

The Impact of Product Costing Choices on Profitability Being Reported in the Current Operating Environment among Stock Exchange of Thailand Listed Manufacturing Companies 2003-2011

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ABSTRACT

It has widely been acknowledged that net income under absorption costing can be different from that which would have been under variable costing. The proportion of fixed manufacturing overhead to total manufacturing costs and inventory adjustment are the two factors that explain the difference between net incomes under the two product costing methods. It is questionable whether recent changes in manufacturing environment where companies are likely to be increasingly capital intensive have driven net income differential to become greater than what it has been in the past. This, however, may also be mitigated by Just-in-Time (JIT) philosophy, an influential management concept embraced widely around the world. This study is, therefore, timely as the collapse of many companies has recently drawn a greater attention to the quality of net incomes. It aims to examine the impact of product costing choices on reported profitability in the current operating environment by (1) examining whether manufacturing companies have been increasingly capital intensive; (2) examining whether JIT philosophy has had

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an impact on how they manage their inventories; (3) examining whether net income differential as a percentage of sales has increased significantly over time; and (4) examining relative impact of capital intensity and the degree to which companies embraced JIT philosophy on profitability differentials over the period studied. The examination was conducted on the Stock Exchange of Thailand listed manufacturing companies in three industries during 2003–2011. The evidence in this study is important as it is generally assumed that JIT philosophy plays an important role in reducing net income differential and provides further support to accounting standard setters in mandating absorption costing in the light of recent changes in current operating and manufacturing environment.

Keywords: Product Costing, Absorption Costing, Inventory, Impact, Manufacturing Companies, Thailand

บทคัดย่อ

เป็นที่ยอมรับกันโดยทั่วไปว่า กำไรสุทธิภายใต้วิธีการบัญชีต้นทุนรวมอาจแตกต่างไปจากกำไรสุทธิภายใต้วิธีการบัญชีต้นทุนผันแปร ผลต่างของกำไรสุทธิภายใต้วิธีการบัญชีที่ใช้ในการคำนวณต้นทุนของผลิตภัณฑ์ทั้งสองวิธีจะมากหรือน้อยขึ้นกับปัจจัย 2 ประการ ได้แก่ อัตราส่วนค่าใช้จ่ายการผลิตเพื่อต้นทุนการผลิตรวม และการเปลี่ยนแปลงของสินค้าคงเหลือ การเปลี่ยนแปลงของสภาพแวดล้อมด้านการผลิตในช่วงเวลาไม่นานมานี้ ที่มีการใช้เครื่องจักรในกระบวนการผลิตมากขึ้นและมีผลทำให้ค่าใช้จ่ายการผลิตคงที่กลายเป็นต้นทุนการผลิตที่มีสัดส่วนสูงขึ้น ทำให้เกิดประเด็นที่ควรศึกษาว่ากำไรสุทธิภายใต้วิธีการบัญชีที่ใช้ในการคำนวณต้นทุนของผลิตภัณฑ์ทั้งสองวิธีมีความแตกต่างกันมากกว่าที่เคยเป็นในอดีตหรือไม่ อย่างไรก็ตาม แนวคิดการผลิตแบบทันเวลาที่มีการนำไปใช้อย่างแพร่หลายทั่วโลก อาจมีส่วนช่วยให้ผลกระทบดังกล่าวบรรเทาลง งานวิจัยฉบับนี้จึงถือได้ว่าจัดทำขึ้นในเวลาที่เหมาะสมกับสภาวะแวดล้อมที่เปลี่ยนไป และมีวัตถุประสงค์เพื่อศึกษาถึงผลกระทบของวิธีการบัญชีที่ใช้ในการคำนวณต้นทุนผลิตภัณฑ์ต่อความสามารถในการทำกำไรที่รายงานในสภาวะแวดล้อมในสถานการณ์ปัจจุบัน โดย (1) ศึกษาว่ากิจการผลิตมีการใช้เครื่องจักรในการผลิตมากกว่าในอดีตหรือไม่ (2) ศึกษาว่าแนวคิดการผลิตแบบทันเวลามีผลกระทบต่อการจัดการสินค้าคงคลังของกิจการผลิตหรือไม่ (3) ศึกษาว่าผลต่างของกำไรสุทธิเมื่อคิดเป็นร้อยละของรายได้จากการขายเพิ่มขึ้นอย่างมีนัยสำคัญเมื่อเวลาผ่านไปหรือไม่ และ (4) ศึกษาถึงผลกระทบของการใช้เครื่องจักรในการผลิตและแนวคิดการผลิตแบบทันเวลาต่อผลต่างของความสามารถในการทำกำไรที่รายงานในช่วงเวลาที่ทำการศึกษา กลุ่มตัวอย่างใช้ในการศึกษา คือ กิจการผลิตที่เป็นบริษัทจดทะเบียนในตลาดหลักทรัพย์แห่งประเทศไทยใน 3 อุตสาหกรรม ระหว่างปี พ.ศ. 2546 ถึง 2554 ผลการศึกษาให้หลักฐานและประจักษ์ที่สำคัญ เนื่องจากมักมีการกล่าวว่าแนวคิดการผลิตแบบทันเวลามีบทบาทที่สำคัญในการลดผลต่างของกำไรสุทธิที่รายงานภายใต้วิธีการบัญชีที่ใช้ในการคำนวณต้นทุนผลิตภัณฑ์ทั้งสองวิธี และเป็นหลักฐานเชิงประจักษ์ที่ยังคงสนับสนุนการกำหนดให้ใช้วิธีการบัญชีต้นทุนรวมสำหรับการเปิดเผยข้อมูลต่อบุคคลภายนอกในสภาวะแวดล้อมการดำเนินงานและการผลิตที่เปลี่ยนแปลงไปในปัจจุบัน

คำสำคัญ: การคำนวณต้นทุนของผลิตภัณฑ์ วิธีการบัญชีต้นทุนรวม สินค้าคงเหลือ ผลกระทบ กิจการผลิต ประเทศไทย

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INTRODUCTION

Two product costing methods commonly used in manufacturing companies are: absorption costing and variable costing. The difference between the two methods is that absorption costing treats fixed manufacturing overhead as part of product cost while variable costing treats it as period cost. The difference in the treatment of fixed manufacturing overhead creates the possibility that the two product costing methods produce different net incomes. The appropriateness of treating fixed manufacturing overhead as part of product cost under absorption costing was one of the controversial areas debated extensively in accounting literature during the 1950s and 1960s (Baxendale et al., 2006). The debates have been resolved on logical grounds in favor of absorption costing (Dugdale and Jones, 2003). In the past when direct labor made up a large portion of total manufacturing costs, the impact of product costing choices on net incomes being reported may not have been substantial in 1950s (Foster and Baxendale, 2008).

However, the collapse of many large companies around the world and the current manufacturing

environment where fixed manufacturing costs have gained its significance have raised an important question whether net income differential between the two product costing methods has now become greater than what it has been in the past. The collapse of many companies has indicated that management are under pressure to meet investors' financial performance expectations, which has recently drawn a greater attention to the quality of net incomes. In the last two decades, the manufacturing processes have become increasingly automated as a result of advances in technology and global competition (Weygandt et al., 2012). Fixed manufacturing overhead has become a significant portion of total manufacturing costs. This has raised an important contemporary question whether fixed manufacturing overhead being shifted between periods has become greater. However, since the early 1980s, Just-in-Time (JIT) system has been widely adopted (Huson and Nanda, 1995). In JIT system, inventories are kept to a minimum or even at zero. With little or no inventories, changes in inventories will be minimal and fixed manufacturing overhead shifted between periods under absorption costing will be trivial. Under JIT system, the distortions of income that can occur under absorption costing will largely disappear (Garrison et al., 2008). The two product costing methods would yield net incomes that are not much different.

From the discussion above, it can be seen that the pressure to meet investors' financial expectation and the greater capital intensity as indicated by the greater proportion of fixed

manufacturing overhead to total manufacturing costs may have made net income differential to become greater than what it has been in the past while JIT system tends to minimize net income differential under the two methods. This study aims to examine the impact of product costing choices on profitability in the current operating environment by (1) examining whether manufacturing companies have been increasingly capital intensive; (2) examining whether JIT philosophy has had an impact on how the sample companies manage their inventories; (3) examining whether net income differential as a percentage of sales has increased over time; and (4) examining relative impact of capital intensity and the degree to which companies embraced JIT philosophy on profitability differentials over the period studied.

The results of this study provide several important contributions. Firstly, it provides evidence as to the trend of fixed manufacturing overhead, inventory levels companies maintain to support their sales, and the impact of product costing choices on profitability being reported of Stock Exchange of Thailand (SET) listed manufacturing companies from the year 2003 to the year 2011. Secondly, it sheds light on relative effects of proportion of fixed manufacturing overhead to total manufacturing costs and the degree to which companies embraced JIT philosophy on profitability differentials over the nine years studied. This provides contemporary evidence as to which of the two factors drives profitability differentials to a greater extent.

The remainder of this paper firstly presents literature review. Then, research methodology used in this study is outlined, followed by the results of the study. Finally, it discusses the results and implications of the study.

LITERATURE REVIEW

1. Product Costing Choices and Its Impacts on Net Income Being Reported

Two product costing methods commonly used in manufacturing companies are absorption costing and variable costing. Absorption costing is used for determining product costs and cost of goods sold for external financial reporting in manufacturing companies. It treats both variable and fixed manufacturing costs as product costs. This is in contrast to variable costing, under which only variable manufacturing costs are treated as product costs. Fixed manufacturing overhead is treated as a period cost and is charged off in its entirety against revenue in the period in which they occurred.

The difference in how they treat fixed manufacturing overhead costs may lead to different net incomes reported under absorption costing and variable costing. When the number of units manufactured equals the number of units sold, net income under variable costing is equal to net income under absorption costing. When the number of units manufactured exceeds the number of units sold, net income under absorption costing will be greater than net income under variable costing. This is due to the fact that some of the goods manufactured during the period have not been sold. Fixed manufacturing overhead

costs incurred during the period would not be expensed in entirety in the period in which they incurred. Some remain in ending inventories, which are shown in the statement of financial position. On the contrary, when the number of units manufactured is less than the number of units sold, net income under absorption costing will be less than net income under variable costing. In this case, some of the goods manufactured in prior periods were sold in the current period. Fixed manufacturing overhead in the beginning inventories were, therefore, expensed in the current period in addition to that in the products manufactured and sold during the period.

The differences between net income under absorption costing and net income under variable costing can be calculated using a one-line adjustment proposed by Solomons (1965, p.111–112) as follows:

$$NI_{V,i,t} = NI_{A,i,t} + (BINV_{i,t} - EINV_{i,t}) \times \frac{X_{i,t}}{Y_{i,t}}$$

Where $NI_{V,i,t}$ is net income before tax of company i at time t under variable costing; $NI_{A,i,t}$ is net income before tax of company i at time t , under absorption costing; $BINV_{i,t}$ is beginning inventory based on absorption costing of company i at time t ; $EINV_{i,t}$ is ending inventory based on absorption costing of company i at time t ; $X_{i,t}$ is fixed manufacturing costs of company i at time t ; and $Y_{i,t}$ is total manufacturing costs of company i at time t .

2. Just in Time System

JIT system was first introduced at the Toyota Motor plant in the mid-1970s (Biggart and Gargeya, 2002). There has been a lack of consensus concerning what JIT system means (Pamartou et al., 1995). JIT system has been referred to by many names and can be viewed as either a philosophy or a disciplined method of production (Biggart and Gargeya, 2002). JIT system is generally referred to as a manufacturing system for achieving excellence through continuous improvements in productivity and elimination of waste (Bigart and Grageya, 2002; Fullerton and McWaters, 2001).

Traditionally, inventory is often carried to as a buffer to satisfy customers' demand when production is interrupted from machine breakdowns, late deliveries, manufacturing schedule changes, and unexpected scrap and rework (Reeve and Warren, 2008). However, JIT views inventory as wastes that hide these underlying production problems (Reeve and Warren, 2008). Keeping inventory to a minimum forces companies to remove these production problems. In order to reduce inventory level, the speed of production needs to be improved. This can be achieved through reducing setup time (Horngren et al., 2009). When setup time is short, products will be manufactured in smaller batches, which reduce inventory level and enhance the company's responsiveness to uncertainty in demand (Horngren et al., 2009). The speed of production can also be improved through reducing lead time. Production is organized in manufacturing cells to minimize unnecessary movement between operations and

material handling costs, thereby reducing lead time, work in process, and production costs (Reeve and Warren, 2008; Horngren et al., 2009).

In JIT system, manufacturing activity at any particular workstation is conducted as soon as the workstation's output is needed by the next workstation (Hilton, 2008; Horngren et al., 2009). Raw materials must be available when they are needed for production without carrying inventories (Mowen and Hansen, 2007; Hilton, 2008). This can be done by negotiating long-term contracts with suppliers, which are selected on the basis of their ability to deliver quality materials when needed (Mowen and Hansen, 2007). Defects arising at one workstation inevitably affect other workstations in the production line (Horngren et al., 2009). This creates urgency for tracing the problems to and solving the problems at workstation where the problems are likely to originate (Horngren et al., 2009). Therefore, workers in JIT production system are trained to be multi-skilled and capable of performing routine equipment maintenance and quality control within their manufacturing cell, rather than rely on centralized service departments (Horngren, et al., 2009; Reeve and Warren, 2008).

As such, JIT system enables companies to lower carrying costs of inventory, improve quality by identifying and prevent the cause of defects and rework, and reducing lead time. In addition, the use of manufacturing cells also makes some costs usually classified as indirect costs directly traceable to specific products (Mowen and Hansen, 2007). For example, the costs of setup, maintenance, and quality inspection become direct costs in JIT

system, thereby reducing manufacturing overhead. It is expected that the greater the degree to which companies embraced JIT philosophy, the less the level of inventory and manufacturing overhead will be. Since inventories in companies using JIT system are minimal, changes in inventories from period to period is unlikely to be significant. Therefore, net income differential under the two product costing methods will be immaterial.

3. Prior Research Examining the Impact of Using Absorption Costing as a Basis for Product Costing in Externally Reported Financial Statements

Accounting literature has widely acknowledged that the two product costing methods can render different net incomes. However, the impact of product costing choices on net income being reported may have not been documented. This may be due to the fact that fixed manufacturing overhead was a small portion of total manufacturing overhead when the merits of the two product costing methods was extensively debated.

Until recently, Pong and Mitchell (2006) explored the impact of absorption costing as a basis for product costing on the reported profitability of UK manufacturing companies from 1988 to 2002 by assessing the sensitivity of these companies' net income to the adoption of the variable costing. They found that the selection of absorption or variable costing as a basis for product costing has a potential important impact on UK manufacturing companies' profitability. Foster and Baxendale (2008) revisited the debate and examined whether the current operating environment has increased

the potential for net income smoothing through production and inventory decisions. However, they did this by comparing the trends of capital intensity, inventory levels, and fixed manufacturing overhead in ending inventories of thousands of active and inactive publicly held U.S. and Canadian companies over a 47-year period from the year 1960 to the year 2005. Yongvanich (2013) examined annual inventory adjustments and their impacts on profitability differentials under the two product costing methods of the SET listed manufacturing companies in three industries from the year 2003 to the year 2011. It also explored whether companies with higher capital intensity tends to have higher annual inventory adjustments. It was found that recent changes in operating and manufacturing environment have not induced management to manage net incomes through inventory and production decisions. This study extends Yongvanich (2013) to examine the impact of product costing choices on net income being reported and profit margin ratio from the year 2003 to the year 2011. This is done by examining the direction and extent of profitability differentials. It also examined relative impacts of capital intensity and JIT philosophy on profitability differentials.

RESEARCH METHODOLOGY

1. Sample Selection and Data Collection

Since absorption costing and variable costing are methods of product costing for manufacturing companies, the sample in this study comprises SET listed manufacturing companies in three industries: Agri-Food Industry, Consumer Products, and

Industrials. The data was collected from financial statements in the SETSMART Advance database developed by the SET.

2. Measurement of Variables

2.1 Capital Intensity

Capital intensity is assessed by the proportion of fixed manufacturing overhead to total manufacturing costs instead of the proportion of fixed manufacturing overhead to costs of goods sold that was used in Foster and Baxendale (2008). The proportion of fixed manufacturing overhead to total manufacturing costs incurred in the manufacturing process is deemed to give a clearer indication of capital intensity as it is not affected by timing of selling goods as the proportion of fixed manufacturing overhead to costs of goods sold. The proportion of fixed manufacturing overhead to costs of goods sold may exhibit an increasing (or decreasing) trends, which gives the readers an impression that capital intensity of sample companies is increasing (or decreasing), while in fact the proportion of fixed manufacturing overhead to total manufacturing costs remains the same.

The data used for the calculation of the proportion of fixed manufacturing overhead to total manufacturing costs are not directly available in external financial statements. Fixed and variable portion of total manufacturing costs are not the information disclosed in the public domain. Consequently, fixed manufacturing overhead was estimated. Depreciation relating to manufacturing should be used as a proxy of fixed

manufacturing overhead. While depreciation is not the only fixed manufacturing overhead, it is the major component of fixed manufacturing overhead and other fixed manufacturing overhead are not generally reported. However, not all companies report depreciation specific to manufacturing. Therefore, total depreciation, which comprises depreciation relating to manufacturing and selling and administrative activities, is used instead to represent the major portion of fixed manufacturing overhead. It is acknowledged that a limitation of this study is that the actual fixed manufacturing overhead is not known. Total manufacturing costs during the period are calculated from the following equations:

$$\text{COGS} = \text{FG}_B + \text{COGM} - \text{FG}_E$$

And,

$$\text{COGM} = \text{WIP}_B + \text{TMC} - \text{WIP}_E$$

Hence,

$$\text{COGS} = \text{FG}_B + \text{WIP}_B + \text{TMC} - \text{WIP}_E - \text{FG}_E$$

and

$$\text{TMC} = \text{COGS} + \text{WIP}_E + \text{FG}_E - \text{WIP}_B - \text{FG}_B$$

Where COGS is the costs of goods sold during the period; WIP_E is ending work-in-process; FG_E is ending finished goods; WIP_B is beginning work-in-process; FG_B is beginning finished goods; TMC is total manufacturing costs during the period, which comprise direct material, direct labour, and manufacturing overhead incurred during the period; and COGM is the costs of goods manufactured during the period.

2.2 JIT Philosophy

The degree to which a company embraced JIT philosophy is measured by ending inventory to sales. Ending inventory may be increasing or held to support changing sales in each period. To measure whether ending inventory is managed to be just enough to support sales, ending inventory must be measured relative to sales. The data collected, therefore, are beginning and ending inventories and sales for each of the nine years studied. It is important to note that only were finished goods and work-in-process used to represent inventory in the calculation of ending inventory to sales and inventory turnover. Raw materials are excluded because the level of raw materials companies hold may be impacted by other factors such as purchasing lead time and discounts being offered.

2.3 Profitability Differential

Profitability differential is the adjustment portion of the equation (1) and (2) illustrated earlier, which are reiterated below.

$$\text{NI}_{V,i,t} = \text{NI}_{A,i,t} + (\text{BINV}_{i,t} - \text{EINV}_{i,t}) \times \frac{X_{i,t}}{Y_{i,t}} \quad \dots(1)$$

$$\frac{\text{NI}_{V,i,t}}{\text{Sales}_{i,t}} = \frac{\text{NI}_{A,i,t}}{\text{Sales}_{i,t}} + \frac{(\text{BINV}_{i,t} - \text{EINV}_{i,t})}{\text{Sales}_{i,t}} \times \frac{X_{i,t}}{Y_{i,t}} \quad \dots(2)$$

The adjustment portion in equation (1) is the difference between net incomes reported under the two methods, while that in equation (2) is net income differential as a percentage of sales. Directions of adjustment in equation (1), which will be the same as that of the adjustment in equation (2), can indicate that net incomes under absorption costing of the companies studied are higher or

lower than those which would have been under variable costing for most companies. Negative (positive) adjustments indicate that companies reported net incomes under absorption costing that are higher (lower) than those that would have been under variable costing.

3. Hypotheses Development and Testing

3.1 Fixed Manufacturing Overhead Trend

As described before, companies are now increasingly implementing new manufacturing technology. This has seen an increase in investment in advanced manufacturing technology and indirect costs supporting automation. It is also expected

that fixed manufacturing overhead has become a greater portion of total manufacturing costs on the SET listed manufacturing companies. To assess whether the sample companies have become more (or less) capital intensive, a paired t-test will be conducted to test whether the average proportion of fixed manufacturing costs to total manufacturing costs at the beginning of the period studied is significantly different from that at the end of the period studied at the five percent level of confidence when examined in aggregate for the total sample and separately for each of the three industries. It was hypothesized that:

$$H1_o: \text{Capital Intensity}_{\text{beginning}} - \text{Capital Intensity}_{\text{ending}} = 0$$

$$H1_a: \text{Capital Intensity}_{\text{beginning}} - \text{Capital Intensity}_{\text{ending}} \neq 0$$

3.2 Effect of JIT Philosophy

In JIT production system, finished products are manufactured when they are needed. Embracing JIT philosophy at a greater degree should result in a decline in finished goods and work-in-process level. Hence, it is expected that ending inventories to sales would decline throughout the period. To assess whether the sample companies have been

increasingly embracing JIT philosophy, a paired t-test will be conducted to test whether average ending inventory to sales at the beginning of the period studied is significantly different from that at the end of the period studied at the five percent level of confidence when examined in aggregate for the total sample and separately for each of the three industries. It was hypothesized that:

$$H2_o: \text{Inventory to Sales}_{\text{beginning}} - \text{Inventory to Sales}_{\text{ending}} = 0$$

$$H2_a: \text{Inventory to Sales}_{\text{beginning}} - \text{Inventory to Sales}_{\text{ending}} \neq 0$$

3.3 Net Income Differential over Time

To assess whether net income differential has increased significantly over time, paired t-tests will be conducted to test whether average net income differential at the beginning of the period studied

is significantly different from that at the end of the period studied at the five percent level of confidence when examined in aggregate for the total sample and separately for each of the three industries. It was hypothesized that:

$$H3_o: \text{Net Income Differentials}_{\text{beginning}} - \text{Net Income Differentials}_{\text{ending}} = 0$$

$$H3_a: \text{Net Income Differentials}_{\text{beginning}} - \text{Net Income Differentials}_{\text{ending}} \neq 0$$

3.4 Net Income Differential as a Percentage of Sales over Time

To assess whether net income differential has increased significantly over time, a paired t-test will be conducted to test whether average net income differential as a percentage of sales at

the beginning of the period studied is significantly different from that at the end of the period studied at the five percent level of confidence when examined in aggregate for the total sample and separately for each of the three industries. It was hypothesized that:

$$H4_o: \text{Net Income Differentials/Sales}_{\text{beginning}} - \text{Net Income Differentials/Sales}_{\text{ending}} = 0$$

$$H4_a: \text{Net Income Differentials/Sales}_{\text{beginning}} - \text{Net Income Differentials/Sales}_{\text{ending}} \neq 0$$

3.5 The Relative Impact of Capital Intensity and the Degree to Which Companies Embraced JIT Philosophy on Profitability Differentials over Time

As indicated earlier, the proportion of fixed manufacturing overhead to total manufacturing costs and annual inventory adjustment are the two factors that determine net income differentials. The analysis in this section examines the relative impact of capital intensity and JIT philosophy on profitability differentials over the period studied. The greater (lower) the level of capital intensity

of companies, the greater (lower) the net income differentials. However, JIT system is a prominent management concept in the past two decades. Embracing JIT philosophy should result in minimal inventory levels and inventory adjustments, thereby mitigating the impact of the choices of product costing. Management should be well aware of the effect of high inventory level and tend to decrease inventory to the levels necessary for sales rather than building up inventory to manage net income. Hence, the greater degree to which companies embraced JIT philosophy into their operations in

each period, the smaller net income differentials will be. Therefore, it is important to examine relative impact of the two factors on profitability differentials over time. To do this, data of nine years were pooled and analyzed by the following multiple regression analysis model:

$$\text{Profitability Differential} = a + b_1(\text{CI}) + b_2(\text{JIT}) + \text{Sales} + e$$

Where CI is measured by the proportion of fixed manufacturing costs to total manufacturing costs. JIT is measured by ending inventory to sales. Profitability differential is measured by each of the following three proxies:

1) the adjustment portion in Solomons' (1965) equation;

$$\frac{(\text{BINV}_{i,t} - \text{EINV}_{i,t}) \times \frac{X_{i,t}}{Y_{i,t}}}{Y_{i,t}}$$

2) the adjustment in item 1) above divided by sales;

$$\frac{(\text{BINV}_{i,t} - \text{EINV}_{i,t}) \times \frac{X_{i,t}}{Y_{i,t}}}{\text{Sales}_{i,t}}$$

It was hypothesized that:

$$\begin{aligned} H5_o: & b = 0 \\ H5_a: & b \neq 0 \end{aligned}$$

RESULTS OF THE STUDY

1. Samples

At the end of the year 2011, there were 153 SET listed companies in the three sectors used as samples of this study: 41, 39, and 73 companies in Agro & Food Industry, Consumer Products, and Industrials, respectively. Non-manufacturing companies, those did not remain listed throughout the period studied, and one company in Industrials industry that was deemed to be an outlier of the data set were excluded, leaving 104 companies in the final sample. Table 1 shows the number of sample companies in each of the three industries.

Table 1 Industries of the Samples

Industry	Number of Companies
Agro & Food Industry	33
Consumer Products	30
Industrials	41
Total	104

2. Descriptive Statistics of Variables of Interest

This section provides descriptive statistics of variables used in the examination of this study, which include the proportion of fixed manufacturing costs to total manufacturing costs, inventory to sales, directions of net income differentials, net incomes differentials, and net income differentials as a percentage of sales.

2.1 The Proportion of Fixed Manufacturing Costs to Total Manufacturing Costs

From Table 2, the average proportion of fixed manufacturing costs to total manufacturing costs

of the total sample decreases consistently from 5.38% in the year 2003 to 4.38% in the year 2011. Average proportion of fixed manufacturing costs to total manufacturing costs of Agro & Foods Industry and Industrials also exhibit similar trends. However, average proportion of fixed manufacturing costs to total manufacturing costs of Consumer Products increases slightly over time.

The decreasing trends of capital intensity of the total sample, Agro & Foods Industry, and

Industrials over the period are in contrary to what has been expected. This is likely to be due to the fact that the nine-year period is too short to observe significant changes in manufacturing technology that causes manufacturing overhead costs to increase and that sample companies may have implemented new manufacturing technology before the year 2003 which is the beginning of the period studied.

Table 2 Descriptive Statistics of the Proportion of Fixed Manufacturing Costs to Total Manufacturing Costs

Year	Average (Median) (%)				Standard Deviation (%)
	Agro & Food Industry	Consumer Products	Industrials	Total	
2003	4.04 (3.46)	5.27 (4.76)	6.54 (6.14)	5.38 (4.77)	3.56
2004	3.98 (3.34)	5.09 (4.51)	5.46 (5.30)	4.88 (4.29)	3.12
2005	4.29 (3.07)	5.09 (4.32)	4.95 (4.62)	4.78 (4.20)	3.21
2006	4.03 (3.17)	4.83 (4.11)	4.88 (4.03)	4.60 (3.85)	3.10
2007	4.11 (3.01)	5.10 (4.77)	5.00 (4.31)	4.74 (4.05)	3.13
2008	3.87 (3.58)	5.54 (4.29)	4.73 (3.93)	4.69 (3.97)	3.28
2009	4.63 (3.65)	6.53 (5.98)	6.24 (5.13)	5.81 (4.71)	4.21
2010	4.04 (3.59)	5.63 (4.32)	5.21 (4.16)	4.96 (3.94)	3.95
2011	3.40 (3.02)	5.51 (4.48)	4.34 (3.98)	4.38 (3.40)	3.97
Standard Deviation (%)	3.17	4.13	3.24	3.54	

2.2 Inventory to Sales

Average inventory to sales of the total sample varies slightly over the nine-year period. When examining average inventory to sales of each industry, average inventory to sales of Agro & Food Industry exhibits a decreasing trend while that

of Consumer Products gradually increases over the period studied. Average inventory to sales of Industrials has increased from the year 2003 to the year 2009 and decline in the last two years.

This suggests that JIT philosophy has an inconsistent impact on the SET listed manufacturing

companies. This is in line with what happened in the U.K. reported in Pong and Mitchell (2006, p.141). This may be attributable to nature of products of the industries. Products of Agro & Foods Industry have shorter lives than those of other industries. This, therefore, creates pressure onto the Agro & Food Industry manufacturers to keep inventory just enough to support sales. Similarly, products of Industrials tend to capture a significant amount of working capital and demand for products is more difficult to forecast than that

of Consumer Products. This also creates greater pressure on manufacturers in this industry than manufacturers in Consumer Products to try to lower inventory. Although it is relatively easier to forecast demands for Consumer Products and make it easier to implement JIT philosophy in the Consumer Products, functionality of the products, economies of scale to be achieved in the supply chain, and lost sales opportunity make it unwise to produce product in a make-to order fashion.

Table 3 Descriptive Statistics of Inventory to Sales

Year	Average (Median (%))				Standard Deviation (%)
	Agro & Food Industry	Consumer Products	Industrials	Total	
2003	10.32 (7.27)	13.93 (11.24)	9.85 (6.14)	11.17 (7.61)	13.38
2004	10.61 (7.92)	12.92 (10.88)	10.60 (6.52)	11.28 (8.16)	12.33
2005	11.05 (7.48)	14.22 (11.07)	11.86 (8.93)	12.28 (9.15)	14.34
2006	9.69 (7.75)	15.87 (9.40)	11.24 (8.04)	12.08 (8.21)	14.35
2007	9.70 (6.71)	14.53 (11.79)	10.48 (7.68)	12.27 (8.34)	15.55
2008	9.29 (5.43)	16.56 (12.24)	10.42 (7.18)	11.83 (7.64)	13.67
2009	9.34 (6.38)	16.97 (13.55)	12.47 (7.79)	12.78 (8.30)	13.14
2010	7.72 (5.55)	16.15 (13.12)	8.73 (5.13)	10.55 (6.75)	11.32
2011	7.31 (5.19)	17.17 (14.22)	9.07 (6.09)	10.85 (7.53)	11.15
Standard Deviation (%)	16.37	16.09	12.39	13.28	

2.3 Net Income Differential

2.3.1 Directions of Net Income Differential

Table 4 reports the number of companies that have negative net income adjustments in each year. It can be seen that there are a greater number of companies having negative adjustments

in the majority of the years studied regardless of whether examining in aggregate or by industry. In other words, companies reported net incomes under absorption costing that are higher than those, which would have been under variable costing are more pervasive.

Table 4 Number of Companies Having Negative Adjustments

Industry	Total	2003	2004	2005	2006	2007	2008	2009	2010	2011
Agro & Food Industry	33	21	23	17	20	14*	22	10*	15*	22
Consumer Products	30	12*	21	19	15	14*	15	10*	21	25
Industrials	41	27	33	21	23	13*	25	9*	26	31
Total	104	60	77	57	58	41*	62	29	62	76

* Less than half of total number of companies in each category.

2.3.2 Average Net Income Differential

Table 5 shows average net income differential, ignoring the direction of net income differential. It can be observed that average net income differential of the total sample and that of each industry increase over time. Also, average net income differential of Industrial is the largest

and that of Consumer Products is the smallest in the majority of the nine years studied. However, this should not be interpreted as that impact of product costing on Consumer Products is relatively smaller than that of the other two industries as sample companies in each industry are of different sizes.

Table 5 Descriptive Statistics of Average Net Income Differential

Year	Average (Median) (Millions Baht)				Standard Deviation (Millions Baht)
	Agro & Food Industry	Consumer Products	Industrials	Total	
2003	2.10 (1.14)	1.64 (0.99)	2.50 (1.30)	2.12 (1.17)	2.50
2004	3.85 (0.77)	2.58 (1.25)	3.98 (1.80)	3.53 (1.35)	6.36
2005	5.95 (1.42)	2.24 (1.52)	5.65 (1.55)	4.76 (1.52)	16.77
2006	4.61 (1.20)	1.80 (1.11)	5.18 (1.26)	4.02 (1.19)	11.13
2007	3.38 (1.37)	1.70 (0.63)	4.66 (0.83)	3.40 (1.01)	9.78
2008	2.67 (1.41)	2.90 (1.56)	4.00 (0.93)	3.26 (1.40)	4.89
2009	2.52 (0.92)	3.20 (0.84)	4.42 (1.53)	3.46 (1.04)	5.73
2010	3.56 (1.06)	4.73 (0.85)	3.52 (1.21)	3.85 (1.05)	8.26
2011	4.52 (1.23)	2.25 (0.89)	3.66 (2.49)	3.50 (1.05)	6.30
Standard Deviation (Millions Baht)	10.30	4.40	9.99	8.88	

2.3.3 Average Net Income Differential as a Percentage of Sales

Taken into account the effect of company size, the impact of the two product costing methods was calculated as a percentage of sales. This also indicates the impact of the two product costing methods on profit margin ratio. Table 6 shows descriptive statistics of average net income differential as a percentage of sales. It can be

observed that the impact of the two product costing methods in Consumer Products is now the largest and that in Agro & Foods Industry is the smallest in the majority of the nine years studied. Also, the impact of the two product costing methods on profit margin ratio of the total sample changes slightly over the period studied, except that in the year 2008 to the year 2010.

Table 6 Descriptive Statistics of Average Net Income Differential as a Percentage of Sales

Year	Average (Median)				Standard Deviation (%)
	Agro & Food Industry	Consumer Products	Industrial	Total	
2003	0.11 (0.04)	0.09 (0.05)	0.11 (0.05)	0.12 (0.05)	0.19
2004	0.15 (0.03)	0.16 (0.05)	0.14 (0.11)	0.18 (0.07)	0.37
2005	0.11 (0.03)	0.14 (0.06)	0.16 (0.09)	0.14 (0.07)	0.20
2006	0.11 (0.03)	0.24 (0.06)	0.15 (0.05)	0.16 (0.05)	0.50
2007	0.08 (0.06)	0.25 (0.06)	0.11 (0.07)	0.14 (0.06)	0.50
2008	0.11 (0.03)	0.18 (0.01)	0.12 (0.05)	0.22 (0.05)	0.96
2009	0.21 (0.03)	0.27 (0.09)	0.32 (0.06)	0.27 (0.06)	0.78
2010	0.14 (0.03)	0.44 (0.07)	0.38 (0.05)	0.32 (0.05)	1.38
2011	0.09 (0.03)	0.17 (0.06)	0.12 (0.08)	0.12 (0.05)	0.25
Standard Deviation (%)	0.85	0.86	0.75	0.68	

3. Hypotheses Testing Results

3.1 Capital Intensity

In order to determine whether there is any significant change in capital intensity over the period studied and reduce the impact of one-year anomalies, average proportion of fixed manufacturing costs to total manufacturing costs was calculated for the 2-year period at

the beginning of the period studied (2003 and 2004) and at the end of the period studied (2010 and 2011). A paired t-test was conducted to test whether the 2-year average proportion of fixed manufacturing costs to total manufacturing costs at the beginning of the period studied is significantly different from that at the end of the period studied when examined in aggregate and

by industry. Table 7 shows the correlations and paired-sample t-test results of 2-year average proportion of fixed manufacturing costs to total

manufacturing costs of the total sample and each of the three industries at the beginning and at the end of the period studied.

Table 7 Correlations and Paired-Sample T-Test Results of 2-Year Average Proportion of Fixed Manufacturing Costs to Total Manufacturing Costs of the Total Sample and Each of the Three Industries at the Beginning and at the End of the Period Studied

Year	Average			
	Agro & Food Industry	Consumer Products	Industrials	Total
$CI_{2003-2004}$	4.01%	5.18%	6.00%	5.13%
$CI_{2010-2011}$	3.72%	5.57%	4.78%	4.67%
Correlation of $CI_{2003-2004}$ and $CI_{2010-2011}$	0.846*	0.227	0.560*	0.532*
$CI_{2003-2004} - CI_{2010-2011}$	0.28%	0.39%	1.22%	0.46%
T Value	1.008	0.439	2.698*	1.406

*significantly different at the 5% level of confidence.

The correlations between 2003–2004 average capital intensity and 2010–2011 average capital intensity both when examined in aggregate and by industry are all positive and significant. This indicates that sample companies which have higher (or lower) capital intensity continue to have higher (or lower) capital intensity. However, the result of paired t-test shows that the 2-year average proportion of fixed manufacturing costs to total manufacturing costs of the total sample at the beginning of the period studied is not significantly different from that at the end of period studied at the five percent level of confidence. When examining the 2-year average proportion of fixed manufacturing costs to total manufacturing costs of each of the three industries, only Industrials

exhibits a significant decrease in capital intensity. As indicated earlier, this may be attributable to the fact that the nine-year period is too short to observe significant changes in manufacturing technology that causes manufacturing overhead costs to increase and that sample companies may have implemented new manufacturing technology before the year 2003 which is the beginning of the period studied.

3.2 Inventory to Sales

In order to determine any significant change in the inventory levels maintained to support sales over the period studied and reduce the impact of one-year anomalies, average inventory to sales was calculated for the 2-year period at the beginning of the period studied (2003 and 2004) and at the end

of the period studied (2010 and 2011). A paired t-test was conducted to test whether the 2-year average inventory to sales at the beginning of the period studied is significantly different from that at the end of the period studied when examined in aggregate and by industry. Table 8 shows the

correlations and paired-sample t-test results of 2-year average inventory to sales of the total sample and each of the three industries at the beginning and those at the end of the period studied.

Table 8 Correlations and Paired-Sample T-Test Results of 2-Year Average Inventory to Sales of the Total Sample and Each of the Three Industries at the Beginning and at the End of the Period Studied

Year	Average			
	Agro & Food Industry	Consumer Products	Industrials	All Three Industries
INV/S ₂₀₀₃₋₂₀₀₄	10.47%	13.43%	10.22%	11.22%
INV/S ₂₀₁₀₋₂₀₁₁	7.51%	16.66%	8.90%	10.70%
Correlation of INV/S ₂₀₀₃₋₂₀₀₄ and INV/S ₂₀₁₀₋₂₀₁₁	0.725*	0.414*	0.778*	0.583*
INV/S ₂₀₀₃₋₂₀₀₄ – INV/S ₂₀₁₀₋₂₀₁₁	2.96%	-3.23%	1.32%	0.53%
T Value	1.817	-1.190	1.092	0.494

* significantly different at the 5% level of confidence.

The correlations between 2003–2004 average inventory to sales and 2010–2011 average inventory to sales both when examined in aggregate and by industry are all positive and significant. This indicates that sample companies which maintain higher (or lower) inventory levels to support sales continue to maintain higher (or lower) inventory levels to support sales. However, the results of paired t-tests show that the 2-year average inventory to sales at the beginning of the period studied is not significantly different from that at the end of the period studied at the five percent level of confidence both when

examined in aggregate and separately by industry. As indicated earlier, it shows inconsistent impacts of JIT philosophy. This is consistent with what happened in the U.K. reported in Pong and Mitchell (2006, p.141). Although there is a greater pressure on manufacturers in Agro & Food Industry and Industrials to embraced JIT philosophy, there still is a significant work to be done.

3.3 Net Income Differential over Time

In order to determine any significant change in net income differential over the period studied and reduce the impact of one-year anomalies, average net income differential was calculated for

the 2-year period at the beginning of the period studied (2003 and 2004) and at the end of the period studied (2010 and 2011). A paired t-test was conducted to test whether the 2-year average net income differential at the beginning of the period studied is significantly different from that at the end of the period studied when examined

in aggregate and by industry. Table 9 shows the correlations and paired-sample t-test results on 2-year average net income differential of the total sample and each of the three industries at the beginning and that at the end of the period studied.

Table 9 Correlations and Paired-Sample T-Test Results of 2-Year Average Net Income Differential of the Total Sample and Each of the Three Industries at the Beginning and at the End of the Period Studied

Year	Average			
	Agro & Food Industry	Consumer Products	Industrials	Total Sample
Net Income Differential ₂₀₀₃₋₂₀₀₄	2,977,048	2,398,520	3,243,119	2,828,520
Net Income Differential ₂₀₁₀₋₂₀₁₁	4,045,818	3,494,818	3,585,999	3,705,620
Correlation of Net Income Differential ₂₀₀₃₋₂₀₀₄ and Net Income Differential ₂₀₁₀₋₂₀₁₁	.403	.575*	.236	.365*
Net Income Differential ₂₀₀₃₋₂₀₀₄ – Net Income Differential ₂₀₁₀₋₂₀₁₁	-1,068,830	-1,396,298	-342,880	-877,100
T Value	-.924	-1.728	-.358	-1.533

* significantly different at the 5% level of confidence.

The correlations between 2003–2004 average net income differential and 2010–2011 average net income differential both when examined in aggregate and by industry are all positive and significant, except for that of Industrials. The significant positive correlation indicates that sample companies which have higher (or lower) net income differential continue to have higher (or lower) net income differential. However, the results of paired t-tests show that the 2-year average net income differential at the beginning

of the period studied is not significantly different from that at the end of the period studied at the five percent level of confidence when examined both when examined in aggregate and separately by industry.

3.4 Net Income Differential as a Percentage of Sales over Time

In order to determine any significant change in net income differentials as a percentage of sales over the period studied and reduce the impact of one-year anomalies, average net income

differential as a percentage of sales was calculated for the 2-year period at the beginning of the period studied (2003 and 2004) and at the end of the period studied (2010 and 2011). A paired t-test was conducted to test whether the 2-year average net income differential as a percentage of sales at the beginning of the period studied is significantly different from that at the end of the

period studied when examined in aggregate and by industry. Table 10 shows the correlations and paired-sample t-test results of 2-year average net income differential as a percentage of sales of the total sample and each of the three industries at the beginning and that at the end of the period studied.

Table 10 Correlations and Paired-Sample T-Test Results of 2-Year Average Net Income Differential as a Percentage of Sales of the Total Sample and Each of the Three Industries at the Beginning and at the End of the Period Studied

Year	Average			
	Agro & Food Industry	Consumer Products	Industrials	Total Sample
Net Income Differential/Sales ₂₀₀₃₋₂₀₀₄	.001277	.001293	.001835	.001501
Net Income Differential/Sales ₂₀₁₀₋₂₀₁₁	.001122	.003066	.002469	.002213
Correlation of Net Income Differential/Sales ₂₀₀₃₋₂₀₀₄ and Net Income Differential/Sales ₂₀₁₀₋₂₀₁₁	.136	.415*	0.002	.100
Net Income Differential/Sales ₂₀₀₃₋₂₀₀₄ – Net Income Differential/Sales ₂₀₁₀₋₂₀₁₁	-.0001557	-.0017738	-.0006345	-.0007124
T Value	.327	-1.292	-0.38	-.914

* significantly different at the 5% level of confidence.

The correlations between 2003-2004 average net income differential as a percentage of sales and 2010-2011 average net income differential as a percentage of sales both when examined in aggregate and by industry are all positive, but only is that of Consumer Products significant. This indicates that sample companies which have higher (or lower) net income differential as a percentage of sales continue to have higher (or

lower) net income differential as a percentage of sales. However, the results of paired t-tests show that the 2-year average net income differential as a percentage of sales at the beginning of the period studied is not significantly different from that at the end of the period studied at the five percent level of confidence when examined both when examined in aggregate and separately by industry.

3.5 The Relative Impacts of Capital Intensity and the Degree to Which Companies Embraced JIT Philosophy over Time

As indicated earlier, capital intensity and JIT system tend to have diverse impacts on inventory adjustments and profitability differentials. The results of multiple regression analysis to test the relative impacts of capital intensity and the degree to which companies embraced JIT philosophy on profitability differentials over the nine years studied are shown in Table 11. When net income differential and net income differential as a percentage of sales were used as the dependent variable, the model will be referred to as Model 1 and Model 2, respectively.

Table 11 Results of Panel Data Analysis

Independent Variable	Coefficient	
	Model 1	Model 2
C	-0.289215*	-0.005389*
CI	4.747518*	0.182333*
JIT	1.437697*	0.126605*
Income	0.609240*	0.000563
AR(1)	0.149454*	0.262428*
Adjusted R-squared	0.133970	0.410688
Durbin Watson Statistic	2.694493	2.347106

* significantly different at the 5% level of confidence.

The results show that both CI and JIT have significant impacts either on net income differential and net income differential as a percentage of sales. However, capital intensity does have a greater impact on profitability being reported than

inventory to sales, which was used as a proxy of the degree to which companies embraced JIT philosophy. This may be due to the fact that JIT philosophy has an inconsistent effect on the sample companies.

CONCLUSION

1. Summary of the Results and Implications

This study has provided many important findings. Firstly, capital intensity of the SET listed manufacturing companies has not increased significantly over the period studied. Secondly, it has shown that JIT system has not had a consistent impact on SET listed manufacturing companies. Thirdly, net income differential and net income differential as a percentage of sales do not increase significantly over time. Finally, the OLS analysis of panel data shows that the extent of net income differential and net income differential as a percentage of sales are driven by both capital intensity and the degree to which companies embrace JIT philosophy. Although the results in Yongvanich (2013) indicate that inventory adjustment retains its significance, this study shows that its impact is much less than that of capital intensity, which is affected by long-term investment decisions. While it is usually indicated in the accounting literature that JIT philosophy plays an important role in reducing net income differential, this study highlights the impact of capital intensity on net income differential, which has not been referred to as widely as that of JIT philosophy. Additionally, there are many other ways to influence net income being reported.

This should deter management from managing net incomes through inventory and production decisions. Therefore, the notion that absorption costing provides an opportunity for management to manage net income through production and inventory decisions should not cause a great concern. The evidence in this study, therefore, provides further supports for accounting standard setters in mandating product costing choices even in the light of recent changes in current operating and manufacturing environment.

2. Limitations and Future Research

Limitations of the current study are: 1) some of the variables used in this study are not directly available in the public domain and have been estimated and 2) due to availability of data, the number of years studied may be not large enough to observe the impact of new manufacturing technology implemented on fixed manufacturing costs and the impact of JIT system. Future research may be conducted in other countries with a longer period studied where the impact of capital intensity and JIT system can be clearly observed to determine whether the findings of this study can be generalized when using different sets of data.

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