경영학석사학위논문

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이 논문을 경영학석사학위논문으로 제출함

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Abstract

Financial Reporting and Tax Strategies of Major Korean Oil Refinery Companies in Response to LIFO Abandonment Mandated by K-IFRS

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After K-IFRS roadmap was announced in March 2007, using LIFO method as an inventory valuation method is expected to be prohibited under the new standard. The main issue is that major oil refinery companies who previously used LIFO method anticipated the temporary hike in earnings and tax liability triggered by massive restoration of LIFO reserves, when LIFO is abandoned. Thus, this paper analyzes the companies' financial reporting and tax strategies in response to the restoration of LIFO reserve. According to the results, it turned out that companies liquidated significant amount of LIFO inventory over the period before IFRS adoption in order to avoid volatile financial reporting earnings and conduct smooth income. For lowering the increased tax liability, companies temporary boosted the investment in tax-favored equipment and utilized tax credit as a means of lessening tax burden. After the IFRS adoption, it is confirmed that companies reduced the inventory level since the risk of LIFO inventory liquidation and decrease in after-tax cash flow disappeared.

Keywords *: LIFO, LIFO inventory liquidation, LIFO reserve, smoothness, tax strategy, Oil refinery companies*
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I. Introduction

Since K-IFRS roadmap announced in March 2007, Korean listed companies are obligated to adopt Korean International Financial Reporting Standard as of 2011 or before and required to adjust their accounting policies under the guidance of new standard. One of several mandatory policy changes is a disallowance of LIFO(Last-In First-Out) method, one of three inventory accounting methods that was allowed under Korean Generally Accepted Accounting Principle(K-GAAP). However, LIFO method is forbidden under K-IFRS because of two major reasons. Primarily when using LIFO method, inventory book value cannot properly reflect the fair value of the inventory since inventory book value is lower than its fair value under inflation. IFRS encourages the proper reflection of the fair value of each account[1]. Secondly, corporate managers are likely to manipulate earnings or tax liabilities under LIFO method by adjusting inventory level at year-end period. For instance, during mid-1970s SuCrest, a sugar company run in the U.S. manipulated their inventory quantity and kept it from being liquidated and avoided decrease in after-tax cash flow. They colluded with their raw material supplier and conducted pseudo-purchase fraud to prevent their inventories from being liquidated since realized earnings would face high amount of taxation[2]. In order to curb this illegal activity, IFRS banned the use of LIFO as a

[1] IFRS 13 seeks to increase consistency and comparability in fair value measurements and related disclosures through a 'fair value hierarchy'. The hierarchy categorizes the inputs used in valuation techniques into three levels. The hierarchy gives the highest priority to (unadjusted) quoted prices in active markets for identical assets or liabilities and the lowest priority to unobservable inputs. IFRS 13:72

[2] The highest Income tax rate in 1970s was 48%.

inventory accounting method. Consequently Korean firms that used LIFO method before K-IFRS should change their inventory method into FIFO(First-in First-out) or average method. But the problem is that LIFO abandonment could inadvertently incorporate restoration of LIFO reserves that had been accumulated over a LIFO using period. LIFO reserve refers to the deferred cumulative earnings generated when the inventory at low cost is not sold and remains in the balance sheet. If these reserved inventories are sold at high price under inflation in latter period, then firms make more income than it had used FIFO or average method as their inventory accounting. But this temporary reserve restoration makes income more volatile. Prior research has long maintained the link between high cost of equity and volatile income and described the firm's effort to smooth earning.(Francis et al. 2004; Graham et al. 2005) So LIFO firms have an incentive to avoid this earnings hike resulted from inventory method change. That is the main concern of this study. According to Johnson and Dhaliwal(1998), LIFO abandonment entails two tax costs: (i) the tax levied on restoration of the LIFO reserve and (ii) the opportunity cost of foregone current and future LIFO tax benefits. They pointed out that changing the method also brings positive effects like earnings increase, relaxation of debt covenant requirement or lower possibility of technical default, and thereby method switching provides researchers to investigate the trade-off between these benefits and costs. On top of this financial effect, the restoration of LIFO reserve under inflation entails the additional income tax liability levied by tax authority.

In Korea, Oil refinery companies that used LIFO method before K-IFRS adoption are supposed to change their inventory accounting method and are subject to face a large amount of taxation. The estimated amount of tax expense arising from LIFO liquidation is from approximately 3 billion to 137.2 billion KRW, which substantially reduces company's net income and deter their profitability. The National Tax Service manifested that they would allow tax payment over 5 year period to lighten the burden of high tax cost[3] [4], but still it is a significant liability for the IFRS adopting oil firms. Thus we might suppose that oil refinery companies would possibly have conducted several strategies in preparation for the LIFO method switching and following tax liabilities. This paper identifies the oil companies' strategies to lessen the various impacts before or after they converted LIFO method under newly adopted K-IFRS. Section II studies prior literatures regarding LIFO inventory accountings and Section III develops the research conjectures. Section IV explains the theoretical mechanisms of LIFO reserves generation and liquidation effect. Section V identifies the Korean oil industry's financial reporting and tax strategies. Section VI concludes and addresses caveats of this study.

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[3] Corporate tax law(December 31, 2011 No. 11128) partial amendment, Section 42 article 2 : 1) when domestic companies report regarding change in inventory accounting policy from LIFO to other methods at initial IFRS adoption year, they can deduct the gain on inventory value re-evaluation. In this case, this total amount of accounting gain is equally included in the taxable income over the 5-year period.

[4] U.S. tax code provisions allow firms to request IRS approval for the allocation of LIFO reserves to taxable income over a period equal to the number of years LIFO was used up to a maximum of 10 years(Section 731, Internal Revenue Code)

II. Literature Review

Prior literatures regarding LIFO method mainly focus on the backgrounds of LIFO use and its reserve restoration. Johnson and Dhaliwal(1988) examined the conditions of LIFO abandonment decision by studying 83 firms between 1950 and 1983. They matched firms that abandoned LIFO method as their inventory accounting and firms who retained LIFO method in terms of firm performance represented by stock price, debt covenant, and tax credit availability. The results indicated that (1) firms who abandoned LIFO method showed steeper stock price decline, (2) abandonment firms are more likely to show higher debt-to-equity rate, are closer to violating working capital restrictions, and have larger operating loss carryforward and tax credits. (3) Also, abandonment firms' tax cost was negatively correlated with existing tax credits and positively correlated with proximity to required working capital rate. These findings indicate that firms who are stuck in financial distress are more likely to abandon LIFO method and this abandonment possibly helps firms relieve their financial burden with the inventory liquidation. Dhaliwal further developed his research regarding LIFO method and focused on LIFO liquidation motives in his 1994 study. He argued that LIFO reserves are more likely to be restored when a NOL firm faces higher marginal tax rate, is closer to debt covenant violation or negative earnings change. And it is also identified that LIFO liquidation lessens the variability of reported earnings in the long term. Frankel and Trezevant(1994) scrutinized LIFO using firms' earnings management activity with year-end LIFO inventory purchasing behavior.

This study found empirical evidence that (1) high-tax LIFO firms are more likely to purchase extra inventory at year-end than low-tax LIFO firms; (2) LIFO firms are more likely to purchase extra inventory at year-end than FIFO firms; (3) no difference in year-end inventory purchasing behavior exists for FIFO firms as a function of their tax status; and (4) a LIFO firm purchases more extra inventory at year-end if it faces a declining marginal tax rate in future years than if it faces the same marginal tax rate over time. These empirical findings are consistent with Dhaliwal's study(1994): LIFO reserves are more prone to be restored when a firm anticipates financial distress, and year-end inventory purchases are more likely to be implemented when a firm expects higher income and subsequent higher tax liability. Both studies indicate the possibility of earnings management under LIFO method for earnings increase and tax minimization purposes and this leads to inventory management inefficiencies. Kinney and Wempe study(2004) firstly identified the use of LIFO reserve as a means of income smoothing incentive. They considered the influence of LIFO reserve over JIT adoption decision, so they divided sample firms into groups of high and low reserve firms and compared each groups' earnings smoothness, leverage(debt covenant violation) and marginal tax rate. They only found out the weak evidence that high reserve firms are less likely to adopt JIT because of the higher burden of reserve restoration. But they showed the strong and consistent evidences that highly leveraged and low-taxed firms are more likely to switch their inventory method and adopt JIT for earnings effect since they could benefit from reserve

restoration and relieve the burden of high leverage. Above studies remarkably identified earnings manipulation under LIFO method, but we should note that these studies presume that firms are able to arbitrarily adopt or abandon LIFO as their inventory accounting method.

Guenther and Sansing(2012) study expected the effects of LIFO repeal on oil refinery companies in the U.S.. Anticipating LIFO repeal which Obama government tries to implement, they analyzed the expected consequences LIFO abandoning oil refinery companies would face. They applied demand elasticity when investigating the impact of inventory accounting method switching and concluded that U. S. firms would face an increase in their marginal costs, which would make them reduce their product output, which in turn, would increase the sales price of their products. Since products such as oil and gasoline exhibit inelastic demand, higher sales price doesn't necessarily lead to proportional demand decline. Therefore, their model surprisingly predicts that LIFO repeal would increase the future after-tax cash flows of oil refinery firms. They emphasized that absent collusion, the same firms cannot achieve this outcome on their own by voluntarily switching to FIFO, because each firm would maximize its own after-tax profits by using LIFO, even though all firms in the industry are better off if they all use FIFO. Rather it allows an adopting firm to deduct more recent inventory purchases in high tax years while deducting older low-cost inventory layers in low-tax years.

In Korea, Park, Shawn and Shim(2011) addressed the various effects of IFRS adoption on oil refinery companies who are about to adopt K-IFRS. They analyzed the impact of K-IFRS adoption on energy business and briefly mentioned the effect of inventory accounting change. They anticipated that LIFO repeal would lead to the increase in tax cost because of massive and cumulative LIFO reserve restoration at switching year, so they addressed that government should alleviate their tax burden by allowing tax payment over the years. They properly expected the increased tax cost generated from LIFO reserve restoration imposed on Korean oil refinery companies, but failed to identify companies' strategies in preparation of LIFO switch. Therefore, this study develop their ideas and further identifies firms' financial reporting and tax strategies in preparation for K-IFRS adoption.

III. Research ideas development

When K-IFRS roadmap was announced in March 2007, use of LIFO method as inventory valuation method is prohibited and firms that had used LIFO had to switch the method at IFRS adoption year. And the critical issue arises when method is switched—it is expected that previously accumulated LIFO reserves are restored simultaneously. The restoration causes earnings and tax liability to hike temporarily and this could be a burden to the company since volatile earnings are known to be correlated with higher cost of equity and

thereby firms prefer smooth income reporting to a one time earnings hike. Therefore, oil refinery firms would have an incentive to restore LIFO reserves aforetime before IFRS is adopted and avoid massive restoration. So the first conjecture is as follows:

Conjecture 1 : For income smoothing, LIFO firms would liquidate LIFO inventory over the period from 2007 to the year of IFRS adoption.

Firms are able to achieve income smoothing by liquidating LIFO inventory over the post-IFRS roadmap announcement until IFRS adoption. However, this measure is not an optimal decision in terms of tax perspective because it is more beneficial for firms to defer taxation than being taxed earlier. But if firms liquidate LIFO inventory in advance for a financial reporting purpose anyway, they have to take certain measures to lower the increased tax liability coming from LIFO inventory liquidation and following increase in taxable income. Johnson and Dhaliwal(1988) study found out that LIFO abandonment firms have larger amount of operating loss carryforward or available tax credit than LIFO retaining firms. So it is likely that firms strive to lessen their tax cost by utilizing tax credit or loss carryforward. Kinney and Trezevant (1993) found the evidence that firms accelerated investment activities eligible for the tax credit for tax and earnings-management purposes. Thus it is also supposed that Korean oil refinery companies would

implement such measures to reduce the tax liability during LIFO inventory liquidating period. Therefore:

Conjecture 2 : Firms would utilize higher amount of tax credit or loss carryforward in order to lessen the increased tax caused by reserve restoration.

Inventory method change under IFRS adoption raises the other issue, change in the optimal inventory level. Davis et al.(1984) argued that LIFO firms will avoid liquidating inventories wishing to maximize its after-tax cash flow, thereby they would maintain relatively constant physical inventories compared to the level under non-LIFO method. In other words, provided that absent from the risk of liquidation firms would no longer need to maintain relatively higher level of inventory under LIFO method, since the risk of inventory liquidation would disappear. Thus, after LIFO firms change their inventory valuation method, the inventory level under non-LIFO method would be decreased compared to the level under LIFO method and this would reduce their inventory holding cost.

Conjecture 3 : After LIFO method is switched, firms that used to utilize LIFO would decrease the inventory level.

IV. LIFO reserve accumulation and restoration

Before we jump into the main part, it is necessary to scrupulously understand how LIFO method abandonment leads to the realization of earnings. Johnson and Dhaliwal(1988) defined the LIFO reserve as the aggregate annual difference between LIFO and non-LIFO cost-of-good-sold under inflationary period. Suppose the inflation of inventory price lasts until abandonment year and LIFO inventory is not liquidated, LIFO reserve is consecutively accumulated until its restoration. The following example helps understand the way LIFO reserve is accumulated. Suppose that a firm has made a purchase twice in the first year—they bought 10 inventories for $5 and another 10 inventories for $10. Then they sold 10 inventories for $20 in the first year. Then the firm's cost-of-good-sold and ending inventory would be as follows under two inventory accounting methods.

	Cost-of-good-sold	Ending Inventory	Impact on N/I (Compared to FIFO)
FIFO	$5 * 10 = $50	$10 * 10 = $100	-
LIFO	$10 * 10 = $100	$5 * 10 = $50	-$50

As you can see in the above table, cost-of-good-sold under LIFO method is $50 higher than that of FIFO method, while LIFO ending inventory is $50 lower than that under FIFO method. And the higher cost-of-good-sold decreases net income by $50 compared to one under FIFO method. The difference between cost-of-good-sold under LIFO and cost-of-

good-sold under FIFO is defined as LIFO reserve and is accumulated until purchased inventory is liquidated in the future. Supposing inventory price keeps increasing in the second year, and the firm purchases 10 inventories for $15 and sells 10 inventories for $25. Then the cost-of-good-sold and ending inventory would be like this:

	Cost-of-good-sold	Ending Inventory	Impact on N/I (Compared to FIFO)
FIFO	$10 * 10 = $100	$15 * 10 = $150	-
LIFO	$15 * 10 = $150	$5 * 10 = $50	-$50

Cost-of-good-sold under LIFO method is $50 higher than the one under FIFO because the purchase price was higher than the last year. And the reserved $50 goes to the ending inventory account, so the difference between ending inventory in FIFO and the one under LIFO becomes $100. Plus, it is confirmed that under inflationary period LIFO reserve amount that resides in ending inventory is cumulative figure.

Now suppose that the firm made no purchase and all inventories are cleared in the third year. Then LIFO reserve would be entirely restored and that increases the net income. The following table presents the restoration effect.

	Cost-of-good-sold	Ending Inventory	Impact on N/I (Compared to FIFO)
FIFO	$15 * 10 = $150	-	-
LIFO	$5 * 10 = $50	-	+$100

Now all of the inventories are liquidated and cost-of-good-sold under LIFO is $100 higher under FIFO. And reserves which were accumulated in ending inventory account are restored and make the net income soared by $100 compared to the one under FIFO.

When it comes to tax cost, Johnson and Dhaliwal(1988) defined the tax burden LIFO abandoning company has to take as follow:

$$TAX = TR_0 \sum_{t=-n}^{-1} [COGS(\mathit{LIFO})_t - COGS(\mathit{Non\text{-}LIFO})_t]$$

TR_0 denotes the statutory tax rate when LIFO reserves are restored and the summation term denotes the accumulated LIFO reserves(the sum of the difference between LIFO and non-LIFO cost-of-good-sold). For example, suppose the statutory corporate tax rate is 35 percent at the time 0, then the firm should pay $35 more income tax in that year than otherwise they would have used FIFO method. This additional earnings and tax expense are just deferred amount but still, the firm benefits from LIFO reserve realization deferral because the effect is the same as if they have borrowed the deferred amount of money with free of charge and save the amount equivalent to cost of equity, and furthermore, they

could possibly save more tax cost if tax rate declines at the time of restoration. The Korean firms' detailed strategies regarding financial reporting and tax would be further elaborated in the next section.

V. Financial Reporting and Tax Strategies of Oil Refinery Companies

Description - Oil refinery companies

Before K-IFRS was adopted in 2011, four oil refinery companies in Korea had used LIFO method as their inventory accounting. Table 1 panel A shows each company's inventory accounting method switching status. GS Caltex switched the LIFO method in 2009, S-oil in 2010 and Hyundai Oilbank, SK Energy in 2011. And three companies except S-oil switched LIFO into average method, while S-oil changed it into FIFO. Three companies' choice of average method makes sense such that it creates fewer gaps between the amount of inventory accounts before and after the method switch. S-oil chose FIFO since they were using FIFO when reporting financial statements to their parent company, which is Saudi Arabian company.

Table 1.Panel A. Oil refinery companies' inventory accounting status

	Switching year	K-IFRS adoption year	Method before adoption	Method after adoption	Inventories recorded with LIFO
GS Caltex	2009	2010	LIFO	Moving Average	Raw material, goods-in-process, finished goods, purchased products
Hyundai Oilbank	2011	2011	Monthly LIFO	Moving Average	Raw material
SK Energy	2011	2011	LIFO	Weighted Average	Raw material, goods-in-process, finished goods
S-oil	2010	2011	LIFO	FIFO	Raw material, goods-in-process, finished goods, purchased product

Panel B. Oil refinery companies' ownership status

Company	Owners	Stake	Status
GS Caltex	GS Energy Chevron Holdings Chevron Global Energy	50% 40% 10%	Joint
Hyundai Oilbank	Hyundai Heavy Industry Minority interest	91.13% 8.87%	Domestic
SK Energy	SK Innovation	100%	Domestic
S-oil(Listed)	Aramco Overseas Co. Hanjin Energy Inc. Minority interest	34.09% 27.43% 38.48%	Foreign-owned

Three companies except Hyundai Oilbank were using LIFO method when they recorded raw material, goods-in-process, finished goods and purchased products. Hyundai Oilbank only recorded raw materials with LIFO method. That is why their LIFO reserve amounts are lower than those of other companies. Panel B shows each company's ownership status. GS Caltex is jointly run by GS Group and U.S. Chevron. Hyundai Oilbank and SK Energy are owned by Korean conglomerate companies, Hyundai Heavy Industry and SK Innovation. And S-oil's biggest shareholder is Aramco, one of major Saudi-Arabian oil companies. Companies' ownership structure partly explains the different style of accounting policies such as IFRS adoption year or LIFO applying inventory accounts.

Economic background – Crude Oil Price and LIFO reserve

As I mentioned in section IV, LIFO reserve is closely subject to crude oil price as well as company's inventory policy. If oil price increases then LIFO reserve is accumulated unless firms entirely liquidate the whole inventory purchased in that year, whereas LIFO reserve would decrease if oil price declines even without manager's intentional liquidation. So it is necessary to keep track of oil price changes over the research period. Figure 1 and Table 2 shows the annual Dubai crude oil price change from 2002 to 2012.

Figure 1. Crude oil price change(Dubai, $/barrel) [5]

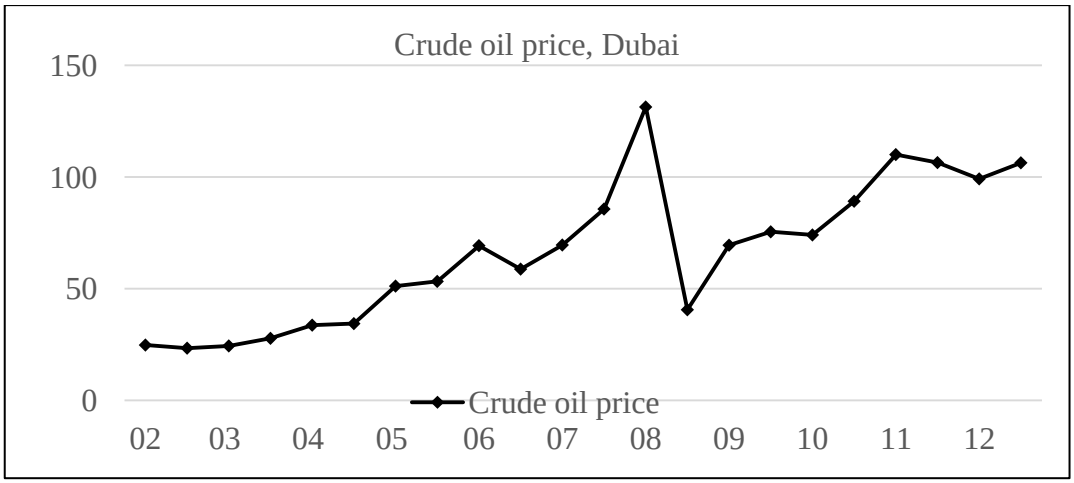


Table 2. Monthly crude oil price from 2002 to 2012(Dubai, $)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg.
2002	18.5	19.0	22.9	24.4	24.7	23.9	24.7	25.2	26.8	26.4	23.3	25.8	23.8
2003	27.9	30.0	27.5	23.5	24.3	25.5	26.7	27.7	25.3	27.3	27.7	28.1	26.8
2004	28.9	28.6	30.8	31.5	34.7	33.5	34.7	38.5	35.6	38	35.1	34.3	33.6
2005	38	39.9	45.9	47.2	45.4	51.1	52.8	56.6	56.5	54	51.4	53.2	49.3
2006	58.4	57.6	57.8	64.1	65	65.2	69.2	68.8	59.8	56.4	56.7	58.7	61.5
2007	51.7	55.8	58.8	64	64.6	65.8	69.5	67.4	73.4	77.1	86.9	85.6	68.4
2008	87.4	90	96.8	103	119	127	131	112	95.9	67.4	49.8	40.5	93.6
2009	44.1	43.1	45.6	50.1	57.9	69.4	64.8	71.3	67.6	73.1	77.7	75.4	61.7
2010	76.7	73.5	77.3	83.6	76.8	74	72.5	74.1	75.1	80.2	83.7	89.1	78
2011	92.5	100	108	116	108	107	110	105	106	104	109	106	106
2012	110	116	122	117	107	94.4	99.1	108	111	109	107	106	109

[5] Korean companies import 85% of crude oil from Dubai and the data represents the price of Dubai crude oil. The data is collected from Korea National Oil Corporation database.

As you can see in Figure 1, crude oil price has been continuously inflated until July 2008 and reached peak to$131.3 per barrel on July. But after hit by worldwide financial crisis, oil price has plummeted into $49.8 in November and kept falling until $40.5 in December 2008. This sharp price drop made large quantities of LIFO reserve decreased. But this decrease was not what managers intended through the inventory quantity management. So when studying LIFO reserve, it should be careful to focus only on the reserve amount change triggered by LIFO inventory liquidation, not by oil price deflation.

The firm's annual audit report released the cumulative amount of LIFO reserves. Table 3 presents each firm's LIFO reserve amount over 10 year period. LIFO reserve is calculated as the sum of differences between cost-of-good-sold in LIFO method and cost-of-good-sold in average method.(cost-of-good-sold in FIFO method for GS Caltex and S-oil)

Table 3. Cumulative LIFO reserves(amount in 1,000KRW)

	2002	2003	2004	2005	2006
GS Caltex	172,955,000	208,245,000	321,666,000	430,229,000	321,692,000
Hyundai	4,609,492	1,628,039	(2,381,440)	(1,817,870)	(2,693,102)
SK Energy	192,674,084	291,956,739	220,579,091	377,976,466	406,473,363
S-oil	41,054,691	73,856,138	4,825,070	41,770,920	(4,157,554)

	2007	2008	2009	2010	Total	Tax amount[6]
GS Caltex	632,768,000	273,781,000	623,689,000[7]	Switched	623,689,000	150,932,738
Hyundai	12,294,929	(30,500,093)	6,352,395	12,639,830	12,639,831	3,058,839
SK Energy	467,398,789	808,585,265	(63,853,175)	411,852,000	411,852,000	99,668,184
S-oil	(53,612,124)	(17,242,252)	40,452,000	85,788,000	85,788,000	20,760,696

In line with oil price increase, LIFO reserves of GS Caltex and SK Energy kept inflated until 2007 when the IFRS roadmap is announced. But after 2008 they were temporarily decreased partly due to oil price decline and partly due to manager's intentional reserve restoration. In the end, they accumulated 623.6 billion won worth of reserve for GS Caltex and about 412 billion worth for SK Energy and faced 150 billion won and 100 billion won taxation each for LIFO reserve restoration. Hyundai Oilbank accumulated relatively small quantity of reserves since they only recorded raw material with monthly LIFO method and kept restoring reserves. And so did S-oil, they kept liquidated LIFO inventory annually and prevented reserves from being largely accumulated. Consequently they accumulated about 12 billion worth of reserve for Hyundai and 86 billion won worth of reserves for S-oil, and each bore 3 and 20.7 billion tax liability from restoration.

[6] Tax cost is estimated by multiplying total reserve amount with 24.2 percent statutory tax rate.
[7] They switched the method in 2009, but the corporate tax act article 42-2 defined the gains on inventory asset evaluation as the difference between the amount of assets when IFRS is adopted and the amount at year-end one year before IFRS is adopted. GS Caltex(S-oil) adopted IFRS in 2010(2011) and the law forced them to calculate and include LIFO reserve until 2009(2010) even if the method is already switched.

Strategies of Oil Refinery Companies – Financial Reporting

I firstly conjectured that firms would conduct early liquidation after IFRS roadmap is announced lest facing the one time earnings realization and income fluctuation when IFRS is adopted and reserves are restored. In order to confirm the firm's income smoothing maneuver, I compared the amount of LIFO inventory liquidation before and after 2007 IFRS roadmap announcement. I categorized four firms' 5 year period('02~'06) liquidation amount at pre-roadmap announcement period as a control group and the amounts at post-roadmap announcement period as a treatment group until firms change their inventory method.(GS '07~'08, S-oil '07~'09, Hyundai, SK '07~'10) Figure 2 and Table 4 present four companies' amount of LIFO inventory liquidation over 10 year period.

Table 4. LIFO inventory liquidation amount(in 1,000 KRW)

	2002	2003	2004	2005	2006	2007	2008	2009	2010
GS Caltex	0	0	107,325,000	117,074,000	116,106,000	131,277,000	250,508,000	Switched	Switched
Hyundai Oilbank	0	0	49,418,082	48,276,156	99,914,380	81,425,364	129,334,157	160,535,919	308,866,833
SK Energy	0	0	0	217,557,035	71,359,691	273,538,955	355,068,236	374,754,865	159,183,869
S-oil	301,333,000	0	228,216,941	242,600,008	401,002,882	348,888,344	468,391,114	518,009,000	Switched

Figure 2. LIFO Inventory liquidation trend

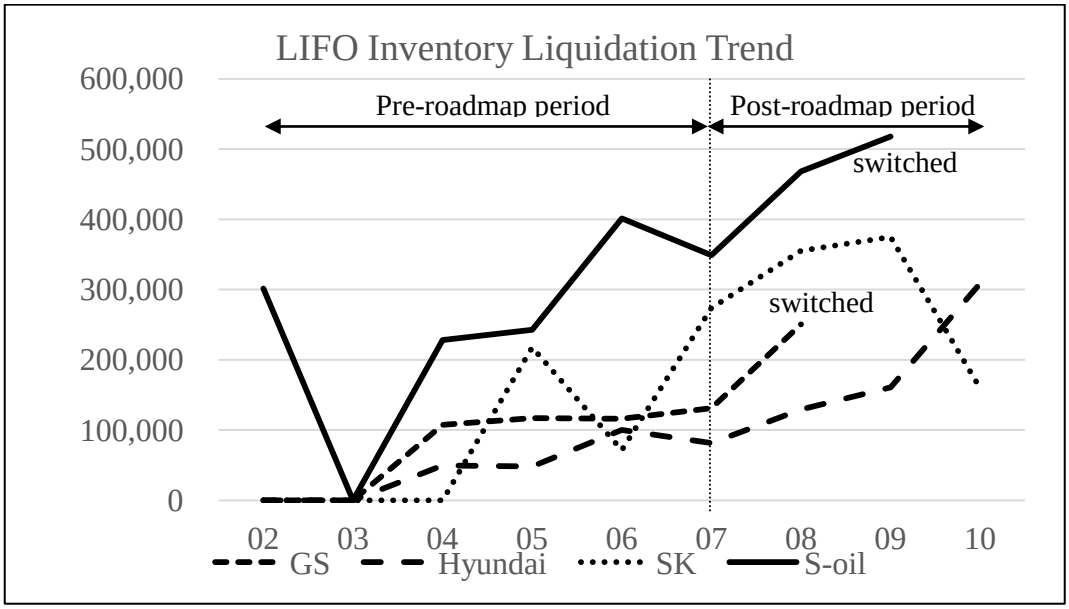


Figure 3. Change in the amount of liquidation

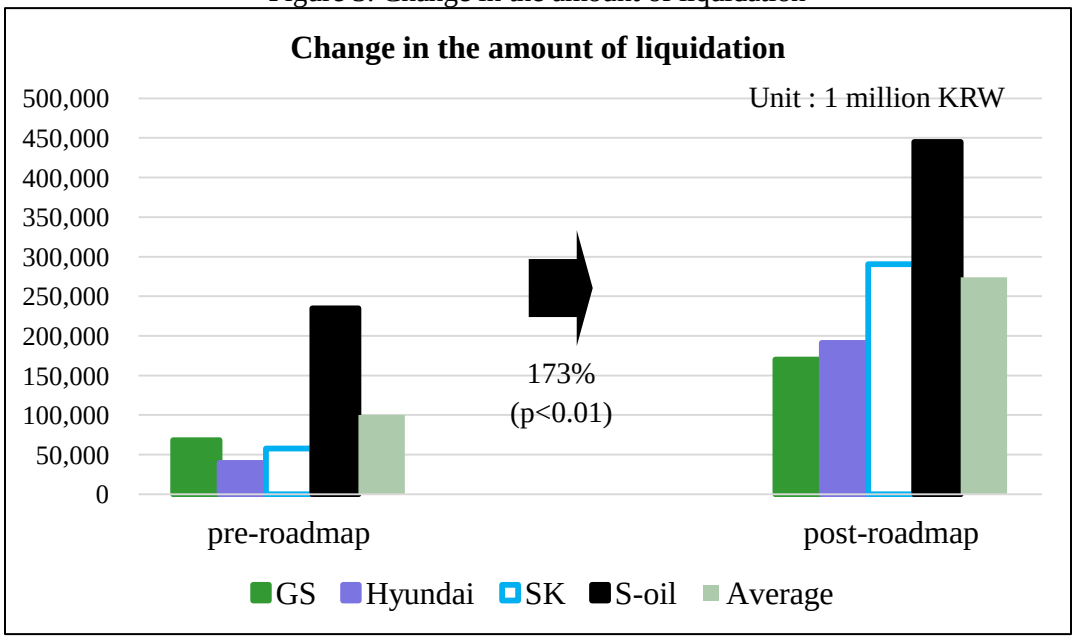


Figure 2 and Table 4 present the amount of LIFO inventories companies liquidated during 2002 to 2010. Looking at Table 4, we can see that companies didn't liquidate LIFO inventories at all during 2002 to 2003(except S-oil), but the amount slightly increased since 2004 and sharply increased after 2008. Again I compared 5-year-average amount of liquidation before the roadmap announcement and 2 to 4-year-average amount after the announcement. Figure 3 graphically shows the liquidation on average. According to the result, companies liquidated LIFO inventories by approximately 100 billion won on average over 2002 to 2006, while they increased liquidation by 273.8 billion won on average after the roadmap announcement until switching method.(173 percent increase after roadmap announcement) The difference was statistically significant at 1 percent. SK Energy showed the largest increase, which is 57 billion won before roadmap to 290 billion won after the roadmap announcement.(408 percent increase) GS Caltex showed 150 percent increase in liquidation after the roadmap announcement, Hyundai Oilbank 387 percent and S-oil presented 90 percent increase. These figures clearly show four firms' income smoothing effort such that they intentionally raised the amount of LIFO inventory liquidation before IFRS adoption. And the amount of four companies' LIFO reserves restored from early liquidation accounts for 67 percent of entire LIFO reserves. And they could avoid temporary earnings hike after IFRS adoption. Overall, this finding supports the first conjecture.

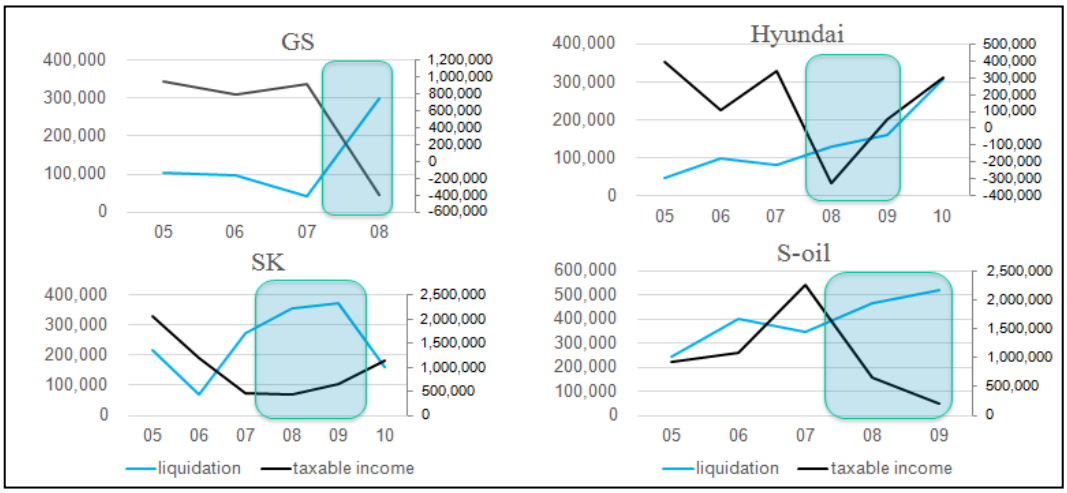
LIFO reserve liquidation in low-tax year

It is confirmed that LIFO liquidation was accelerated after IFRS roadmap is announced and LIFO method is expected to be abolished. Moreover, it is interesting that the amount of inventory liquidation was particularly concentrated during certain period of times. Johnson and Dhaliwal(1988) study found the evidence that LIFO reserve restoration is concentrated in low-tax year because firms face less burden of taxation from the reserve restoration. And I also found the result which is consistent with their study. As I mentioned earlier, worldwide economic crisis in 2008 and 2009 made oil refinery companies suffer from sluggish economic conditions and consequently their earnings have plummeted. And so does their taxable income. Table 5 presents four companies' taxable income which indirectly indicates their marginal tax rate. I compared the amount of inventory liquidation with this taxable income figure in order to find out the relationship between the amount of inventory liquidation and their tax burden. Figure 4 presents the comparison of the amount of liquidation and taxable income.

Table 5. Four companies' taxable income[8](1,000KRW)

	2006	2007	2008	2009	2010
GS Caltex	800,922,000	915,045,000	(402,110,000)	(166,095,000)	523,243,000
Hyundai	106,956,091	339,674,907	(324,526,294)	51,263,458	304,758,131
SK Energy[9]	1,196,326,668	471,345,782	430,299,834	651,063,747	1,151,368,128
S-oil	1,084,391,452	2,251,889,790	649,680,288	208,665,000	722,490,000

Figure 4. Comparison of the amount of inventory liquidation and taxable income



[8] Taxable income was no longer disclosed at the audit report after 2008, so figures after 2008 were estimated from tax expense divided by statutory tax rate(24.2). The method is following prior literatures.

[9] SK Innovation until 2007.

In Table 5, taxable income has sharply decreased for four companies in 2008 and suddenly the amount of liquidation sharply increased in 2008 and 2009. Especially GS Caltex and Hyudai Oilbank reported financial loss in 2008 when they largely increased the inventory liquidation and restored LIFO reserves. As a result, two companies were not being taxed for the amount of reserve restoration in 2008. SK Energy accelerated the liquidation from 2008 until 2010 when they recovered their income and dropped the amount of liquidation. Overall, four firms consistently concentrated the inventory liquidation when they bears lower tax burden because of economic downturn. This supports the evidence that firms do care about the tax aspect when liquidating LIFO inventory and they optimize the timing of liquidation for tax minimization.

Tax strategy using tax credit(Investment in equipment)

It is confirmed that oil refinery companies increased the liquidation of LIFO inventory after IFRS roadmap was announced in 2007. They could achieve income smoothing from the early liquidation, but it also entails the increase in tax liability caused by reserve restoration. So I conjectured that firms would utilize higher amount of tax credit or loss carryforward in order to lessen the increased tax liability. And I found the evidence that they primarily used tax credit in lieu of acceleration of equipment investment for reducing tax cost. Firms started to accelerate investment in equipment after 2007 and qualified temporary tax credit for investment to reduce higher tax cost driven by substantial amount

of LIFO reserve restoration. The amount of investment in equipment and subsequent deducted tax expense from the tax credit are presented in Table 6.

Table 6. Panel A. Investment in equipment(in 1,000 KRW)

	2002	2003	2004	2005	2006
GS Caltex	121,000,000	24,000,000	289,957,000	582,705,000	979,571,000
Hyundai	19287000	33740000	80,753,000	124,182,000	31,723,000
SK Energy	79,900,000	123,300,000	131,900,000	315,800,000	326,200,000
S-oil	169,000,000	-	-	-	66,900,000

	2007	2008	2009	2010	2011	2012
GS Caltex	1,502,985,000	581,000,000	1,419,000,000	622,000,000	116,000,000	571,000,000
Hyundai	31,182,000	167,795,000	671,228,000	1,197,933,000	68,706,000	-
SK Energy	56,900,000	649,300,000	157,100,000	1,800,000	18,500,000	144,200,000
S-oil	4,600,000	108,700,000	492,300,000	704,800,000	-	-

Panel B. Tax credit amount(in 1,000 KRW)[10]

	2002	2003	2004	2005	2006
GS Caltex	1,350,090	2,361,800	5,652,710	8,692,740	2,220,610
Hyundai	8,470,000	1,680,000	20,296,990	40,789,350	68,569,970
SK Energy	5,593,000	8,631,000	9,233,000	22,106,000	22,834,000
S-oil	11,830,000	0	0	0	4,683,000

	2007	2008	2009	2010	2011	2012
GS Caltex	62,077,000	65,657,000	223,390,000	85,911,000	22,071,000	42,062,000
Hyundai	1,065,445	9,375,712	54,440,499	63,239,282	27,392,622	-1,396,059
SK Energy	12,260,899	68,054,585	73,052,710	25,277,569	3,656,000	2,218,000
S-oil	2,610,467	6,699,000	35,216,000	43,590,000	15,666,000	2,871,000

Panel C : Effective tax rate over the period(percent)

	2002	2003	2004	2005	2006	2007	2008	2009	2010
GS	26.7	27.95	29.51	25.60	20.98	19.76	0	0	12.7
Hyundai	0	0	5.5	25.86	30.44	32.50	24.13	0	16.02
SK	24.02	0	28.2	23.69	23.40	28.71	7.3	17.1	18.4
S-oil	26.23	31.61	29.97	28.29	28.08	27.66	28.38	15.47	18.90

[10] Data during 2002 to 2006 were unavailable, so I estimated tax credit by multiplying investment amount with the rate of temporary investment tax credit, which was 7 percent.

As you can see in panel A, four firms' amount of equipment investment substantially increased from 2008 until 2009 or 2010 and then sharply shrank after 2011. I compared four firms' 5 year equipment investment amount before roadmap announcement with those after announcement(from 2007 until method switching year) and I confirmed 201 percent increase in investment after the roadmap announcement.(significant at 5 percent) Subsequently they could earn proportional amount of tax credit from the investment and significantly reduced tax expense during 2008 to 2010. I compared the tax credit amount before and after roadmap announcement and confirmed 217 percent increase on average.(significant at 1 percent) Panel B shows that the amount of tax credit suddenly increased from 2008 for Hyundai Oilbank and SK Energy, and from 2009 for GS Caltex and S-oil until 2010. The tax credit amount even exceeded the tax expense before deduction.(e.g. Hyundai Oilbank's tax expense before tax credit deduction in 2009 was 53.1 billion won, but the tax credit deducted 54.4 billion won, thus created tax credit carryforward; GS Caltex had 134.8 billion won worth of tax expense before tax credit in 2009, but it was entirely deducted by 222.2 billion won tax credit and consequently both companies paid no tax.) Especially three companies except S-oil utilized tax credit for investment in energy-economizing facilities[11] [12] stipulated in Special Tax Treatment

[11] Special Tax Treatment Control Act Article 25-2 (Tax Credit for Investment in Energy-Economizing Facilities) : (1) In cases where a national makes an investment (excluding any investment made by used goods), not later than December 31, 2009 in the energy-economizing

Control Act Article 25-2. They kicked off the construction of gasification desulfurization processing facility[13] which is one of the tax-credit inducing facilities, and could reduce tax expense with the tax credit from 2008 to 2010[14]. In case of GS Caltex in 2008, tax credit for investment in energy-economizing facilities accounts for 88.5 percent of total tax credits they earned. Considering that GS Caltex restored more than 300 billion won worth of LIFO reserves from liquidation in the same year, the tax credit timely and optimally offset the increased taxable income without decreasing financial reporting earnings. With this tax credit utilization, four firms succeeded in decreasing tax expense—four firms' average effective tax rate decreased by 20 percent after the IFRS roadmap announcement.(significant at 10 percent)

Additionally I looked into interest and depreciation expense which are also reducing taxable income. I expected firms would increase interest or depreciation expense so that they could reduce the increased taxable income from liquidation. However, it is confirmed

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facilities prescribed by Presidential Decree, the amount equivalent to 20/100 of the relevant invested amount shall be deducted from the income tax (limited to the income tax on his business income) or corporation tax. In such cases, the provisions of Article 11 (1), (3) and (4) shall apply mutatis mutandis to the methods of tax credit. (2) Any national who intends to be eligible for the application of paragraph (1) shall apply for tax credit as prescribed by Presidential Decree.

[12] According to the Board of Audit and Inspection of Korea report released in 2012, this tax credit became unnecessary as its primary energy economizing motivation is already achieved and the incentive is no longer needed. This facility is excluded from tax credit favored facilities list in 2012.

[13] Gasification desulfurization facility produces highly profitable light oils by re-processing low-cost heavy oil such as bunker-C oil with a mix of catalyst. Heavy oils are the remains of primary crude oil distillation process from which produces lucrative light oils such as gasoline, kerosene, diesel.

[14] Investment deduction rates have changed from 10 percent to 20 percent in 2009, but reduced again to 10 percent from 2010, and deduction finally terminated in 2012.

that firms decreased those expenses which is opposite to the conjecture. Four firms' average interest expense scaled by sales accounted for 1.3 percent before roadmap announcement, but it decreased into 0.8 percent after the announcement. Average depreciation expense scaled by sales was 2.1 percent before announcement, but it cut down into 1.2 percent after the roadmap announcement. So it is concluded that firms did not increase interest or depreciation expense for tax reducing purpose, and the result is understandable because both expenses decrease financial reporting income as well as taxable income. And this proves that tax credit is the most effective instrument to minimize tax liability.

Anecdotal evidence: Tax strategy with loss carryforward

One of the companies utilized operating loss carryforward as well as tax credit in order to lessen the increased tax liability. SK Innovation(currently SK Energy) restored 336 billion won of LIFO reserves in 2008 and faced 92.4 billion won taxation from reserve restoration. In order to prevent the earnings from being taxed, SK Innovation merged one of their subsidiaries, SK Incheon Oil Refinery Co., Ltd[15], which retained net operating loss carryforward at that time. SK Incheon Oil Refinery earned 123.2 billion won of financial accounting income in 2007, but their taxable income is estimated to -344 billion won and also got 30 billion won tax refund by winning tax refund lawsuit, accordingly these created

[15] SK Energy span off SK Incheon Complex department(SK Incheon Oil Refinery. Co., Ltd) again in 2013 May.

105 billion won worth of NOL carryforward. And SK Innovation could use this loss carryforward through the merger with their subsidiary. Pursuant to Corporate Tax Act Article 45(Succession to Loss Carried Forward Following Merger) the deficit of extinguished corporation can be deducted in case of a qualified merger.[16] And according to Article 113(Separate Accounting) (3),[17] provided that two corporations engaged in the same business, separate accounting may not be applied. That is, loss carryforward of extinguished corporation can be deducted from the merged corporation's taxable income from the same business. According to SK Innovation's 2008 audit report, the merger satiates the terms of qualified merger, and SK Innovation and SK Incheon Oil Refinery had conducted the same business-oil refinery, thereby these two conditions enabled SK Innovation to utilize the subsidiary's loss carryforward. As a matter of fact, SK Innovation deducted 106.7 billion won worth of taxable income which accounts for 40 percent of total

[16] Article 45(Succession to Losses Carried Forward Following Merger) (1) Where a domestic corporation merges with another domestic corporation, the deficits under subparagraph 1 of Article 13 of the merged corporation as the date of merger registration shall not be deducted within the extent of income amount (where separate accounting has not been conducted as the corporation fell under the proviso to Article 113 (3), it shall be an amount obtained by dividing the income amount proportionally according to the rate of value of asset prescribed by Presidential Decree; hereafter the same shall apply in this Article) accruing from the business that has been succeeded from the extinguished corporation when tax base for each business year of the merged corporation is calculated.

[17] Article 113(Separate Accounting) (3) A corporation which merges with another domestic corporation and has deficits under subparagraph 1 of Article 13 as at the date of merger registration, and a merged corporation which wishes to deduct the losses carried forward of an extinguished corporation under Article 45 (2) shall keep separate accounting of the assets, liabilities, and profits and losses included in the business succeeded from the extinguished corporation and those included in other business: Provided, That as for merger made between small and medium enterprises in Article 25 (1) 1 or corporations engaged in the same business, separate accounting may not be conducted.

income tax and income tax was cut down to 70.2 billion won, and the effective tax rate of SK Innovation decreased into 7 percent while statutory tax rate was 27.5 percent in 2008. If either one of above two conditions was not met, SK Innovation would have paid 40 percent additional income tax expense and a third of LIFO reserves would be being taxed. This evidence also supports conjecture 2, which addresses firm's tax strategy using tax credit and loss carryforward.

Post-IFRS : Change in inventory level

I conjectured that firms would decrease inventory level after they changed the LIFO into non-LIFO because they no longer bear the risk of inventory liquidation In order to find the evidence, I compared the ending inventory level under LIFO method during 2002 to 2006 and the level after the method switch(GS: 2009 to 2012, S-oil: 2010 to 2012, Hyundai, SK : 2011 to 2012). Only inventories recorded with LIFO method were counted when comparing the inventory value and they were scaled by sales for enhancing comparability. And I also considered crude oil purchase amount to confirm if the decreased inventory level is attributed to decrease in purchase amount. If the purchase amount is decreased after switching method, then it indicates firms decrease the inventory level by purchasing fewer amounts. The amount of purchase is scaled by cost-of-good-sold. Table 7 presents the inventory and purchase amount.

Table 7 Panel A. Change in inventory level(Unit : percent)

	2002	2003	2004	2005	2006	2009	2010	2011	2012
GS	0.098	0.111	0.099	0.093	0.094	0.142	0.140	0.130	0.111
Hyundai	0.012	0.014	0.011	0.017	0.011	-	-	0.030	0.027
SK	0.068	0.133	0.109	0.011	0.117	-	-	0.128	0.097
S-oil	0.071	0.130	0.113	0.143	0.108	-	0.153	0.155	0.131

Panel B. Change in purchase amount(Unit : percent)

	2002	2003	2004	2005	2006	2009	2010	2011	2012
GS	0.693	0.901	0.852	0.852	0.905	0.920	0.845	0.878	0.861
Hyundai	1.100	1.115	0.869	0.871	0.856	-	-	0.931	0.943
SK	1.107	1.147	1.018	0.882	0.934	-	-	0.985	0.991
S-oil	1.058	1.096	0.731	0.829	0.903	-	0.756	0.797	0.772

Comparing the figures under LIFO and non-LIFO method, I found that companies slightly decreased the inventory level from 4.33% to 4.15% which is 4 percent drop. It weakly supports my conjecture even though it is not a drastic change. I also confirmed that relative purchase amount on average decreased from 93.25% to 88.20%, which is 5 percent decrease. Thus it can be inferred that after the K-IFRS adoption, oil refinery companies

decreased the inventory level by purchasing less amount of crude oil. The decrease also reduces the inventory maintenance cost, which is also beneficial for the company. Overall, the result weakly supports the third conjecture.

VI. Conclusion

This study identified Korean oil refinery companies' financial reporting and tax strategies in preparation for K-IFRS adoption. IFRS no longer allowed LIFO method as one of inventory accounting methods and inventory accounting method switching created the LIFO reserve restoration for oil companies in Korea who had adopted LIFO method before IFRS. The cumulative amount of LIFO reserve restoration incurs temporary earnings hike and increase in tax expense, which becomes a burden to the company. In order to avoid more volatile income and to conduct income smoothing, companies largely liquidated LIFO inventories over the period before IFRS adoption, and thereby avoided massive one-time reserve restoration. And in order to reduce the increased tax burden from reserve restoration, companies conducted acceleration of equipment investment and utilized acquired tax credit to offset increased taxable income. Lastly companies slightly decreased the level of inventory after switching LIFO method since they no longer bear the risk of inventory liquidation and following decrease in after-tax cash flow.

Although this study identified oil refinery companies' various strategies regarding LIFO repeal, it is subject to several caveats. Above all, it failed to corroborate conjectures with statistical analysis due to the lack of data, and it somewhat weakens the robustness of the findings. And when comparing the figures before and after IFRS roadmap announcement, it failed to completely control for non-LIFO effects, so I cannot fully guarantee that the change is solely attributed to LIFO repeal. However, albeit these weaknesses, these findings throw a practical implication for the U. S. companies who adopt LIFO method as their inventory accounting. LIFO method is still allowed in the U. S. for now, but Obama government declared the intent of LIFO repeal pointing out the deficits LIFO method bears and increases the conformity with international standard.[18] Many of LIFO using companies objects to adopting this policy, but they should be prepared for the restoration of LIFO reserves and following massive taxation. Therefore, various financial and tax strategies this study identified would be helpful for LIFO using companies to be aware of the impact of ban on LIFO method. Furthermore, researchers would be able to further identify the tax strategies U. S. firms establish regarding LIFO abandonment in the future.

[18] Anticipating SEC adoption of international financial reporting standards (IFRS), the Obama Administration proposed to repeal the last-in, first-out (LIFO) method of accounting for inventories in 2010. Since IFRS do not permit the use of the LIFO method, their adoption by the SEC would cause violations of the current LIFO book/tax conformity requirement. Repealing LIFO would remove this possible impediment to the implementation of IFRS in the United States.

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국문 초록

2007 년 3 월 IFRS 로드맵 발표에서 재고평가법 상 후입선출법의 사용의 금지가 예고되었다. 이로 인하여 후입선출법(LIFO)을 사용하던 한국 정유사들에 누적되어 있던 유보 이익(LIFO reserve)이 평가법 전환 시 일시에 실현될 것으로 예상되었다. 따라서 본 논문은 이러한 일시적 이익의 증가에 대비하여 한국 정유사들이 어떠한 재무 및 세무 전략을 세웠는지 살펴보았다. 연구 결과 기업들은 재무 전략의 일환으로 이익의 일시적인 증가로 인한 변동성 증가를 회피하고, 이익 유연화를 실현하기 위해 기초 재고를 로드맵 발표 이후 IFRS 도입 전까지 미리 청산한 것으로 나타났다. 또한 기업들은 조기 기초재고 청산 및 이익 실현으로 인하여 증가된 세금 부담을 줄이기 위하여 세액 공제와 결손금을 이용하여 세 부담을 줄이는 전략을 세웠다. 한편 IFRS 도입 이후 기업들은 더 이상 기초 재고 청산과 그로 인한 세금 부담의 위험이 소멸되었기 때문에 재고 수준을 IFRS 이전에 비해 줄인 것으로 나타났다.