in 1999. Below, we reproduce the text of the standard that relates to fixed overhead absorption:

"The allocation of fixed production overheads for the purpose of their inclusion in the costs of conversion is based on the normal capacity of the production facilities. Normal capacity is the production expected to be achieved on an average over a number of periods or seasons under normal circumstances, taking into account the loss of capacity resulting from planned maintenance. The actual level of production may be used if it approximates normal capacity. The amount of fixed production overheads allocated to each unit of production is not increased as a consequence of low production or idle plant. Unallocated overheads are recognised as an expense in the period in which they are incurred. In periods of abnormally high production, the amount of fixed production overheads allocated to each unit of production is decreased so that inventories are not measured above cost. Variable production overheads are assigned to each unit of production on the basis of the actual use of the production facilities."

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Table 1

Sample Selection

	Firms	Firm-Years	Firm-Product-Years
Initial sample	2,654	34,203	
Less: fiscal year changes		2,173	
Less: firm years with missing data (sales, book value of equity, assets, profit after tax but before extraordinary items (PATEI), lag sales, lag book value of equity, lag assets, lag PATEI, or shares outstanding)		3,927	
Less: missing stock price data		9,797	
Less: missing quantity data		1,087	
	2,092	17,179	53,617
Less: exclude production sales ratio > 2 (segment level)	13	199	3,991
	2,079	**16,980**	**49,626**

Table 2

Descriptive Statistics

	# obs.	Mean	Median	Std. Dev.	P1	P99
Market Capitalization*	16,980	7,337.2	243.4	62,776.8	5.0	151,559.9
Book Value of Equity*	16,980	2,618.2	300.4	20,859.3	-1,294.4	40,932.3
Market-to-Book ratio	16,980	2.1	0.7	63.2	-3.3	15.4
Profit after Tax but before Extraordinary Items*	16,980	395.2	18.1	3721.5	-819.6	8,152.4
Return on Assets (%)	16,980	2.3	2.9	10.1	-34.2	24.3
Total Assets*	16,980	7,189.9	1,032.9	48,515.0	44.9	102,421.0
Sales*	16,980	7,872.9	1,030.6	69,127.5	13.0	94,647.0
Price per Share	16,980	118.3	23.9	419.1	1.0	1555.1
Book Value per Share	16,980	67.9	32.5	255.0	-72.7	561.8
Earnings per Share	16,980	7.0	2.4	36.4	-37.8	87.7
Mean Production-to-Sales Ratio	16,980	0.98	1.00	0.18	0.27	1.46
Number of segments per firm-year	16,980	2.9	2.0	2.6	1.0	13.0
Change in Price (%)	16,952	88.2	0.9	2680.7	-94.7	2478
Change in Earnings per Share	16,966	-3.4	0.2	420.8	-51.7	43.9
Change in Book Value per Share	16,966	-65.8	1.5	8,624.0	-116.1	103.7
Mean % Change in Production Quantities	16,434	2.9	3.5	27.3	-77.2	73.9
Mean % Change in Sales Quantities	16,400	3.8	4.2	26.3	-70.0	73.6
Mean % Change in Sales Price per Unit	16,642	2.0	1.8	18.3	-53.6	54.3
Mean % Change in Cost per Unit	14,341	2.3	1.7	23.3	-65.3	70.5
Mean % Change in Margin per Unit	14,015	-0.3	-0.04	24.9	-73.0	72.9

* Numbers are reported in millions of INR

Table 3

Effects of Production-to-Sales Ratios on % Change in Mean Per Unit Cost, Selling Price, Margins, and Sales Quantity Growth

Panel A: Unit of Observation = Firm-Product-Year (example: ABB Ltd, Abrasives, 2003)

	% Change in Cost		% Change in Selling Price		% Change in Margin		% Change in Quantity Sold	
	Coef.	t-statistic (p-value)	Coef.	t-statistic (p-value)	Coef.	t-statistic (p-value)	Coef.	t-statistic (p-value)
Intercept	0.374	3.31 (0.00)	0.97	0.91 (0.36)	0.180	0.72 (0.47)	0.006	0.004 (1.00)
Lagged Dependent Variable	-0.231	-12.92 (0.00)	-0.235	-15.85 (0.00)	-0.358	-21.10 (0.00)	-0.165	-19.85 (0.00)
Current P/S Ratio	-0.280	-11.10 (0.00)	0.108	4.45 (0.00)	0.357	7.80 (0.00)		
Lagged P/S Ratio	0.043	1.19 (0.23)	-0.222	-7.52 (0.00)	-0.208	-4.80 (0.00)	0.416	11.24 (0.00)
% Change in Production	-0.023	-2.29 (0.02)						
% Change in Quantity Sold			-0.191	-33.84 (0.00)	-0.067	-3.08 (0.00)		
Adjusted R^2		2.11%		12.79%		5.55%		1.75%
# of obs.		25,684		25,684		25,684		25,684

(Table continued)

Panel B: Unit of Observation = Firm-Year (example: ABB Ltd, 2003);
Per Unit Margins, Selling Prices, and Costs are averaged across products for each firm-year

	% Change in Cost		% Change in Selling Price		% Change in Margin		% Change in Quantity Sold		Change in PATEI/Sales	
	Coef.	t-statistic (p-value)	Coef.	t-statistic (p-value)	Coef.	t-statistic (p-value)	Coef.	t-statistic (p-value)	Coef.	t-statistic (p-value)
Intercept	0.249	2.13 (0.03)	-0.436	-0.42 (0.67)	0.116	1.65 (0.10)	1.033	1.25 (0.21)	-0.017	-0.94 (0.35)
Lagged Dependent Variable	-0.115	-3.65 (0.00)	-0.127	-1.56 (0.12)	-0.065	-3.76 (0.00)	-0.084	-2.91 (0.00)	-0.258	-7.86 (0.00)
Current P/S Ratio	-0.260	-3.17 (0.00)	0.393	2.37 (0.02)	0.135	3.11 (0.00)			0.021	2.55 (0.01)
Lagged P/S Ratio	0.156	1.61 (0.11)	-0.373	-2.02 (0.04)	-0.065	-1.75 (0.08)	0.259	0.78 (0.44)	-0.028	-2.62 (0.01)
% Change in Production	0.009	1.51 (0.13)								
% Change in Quantity Sold			-0.015	-2.12 (0.03)	0.009	2.03 (0.04)				
Adjusted R^2		1.55%		1.06%		3.79%		0.61%		3.72%
# of obs.		11,242		11,242		11,242		11,242		11,242

In panel A, standard errors are adjusted for clustering by firm-segment and year and in panel B, standard errors are adjusted for clustering by firm and year. Firm-segment (Firm) fixed effects, year effects, and industry effects are included in all regressions in Panel A (B), but not reported to conserve space. All variables are winsorized at 1% and 99% levels.

Table 4

Valuation Regressions

Panel A: Dependent Variable - Market capitalization four months after fiscal year end date		
	Coef.	t-stat (p-value)
Intercept	59.99	0.05 (0.96)
Book Value of Equity	1.20	8.03 (0.00)
Profit After Tax, Before EI and PPI	9.29	10.20 (0.00)
Mean Production to Sales ratio	-819.90	-1.95 (0.05)
Shares Outstanding	0.00	7.21 (0.00)
# of Obs.		16,980
Adjusted R^2		72.31%

Panel B: Dependent Variable - Price per share four months after fiscal year end date		
	Coef.	t-stat (p-value)
Intercept	71.96	3.64 (0.00)
Book Value of Equity per share	0.93	8.56 (0.00)
Profit After Tax, Before EI and PPI per share	4.80	9.77 (0.00)
Mean Production to Sales ratio per share	-8.17	-2.38 (0.02)
# of Obs.		16,980
Adjusted R^2		59.30%

Standard errors are adjusted for clustering by firm and year to control for cross-sectional and time-series correlation. Firm effects, year effects, and industry effects are included in all regressions, but not reported to conserve space. All variables are winsorized at 1% and 99% levels.

Table 5

Return Regressions

Dependent Variable: Annual Percentage Change in Price ending four months after fiscal year end

	Coef.	t-stat (p-value)	Coef.	t-stat (p-value)	Coef.	t-stat (p-value)	Coef.	t-stat (p-value)
Intercept	0.734	3.20 (0.00)	0.794	3.58 (0.00)	0.796	3.55 (0.00)	0.813	3.67 (0.00)
Change in EPS	0.252	3.17 (0.00)	0.248	3.20 (0.00)	0.247	3.22 (0.00)	0.238	3.32 (0.00)
Change in BVPS	0.037	0.90 (0.37)	0.033	0.85 (0.40)	0.034	0.85 (0.40)	0.030	0.81 (0.42)
Change in Mean ΔProduction-to-Sales ratio	-0.010	-1.77						
Mean % Change in Production Quantities			-0.007	-2.13 (0.03)	-0.007	-2.06 (0.04)	-0.008	-1.93 (0.05)
Mean % Change in Sales Quantities			0.013	1.96 (0.05)	0.013	1.92 (0.05)	0.015	1.83 (0.07)
Mean % Change in Margin per Unit					0.001	0.31 (0.76)		
Mean % Change Sales Price per Unit							0.011	1.17 (0.24)
Mean % Change in Cost per Unit							0.002	1.68 (0.09)
# of obs.		13,616		13,616		13,616		13,616
Adjusted R^2		23.00%		23.05%		23.05%		23.14%

Standard errors are adjusted for clustering by firm and year to control for cross-sectional and time-series correlation. Firm effects, year effects, and industry effects are included in all regressions, but not reported to conserve space. The dependent variable is the 12-month percentage change in price per share, where share price is measured four months after the fiscal year end date. All independent variables are scaled by lagged price per share, consistent with the deflator of the dependent variable. All variables are winsorized at 1% and 99% levels.