sustainability

MDPI

Article

Cost Adjustment in the Korean Defense Industry: Empirical Research on the Relation between Earnings Management and Sustainability

Sangkyun Sohn [1], Joonho Park [2,*] and Jinseek Lee [3]

1 The Department of Accounting, Hanyang University, Seoul 04763, Korea; sohnsk1@daum.net
2 The School of Business, Hanyang University, 222, Wangsimni-ro, Seongdong-gu, Seoul 04763, Korea
3 Defense Acquisition Program Administration, Gwacheon-si 13809, Korea; wami98@daum.net
* Correspondence: bizintel@hanyang.ac.kr; Tel.: +82-10-4291-1077

Received: 27 January 2019; Accepted: 4 March 2019; Published: 11 March 2019

check for updates

Abstract: This article is a demonstrative research on the motivation and method for earnings management in the Korean defense industry and its connection with the cost of equity capital. The data for this article comes from the Korean DICS (Defense Integrated Cost System). The difference between the cost data submitted by defense corporations and those verified by DAPA (Defense Acquisition Program Administration) serves as an indicator of earnings management; such a direct measurement of earnings management distinguishes this research from previous studies focusing on indirect indicators of earnings management, such as discretionary accruals. This article purposefully names such a specific form of earnings management as 'cost adjustment' that takes advantage of the difference between the submitted cost and the verified cost. The result of the research shows that cost adjustment activities in the defense industry are proportional to the capital cost required by shareholders. It is also notable that the cost adjustment activities in the defense industry are mostly done by making use of direct costs, in contrast to other industries utilizing indirect costs, which are hardly traceable. As a result of cost adjustment to meet short-term target profit, the long-term sustainability of the company would get impaired from the inflated costs in direct cost adjustments.

Keywords: cost adjustment; earnings management; defense industry; regulated industry; cost of equity capital; direct cost

---

1. Introduction

Fraud in earnings management significantly contributes to the far-reaching corruption and unsustainability of the Korean defense industry. Cost fraud in the defense industry has continuously been detected every year, causing the public to cast doubts on the morality of the former and current administrations. Figure 1 shows the magnitude of cost fraud in the Korean defense industry.

Earnings management is not just a unique issue in the Korean defense industry, but also a growing concern in western defense industries. Figure 2 is the trend in military spending, showing a sharp decrease in the expenditure of the western countries. Defense expenditures of US, UK, France, and Italy have been reduced by −3.9%, −7.2%, −5.9%, and −30%, respectively, whereas defense expenditures of China, Saudi Arabia, Russia, UAE, and South Korea have been increased by 132%, 97%, 91%, 136%, and 37%, respectively, from 2006 to 2015. The world total figure has been raised by 19% over 10 years [1]. Such reductions in western military expenditure, we assume, mean that the overall size of an economic pie granted for western defense firms becomes smaller. Thus, those companies in the west should take the best advantage of the deals they manage to get, which can drive them to make use of financial tactics that are not directly related to the company's actual performance, i.e., earnings management. This expands the relevance of this article to a global scope.

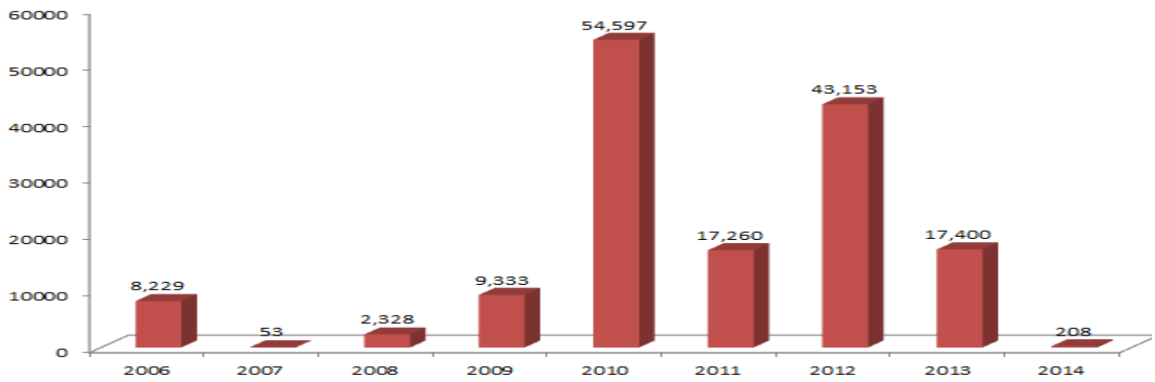


Figure 1. Cost Fraud Detected from 2006 to 2014, First Semi-year (Unit: $1000 USD) [2].

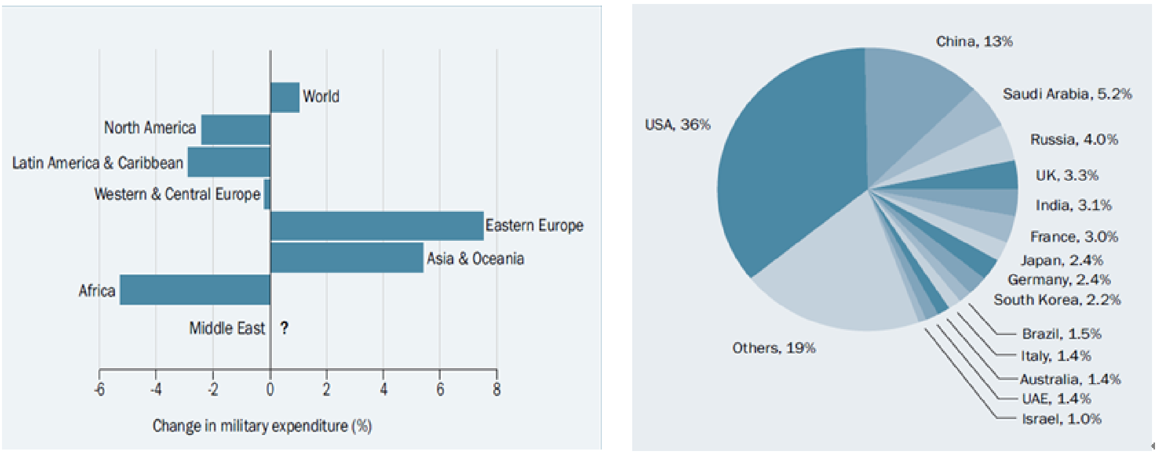


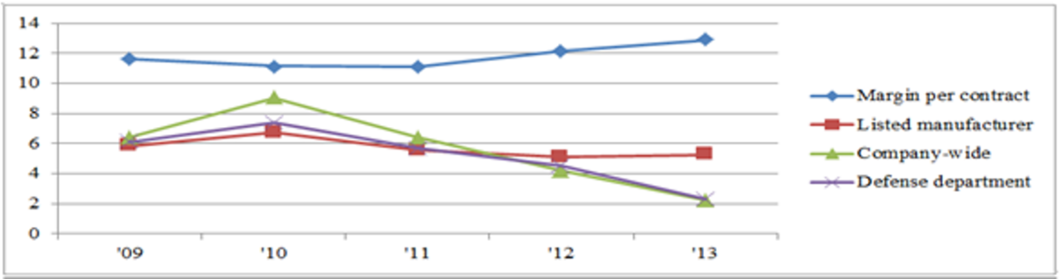
Figure 2. Trends in International Military Expenditure 2014–2015 [1].

This article will provide government regulators, including those in the west, with insight to find the blind spot in the current compensation policy, along with opportunities to apply it to other regulated industries.

This article also sheds light on whether the current compensation rules of 'actual costs' in regulated industries, including the defense industry, are operating properly. The defense industry shares common issues with regulated industries such as telecommunications, gas, electric power, and other major government-led industries. Thus, an analysis on earnings management in the defense industry can yield political implications and insight, especially when it comes to compensation rules, which can also be applied to other fields in the regulated industries.

The characteristics of the defense industry are similar to that of regulated industries, in several points referred to as US FASB No. 71. First, the price of goods or services is determined by a third party. There is no such thing as a 'fair price' in the defense industry as the market is a bilateral monopoly. The government determines the price based on the defense laws and regulations, called 'actual cost compensation rules'. There are usually two kinds of major contracts in those laws and regulations. One is a private contract and the other is a competitive contract. As the defense market is characteristically a monopoly market, private contracts are the most usual, except for the R&D phase. Private contracts consist of cost reimbursement contracts and fixed price contracts. Unlike competitive contracts, private contracts are the mainstream in actual cost compensation. A fixed price contract is also part of the actual cost compensation since it determines the fixed price by estimating the actual cost based on the past performance and cost-plus system. Second, the price level is set high enough to cover all the actual costs generated in the manufacturing process. Third, the cost of goods or services produced is expected to be recovered and charged to the consumer. Another characteristic of the defense industry is that its pricing methods are internationally similar [3]. It is natural to have such a policy because governments intend to control the monopolistic status of suppliers. A cost-plus policy is considered to be the most efficient in the defense industry, especially when the amount of production is relatively small and R&D expenditure is large.

The countries with cost-plus policies are highly vulnerable to cost adjustment by defense firms. Figure 3 shows average returns on operating income for defense firms and listed manufacturers. Large defense firms usually have diversified business portfolios, which includes non-defense sectors. Considering the fact that DAPA (Defense Acquisition Program Administration) allows for an 11% to 12% margin, it is reasonable to assume that the profit ratio of defense firms remains stable. However, their return on operating income parallels that of the company-wide ratio. Based on Rogerson's (1992) [4] assertion, we believe this is evidence of a cost shift from the commercial sector to the defense sector.



Year	'09	'10	'11	'12	'13	Average
Margin %	11.64	11.16	11.12	12.16	12.88	11.83
Listed manufacturer	5.83	6.72	5.57	5.13	5.25	5.70
Company-wide	6.4	9.05	6.41	4.21	2.23	5.66
Defense department	6.1	7.39	5.72	4.53	2.33	5.21

Figure 3. Average Return on Operating Income Comparisons and Profit Ratios for Average Contact of Weapon Procurements [5].

As shown in Figure 3, the returns on operating income of the Korean defense industry are very low and are decreasing. Companies with low profitability are more likely to fall into the temptation to adjust their cost to meet the interest of shareholders under the cost-plus system. However, because of the relatively small domestic market, Korean defense companies need to expand their market through exports. But the inflated cost to increase profits lowers price competitiveness in export markets. Hence, adjusting costs to meet short-term target profits would impair the long-term sustainability of the company. For example, KAI (Korea Aerospace Industry) and Lockheed Martin consortium participated in the USAF (US Air-Force) APT (Advanced Pilot Trainer) program. They bided against the Boeing-Saab consortium, but failed. USAF APT is to replace an aging supersonic trainer with an advanced pilot trainer. KAI offered $16 billion for a 350 T-50A trainer, but Boeing offered only at $9.2 billion. KAI's failure was mainly on the high cost of T-50A [6]. If cost adjustments are outside the scope of the law, the government imposes penalties on the company, such as restricting bid participation, imposing fines, and canceling the defense industry. Table 1 summarizes relation between cost adjustment and sustainability.

The contribution of this paper is to remind others that adjusting the costs for short-term target profit detracts from the long-term sustainability of corporations. Furthermore, implications from this paper that study the area of cost adjustment would allow the defense administration to revise and refocus its verification frameworks and procedures, which will help in rebuilding public trust in the government and the defense industry.

Table 1. Summarization of relation between cost adjustment and sustainability.

When cost adjustment is undetected	Cost inflation → Weakening price or export competitiveness → Long-term Sustainability is impaired
When Illegal cost adjustment is detected	Penalties imposed → Deteriorating reputation → Worsening business environment → Long-term or short-term sustainability is impaired

2. Prior Research and Different Concepts of Earnings Management

We know that earnings management can take place and the definitions of earnings management are numerous. The prominent motivations for earnings management can be put into the following categories: (1) motivations to smooth earnings [7–11], (2) motivations to meet the expectations of the analysts or of the company's stakeholders [12–15], (3) motivations from contractual perspectives, such as maximizing the manager's bonus [16–18], and (4) motivations to reduce tax expenses [19–22].

Most cases of earnings management are about intentionally reducing costs or expenses to increase income or increasing costs or expenses to decrease income. However, this article deals with a unique form of earnings management, which is to increase costs or expenses intentionally in order to increase income and to reduce costs or expenses in order to decrease income under a cost-plus system.

We explain this phenomenon by using 'cost of equity capital hypothesis', a theory we newly introduced to explain the hidden motivation for earnings management that has not been covered in previous research. It argues that under the actual cost reimbursement system, firms try to maximize the market value of equity by purposely increasing expenses in order to increase its profit or decreasing expenses in order to decrease its profit.

The cost of equity capital at a major firm has an impact on the manager's target profit. Production costs provide the motivation for managers to conduct earnings management under the actual cost reimbursement system of the defense industry in order to fulfill the revised target profit. Table 2 compares prior earnings management mechanisms with this study, when the company has a positive earnings management. This study deals with a special form of earnings management, which is to increase costs for the purpose of increasing income that comes from the compensation policy.

Table 2. Different concepts of earnings management compared between prior studies and this study.

Prior study	Incentive for earnings management → Earnings management through cost decrease to increase income → 'Quality of income' decrease → 'Accounting quality' decrease → Reliability decrease → Cost of capital increase [23]
This study	Incentive for earnings management (Shareholder's demand in income raise etc.) → Cost of capital increase → Adjustment of target income → Earnings management through expense increase to increase income → Cost increase → Maximization of compensation under cost-plus system → Maximization of the market value of equity

Previous research has taken various approaches to prove the existence of earnings management in the Korean defense industry. Lee (2014) [24] presented indirect evidence of earnings management through the analysis of cost stickiness and information asymmetry in the defense procurement. Kim and Jung (2012) [25] suggested the possibility of earnings management by verifying that defense industries' labor cost ratios were triple the ratio of the commercial industry. They showed that defense companies' labor cost compared to production cost was 21.43%, while that of commercial companies was 7.46%, from 2000 to 2009. It implies that defense companies inflate labor costs which are the main allocation based in defense product costing. In other research on the motivation behind earnings management, Yoon (2006) [26] proposed a 'political cost hypothesis'. It assumed that earnings management in regulated industries is mainly carried out using cost factors such as discretionary accruals, resulting in lower political costs. He provided empirical evidence of earnings management in firms in the Korean defense industry, which are more likely to manage earnings to preserve their bargaining power in government contracts since firms are better able to take advantage of management discretions under the low competition environment of the industry. Ahn and Heo (2003) [27], on the other hand, use structural equations to demonstrate the validity of the cost-shift hypothesis in Korea, which deals with a cost shift from a commercial sector to a defense sector in order to maximize income. Rogerson (1992) [4] and Tomas et al. (1992) [28] originally found that defense firms have an incentive for cost shifting because of the actual cost reimbursement policy used in the US.

Regarding the method of earnings management, Shin et al. (2007) [29] implied the possibility of earnings management through indirect cost. However, Kim and Jung (2012) [25] suggested that the earnings management focused mainly on the direct labor cost. Unlike defense industry, commercial industry is supposed to use indirect costs more in their cost adjustment because direct costs are easy to trace, while indirect costs get complicated through allocation procedures. In *Forbes*, "Overhead can kill you" clearly explains the complication involved in indirect cost allocation [30].

In Figure 4, the price of the defense product is composed of total cost and profit (cost-plus margin). Total cost is the sum of the production cost and SG&A. Production costs such as materials, labor, and overhead costs are classified into direct and indirect costs. All SG&A are indirect expenses. All direct costs are traced to each cost objective when they occur, but indirect costs are allocated to each cost objective from a cost center by the most appropriate allocation base. As common costs, which are called indirect costs, cannot be directly traced to the cost objectives, DAPA uses the allocation method [31].

This study focuses on earnings management through cost adjustment, which can be measured by the difference between the firm's submitted cost and the cost examined by Defense Acquisition Program Administration (DAPA). For the research methodology of earnings management, we partly consulted Park et al. (2014) [32] and Roychowdhury's (2006) [15] idea and adjusted them to the defense department. What we had in common is that we extracted contributing parts of the cost elements and compared them with the total cost to see if they were proportional.

A notable difference between Park et al. [32] and this article in terms of research methodology is the explanatory variables and sample selection, but we still had common ideas about dependent variables and control variables derived from DAPA data. Another striking difference in methodology between Roychowdhury [15] and this article is the mechanism of earnings management.

Roychowdhury [15] also focused on the right-hand side effects of cost of goods sold (CGS), such as sales discount adjustment or abnormal production cost. This is another notable difference, because we focused on the left-hand side effect of CGS, originating from costs of goods manufactured.

As shown above, this article is somewhat unique and different from traditional research in that it deals with earnings management using direct costs such as material, labor, and other costs. Throughout the article we have called this practice 'cost adjustment'. By taking a close look at the cost adjustment in the Korean defense industry, this article contributes to the establishment of fair price control mechanisms for the regulated industries with the empirical demonstration of how and why cost adjustment is conducted.

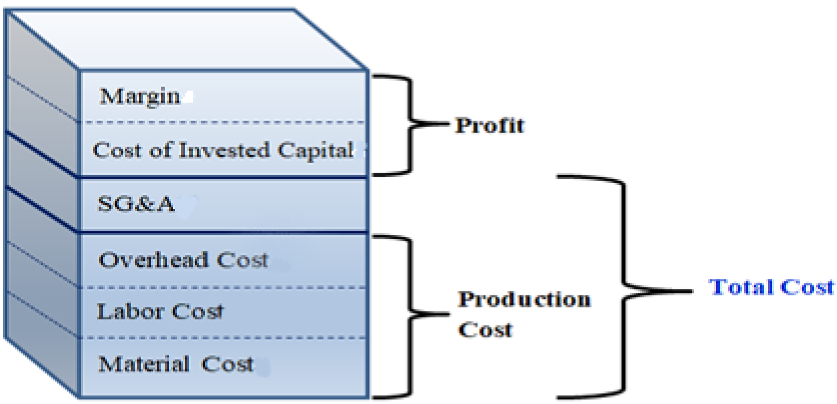


Figure 4. Defense Product Price Composition under the Cost-Plus System [31].

3. Hypotheses and Research Design

3.1. Hypotheses

As stated in the previous study, there are many kinds of earnings management incentives. Management bonuses and the debt covenant hypothesis are income-increasing motivations, and political and the big bath hypothesis are income-decreasing motivations [7–22].

In this article, we focus on 'cost of equity capital hypothesis' and the cost adjustment. The companies may face uncertainties such as the sudden shrinkage in the planned amount of arms procurement by the government or the expectation of sales decrease due to a change in the rules governing the cost. They also may face uncertainty about future sales due to R&D failure in creating new weapon systems. These kinds of uncertainties would increase cost of equity capital [33]. When the capital costs are increased, the shareholders call for an increase in the company's profits to maximize the market value of equity. Since the stock price is a concept of discounting the future cash flow to the capital cost, the company should increase the cash flow in order to increase the stock price when the capital cost increases [34]. To increase cash flow, management would adjust their current and future profits appropriately to maximize cash flows. With respect to cost adjustment within limited costs to increase cash flow under the cost-plus system, it is assumed that increasing costs will increase current profits, and decreasing costs will sacrifice current profits to increase future costs for future profits. Because Korea's defense cost system does not adjust journal entries regarding the variance in sales volume, there is an incentive to maximize the cost allocation ratio at the time of rapid sales growth.

Cost adjustment is considered the only viable option to meet the short-term target profit without increasing sales volume or decreasing production cost in regulated industries, as it is the government that controls the procurement price within a predetermined budget. Unlike commercial companies, the managers of defense companies do not have control over supply volume through marketing strategies, such as aggressive promotion or reducing the price margin rate since demands are determined by the government. For example, if the government signs a contract with a defense company for twenty tanks, the company on the contract must supply the exact quantity as specified in the contract. Thus, the company can't dramatically increase its income through marketing activities in the short term, nor does it want to look into the possibility of decreasing the production cost internally because, under the actual cost reimbursement system of the defense industry, the government will notice the decrease in the production cost and will respond to it by decreasing the buyout price accordingly. They are left without many options when shareholders require a higher rate of return, which compels them to turn to cost adjustment.

Based on the above, we suggest two hypotheses regarding the motivation for cost adjustment (H1), and the method of cost adjustment (H2). If shareholders hold a risky stock, they require high profit and pressure the management to gain more profit. Then, the management would adjust the target profit and tend to conduct cost adjustments in the following year. Companies with their own managers face relatively weaker pressure regarding the firm's performance than companies with a professional manager, the key influence being the owner who is less interested in the short-term performance of the company. However, companies with professional managers face high pressure from various shareholders [18,35]. Thus, managers of such companies would have more incentives to adjust costs. When it comes to cost adjustment in the defense industry, the managers would adjust direct costs more frequently than indirect costs because indirect costs are mainly allocated according to direct costs. Furthermore, as direct labor cost is the most used allocation base, the managers would use direct labor costs the most out of all the cost elements.

Hypothesis 1 (H1). *Companies with professional managers tend to conduct cost adjustment to respond to the increase in shareholders' required rate of return.*

Hypothesis 2 (H2). *Direct costs tend to be used more for cost adjustment than indirect costs.*

Hypothesis 2a (H2a). *Direct labor costs are the most used among direct cost elements.*

3.2. Cost Adjustment Detection

Most recent articles about earnings management use indirect proxies such as discretionary accruals or abnormal production costs. In this article, however, we employed a more direct measurement of earnings management named 'Cost Adjustment detection'. Cost Adjustment detection 1 (CA_1) is defined as the gap of 'Firms' offering cost, minus the government's accepted cost (refer to Figure 5). For example, if the defense company submits accounting records that contain special bonuses for the workforce, then DAPA reviews whether the bonuses are acceptable and in line with company policy. If the company record is $100 and DAPA's acceptable level is $80, then $20 is supposed to be the earnings management to inflate the cost under an actual cost compensation system. If the defense company submits material cost records, DAPA reviews whether the material used is appropriate compared to the planed amount. The defense company often does not follow the cutting plan, so they use more material than is desirable. If the company record of materials used is $200 and DAPA's acceptable level is $120, then $80 is also supposed to be the earnings management to inflate cost. DAPA's detected examples are as follows: purchasing expensive materials, submission of false tax statements or false import masters, cost switching between civilian parts and defense parts, allocation of high wage employees to the defense department, etc. Cost adjustment detection 2 (CA_2) is defined by the ratio of the Firm's offering cost over the government's accepted cost accepted. All the data is obtained directly by the Defense Integrated Cost System (DICS) from Korea Defense Acquisition Program Administration (DAPA). Every year, Korean defense firms offer all cost data to DAPA to let it determine the cost allocation base, and then DAPA inspects all offered cost data and discloses the acceptable cost base to individual defense firms. Mistakes made during cost verification are not significant because mistakes found with the submitted costs are returned to the company, and the revised cost data is reviewed again before being finally accepted.

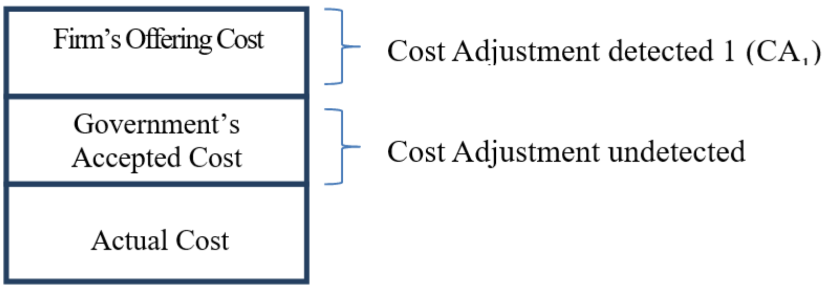


Figure 5. Cost Adjustment Detection Concept.

3.3. Conventional Relationship between 'CA (Cost Adjustment)' Variable and Prior Earnings Management Incentives

We designed the primary research method by using Model 1 to copy the effectiveness of the main research model so as to verify most defense companies' cost adjustment motivations, stemming from the increasing lag in equity capital cost. Then, we have the second research by using Model 2 to verify the relationship between cost adjustment and lagged cost of equity capital. In order to examine the relationship between cost adjustment detection (CA_1) and traditional earnings management motivation, five independent variables were selected as explanatory variables, which are most commonly used in defense costing articles such as Yoon [26] and Park [32] or other major earnings management articles such as Watts and Zimmerman [36], DeFond and Jiambalvo [37], Dechow et al. [38], Jones [19], and Roychowdhury [15].

Model 1 is an OLS (Ordinary Least Squares) model to verify the usefulness of variable '*CA*' by means of conventional earnings management elements. A description of the parameters for Model 1 is as follows:

$$CA_{1i,t} = a_{i,t} + \beta_1 ROA_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \beta_4 GROWTH_{i,t} + \beta_5 MTB_{i,t-1} + Year_{i,t}{}^{dummy} + Ind_{i,t}{}^{dummy} + \varepsilon_{i,t}. \quad \text{(Model 1)}$$

Table 3 is the specification of variables regarding Models 1–5.

Table 3. Variable Specifications of Models 1–5.

	Variables	Specification
Models 1–3	$CA_{1i,t}$	Total cost gap between firm offered and government accepted (∣Total $Cost_t^{firm}$ − Total $Cost_t^{gov't}$∣)/$Asset_{t-1}$
	$CEC_{i,t-1}$	Explanatory variable, lagged cost of equity capital
	$PROF_{i,t}$	Dummy variable, if firms run by professional manager 1, or 0
	$ROA_{i,t}$	'NI_t/$Asset_{t-1}$' adjusted by the defense department
	$SIZE_{i,t}$	Log value of the initial assets adjusted by the defense department Ln($Asset_{t-1}$)
	$LEV_{i,t}$	'$Debt_t$/$Asset_{t-1}$' adjusted by the defense department
	$GROWTH_{i,t}$	Growth of sales adjusted by the defense department $\Delta Sales_t$/$Asset_{t-1}$
	$MTB_{i,t-1}$	The initial market value to the initial book value ratio Market $value_t$/Book $value_{t-1}$
	$Year^{dummy}$	Year dummy variable
	Ind^{dummy}	Industry dummy variable
Models 4–5	$CA_{2i,t}$	Total cost ratio of firm compared to government Ln(Total $Cost_t{}^{firm}$/Total $Cost_t{}^{gov't}$)
	$Direct_{i,t}$	All direct cost group ratio of firm side compared to government side Ln(All the Direct $Cost_t{}^{firm}$/All the Direct $Cost_t{}^{gov't}$)
	$Indirect_{i,t}$	All indirect cost group ratio of firm side compared to government side Ln(All the Indirect $Cost_t{}^{firm}$/All the Indirect $Cost_t{}^{gov't}$)
	$DMC_{i,t}$	Direct material cost ratio of firm compared to government Ln(Direct Material $Cost_t{}^{firm}$/Direct Material $Cost_t{}^{gov't}$)
	$IMC_{i,t}$	Indirect material cost ratio of firm compared to government Ln(Indirect Material $Cost_t{}^{firm}$/Indirect Material $Cost_t{}^{gov't}$)
	$DLC_{i,t}$	Direct labor cost ratio of firm compared to government Ln(Direct Labor $Cost_t{}^{firm}$/Direct Labor $Cost_t{}^{gov't}$)
	$ILC_{i,t}$	Indirect labor cost ratio of firm compared to government Ln(Indirect Labor $Cost_t{}^{firm}$/Indirect Labor $Cost_t{}^{gov't}$)
	$DOC_{i,t}$	Direct other cost ratio of firm compared to government Ln(Direct Overhead $Cost_t{}^{firm}$/Direct Overhead $Cost_t{}^{gov't}$)
	$IOC_{i,t}$	Indirect other cost ratio of firm compared to government Ln(Indirect Overhead $Cost_t{}^{firm}$/Indirect Overhead $Cost_t{}^{gov't}$)
	$SGA_{i,t}$	SG&A ratio of firm compared to government Ln($SG\&A_t{}^{firm}$/$SG\&A_t{}^{gov't}$)

CA_1 was set as the dependent variable based on the verifiable cost difference, which was treated as cost adjustment, between submitted cost by manufacturers and identified cost by DAPA. The absolute value was used to eliminate directionality from the reverse cost adjustment. In rare cases, a negative cost gap was observed when the company wanted to reduce present costs in order to increase cost in the future. For example, company X has been producing radio devices for a long time, but new tactical data communication systems, which are more expensive, anticipate higher demands. Company X can estimate the production volume and schedule because it has participated in the R&D phase. Then, the company intentionally reduces depreciation cost to increase future depreciation cost by classifying current buildings or equipment as idle assets, even though their current income may be sacrificed. If discovered, DAPA revises and restores the reduced cost. In the Korean defense industry, indirect costs are to be recognized by applying a predetermined overhead application rate determined by DAPA. Total overhead will be determined by multiplying the overhead application rate with the expected labor cost. Under this structure, for example, the overhead application rate for 2020 is determined by DAPA in 2019 by using 2018 overhead and labor costs data. So, when a company expects a huge increase in labor costs in the future due to the production of new weapon system, it can defer depreciation expenses in order to influence future application rates, which will result in increased costs and, in turn, profits from the price increase. Despite the time value of money, such earnings management activities by the company can result in the maximization of total shareholders' values.

Independent variables were *ROA*, *LEV*, *SIZE*, *GROWTH*, and *MTB*. *ROA* was scaled to the initial total assets. *LEV* was debt ratio, also scaled to the initial total assets. *SIZE* was the adjusted natural log value of the market value of equity at the beginning of the year. *GROWTH* was the sales difference from the current year to the lagged year, scaled to the initial total assets. *MTB*, Market-to-book ratio, was the ratio of the market value of equity to the beginning book value. These were also the most common control variables in prior research. (Yoon [26] and Park et al. [32] used *ROA*, *SIZE*, and *LEV* as control variables, whereas they used *DA* and *EM* as independent variables regarding earnings management in the Korean defense industry. Park et al.'s [32] *EM* concept was identical to CA_1 in this article. Roychowdhury [15] also used *ROA*, *SIZE*, and *MTB* as control variables regarding real activity earnings management research.) *ROA* was a variable to control the measurement error correlated with the financial performance. In the case of lower performance of the executive, more cost adjustments were expected [15,36]. β_1 was predicted as negative. *SIZE* was a variable to control the political influence on the company. The larger the company size, more likely it is to defer the reported earnings [39]. β_2 was predicted as negative. *LEV* was a variable to control the debt covenant effect. The more debt the company has, more likely it is to violate the debt covenant, and the more earnings management it is expected to conduct [37,40]. β_3 was expected to be positive. *GROWTH* was a variable to control the discretionary accrual error. The higher the sales growth, increasing the long-term forecast analysis, the more cost adjustment is needed to fulfill the expected forecast [19]. β_4 was predicted to be positive. *MTB* was a variable to control systematic variation in production costs and discretionary expenses with growth opportunities and size [15,38,41,42]. Companies with relatively low market values compared to the book have higher growth opportunities and tend to carry out cost adjustment more often. β_5 was predicted to be negative. $Year^{dummy}$ was the year dummy variable. Ind^{dummy} was the industry dummy variable. Industries were also classified by subdivision by using KIS-Value data. For example, destroyer manufacturing was classified as shipbuilding, bulletproof vest manufacturing was classified as clothing industry, and fighter production was classified as aviation industry. Because various kinds of conventional motivations will have simultaneous impacts on cost adjustment, we also verified the relationship through Model 1 that was intended to prove whether it coincided with prior research. Model 1 was significant to verify the suitability of the main research model described below.

3.4. Main Research Model and Variable Definitions

Models 2 and 3 were the main research models to demonstrate hypothesis 1 and to detect the possible relationship between cost adjustment of companies run by professional managers and lagged cost of equity capital. Model 2 has introduced the dummy variable *PROF*, which was 1 if it was a registered firm in DAPA and was run by professional manager, and 0 if not. The interaction term $CEC \times PROF$ captured cost adjustment of companies run by professional managers regarding cost of equity capital in the defense industry. Model 3 is the same as model 2 except for variable *PROF*, which avoided the multicollinearity problem measured by VIF (Variance Inflation Factor). A description of the parameters for Model 2 and 3 is as follows:

$$CA_{1i,t} = a_{i,t} + \beta_1 CEC_{i,t-1} + \beta_2 PROF_{i,t} + \beta_3 CEC_{i,t-1} \times PROF_{i,t} + \beta_4 ROA_{i,t} + \beta_5 SIZE_{i,t} + \beta_6 LEV_{i,t} + \beta_7 GROWTH_{i,t} + \beta_8 MTB_{i,t-1} + Year_{i,t}{}^{dummy} + Ind_{i,t}{}^{dummy} + \varepsilon_{i,t}. \quad \text{(Model 2)}$$

$$CA_{1i,t} = a_{i,t} + \beta_1 CEC_{i,t-1} + \beta_2 CEC_{i,t-1} \times PROF_{i,t} + \beta_3 ROA_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 LEV_{i,t} + \beta_6 GROWTH_{i,t} + \beta_7 MTB_{i,t-1} + Year_{i,t}{}^{dummy} + Ind_{i,t}{}^{dummy} + \varepsilon_{i,t}. \quad \text{(Model 3)}$$

The dependent variable CA_1 was the same as Model 1. Basic independent variables such as *ROA*, *SIZE*, *LEV*, *GROWTH,* and *MTB* were similar to Model 1, which was to verify usefulness of the CA_1 variable. The variables had been used as explanatory variables in Model 1, but were used as control variables in Model 2 to disclose possible influences on the hidden motivation for cost adjustment driven by cost of equity capital. CEC_{t-1}, lagged cost of equity capital, was an explanatory variable that was calculated through the CAPM (Capital Asset Pricing Model) method, and was a model designed to test if the manager would try to achieve the target profit through earnings management when lagged cost of equity capital increased. When lagged cost of equity capital increased, CA_1 was predicted to increase as well, which in turn made it natural to expect β_3 to have a positive value. Because of the multicollinearity stemming from using the dummy variable *PROF* and interaction term $CEC \times PROF$ together in Model 2, we first looked at the relationship between earnings management and cost of equity capital through OLS, except for one of the variables in Model 3. Second, to improve reliability of the results from Model 3, an additional analysis was performed using ridge regression in a later part of this article.

Model 4 also is an OLS model designed to prove Hypothesis 2. The definition of variables in Model 4 is as follows:

$$CA_{2i,t} = a + \beta_1 Direct_{i,t} + \beta_2 Indirect_{i,t} + \varepsilon_{i,t}. \quad \text{(Model 4)}$$

CA_2 was set as a dependent variable based on the verifiable cost ratio, which was also treated as another form of earnings management, between cost submitted by manufacturers and cost identified by DAPA. The cost elements in Model 4 had been categorized into direct cost and indirect cost to compare how much each cost of production affects earnings management. Direct was expressed as the sum of direct material costs, direct labor costs, and direct overhead costs in the ratio of cost requested by the company to the cost allocated by the government. This was similarly expressed for the indirect, which was the sum of indirect material costs, indirect labor costs, indirect overhead costs, and SG&A. As the earnings management in each cost element increased, the earnings management in total cost was predicted to increase, so β_1 and β_2 were expected to be positive values again. Furthermore, the direct cost was predicted to be used more than indirect cost in earnings management, so using the standardized coefficients from the regression equation can be used to compare, $\beta_1 > \beta_2$.

Model 5 is an OLS model designed to prove Hypothesis 2a, and the variables in the model 5 are as follows:

$$CA_{2i,t} = a + \beta_1\, DMC_{i,t} + \beta_2\, IMC_{i,t} + \beta_3\, DLC_{i,t} + \beta_4 ILC_{i,t} + \beta_5 DOC_{i,t} + \beta_6 IOC_{i,t} + \beta_7 SGA_{i,t} + \varepsilon_{i,t}. \quad \text{(Model 5)}$$

CA_2 was the same as Model 4. The explanatory variables were *DMC*, *IMC*, *DLC*, *ILC*, *DOC*, *IOC*, and *SGA*. These variables represented the key elements of the defense industry's total cost, including direct material cost, indirect material cost, direct labor cost, indirect labor cost, direct overhead cost, indirect overhead cost, and SG&A. These elements can be arranged such that the variables represent the ratio of the company's total cost submitted to DAPA and DAPA's confirmed cost. Model 5 shows what kind of cost element the earnings management was most likely to happen in. SG&A is distinct in that it can affect other costs because Korean defense firms tend to have incentives to allocate SG&As, which have a ceiling, to other costs. As the earnings management in each cost element increased, the earnings management in total cost was predicted to increase as well, so β_1–β_7 were all predicted to be positive values.

As the dependent variables of Models 2 and 3 were cost data, whereas explanatory variables were based on stock price, it was assumed that endogeneity was less affected. Even if there were influences between variables, the problem of endogeneity seemed to be mitigated because the dependent variables had a time lag of one year when designing models [43]. Regarding Models 4 and 5, the Pearson correlation was somewhat higher among variables in this article, which may raise the endogeneity problem. However, the models were different from ordinary OLS. The model was to determine the extent to which each independent variable affected the dependent variable, such as how much the direct labor cost difference was influencing the total cost difference. Thus, we think there was not much of an endogeneity problem in Models 4 and 5.

4. Sample Selection and Results

4.1. Sample Selection

In Table 4, an average of 90 companies were registered in the Defense Industry's Defense Integrated Cost System (DICS) in Korea DAPA. Panel A for H1 analyzed a time frame of 13 years of cost data to detect the cost adjustment (CA_1) from 2000 to 2012, as the DICS data was available only after 2000. Due to security issues, such as recent fatal hacking from North Korea, data after 2012 could not be obtained because taking data out of DAPA was no longer approved. At the end of 2012, all the KOSPI (Korea composite Stock Price Index) and KOSDAQ (Korea Securities Dealers Automated Quotation) 30 companies related to the Korean defense industry were used to test H1. Firm years of the listed defense companies were initially 330 in total, but were reduced to 177 firm years due to missing data in defense sales, stock prices, initial assets, or other control variables. Sample selected firms accounted for 54% of all the listed firms. If populations were expanded to the whole defense firm, defense sales of sample selected companies accounted for 28% of the total domestic sales of the Korean defense industry in 2012. Aggregate defense sales of sample selected companies were KRW 2.3 trillion, and total domestic sales of Korean defense companies were KRW 8.1 trillion in 2012 [44]. At the same time, a 5-year moving average beta for CAPM to draw *CEC* was calculated by using KIS-Value data from 1999 to 2012. Panel B for H2 also analyzed a time frame of 13 years from 2000 to 2012, which added up to 969 firm years for all the defense companies. After excluding the missing values of each cost element, we ended up with 777 firm years. There can be a little bit of difference in the final number of samples per applicable hypothesis because there are differences in the number of missing values for each element. As panel A needed cost of equity capital for its data, population was limited to listed firms. Whereas panel B only needed cost data, populations need not be limited. Outliers were removed with an upper and lower limit of 1% for panel A and B, respectively.

Table 4. Sample Selection.

Panel A: Sample selection for H1			
Number of Samples	**Deduction**	**Total**	**Remark**
Listed defense firms		330	Year: 2000–2012
Missing defense sales	−36	294	
Missing stock price	−72	222	
Missing beginning asset	−14	208	
Missing control variables	−28	180	
Excluding Outlier	−3	177	Samples for Model 1–3
Panel B: Sample selection for H2			
Number of Samples	**Deduction**	**Total**	**Remark**
Defense firms registered in DAPA		969	Year: 2000–2012
Excluding missing and outlier	−192	777	Samples for Models 4 and 5

Note: All the KOSPI (Korea composite Stock Price Index) and KOSDAQ (Korea Securities Dealers Automated Quotation) 30 companies regarding the Korea defense industry are used to test H1. Calculating a 5-year average beta for CAPM was done by using KIS-Value data from 1999 to 2012. For defense data, the Defense Integrated Cost System (DICS) was consulted. Outliers were removed at the 1% level.

4.2. Data Deduction

In order to demonstrate Models 2 and 3 to verify Hypothesis 1, cost of equity capital (*CEC*) must be drawn. In this article, the CAPM [45] model was used to compute cost of equity capital, and as shown in Table 5, CAPM was used widely in Korean-regulated industries; thus, it had been used here for consistency. The variables of CAPM in the Equation (1) are as follows:

$$E(R_j) = R_f + \{E(R_m) - R_f\}\ \beta_j, \quad (1)$$

where,
- $E(R_j)$ Cost of equity capital for firm_j
- R_f Risk free rate
- $E(R_m)$ Market risk premium
- β_j Market risk coefficient, systematic risk for firm_j

Table 5. Regulated Industry Profit Determination under Actual Cost Reimbursement Rules in Korea.

Fields	Telecom	Electricity	Gas	Water	Rail	Road
Criteria	CAPM	CAPM	CAPM	Saving interest rate	Saving interest rate	Saving interest rate

Source: Korean Ministry of strategy and finance report, 2013.

In Equation (1), risk-free rate is the interest rate of Korea National Housing Bonds I. There are two popular forms of risk-free assets. One is Korea National Housing Bonds and the other is Korean Treasury Bond. If the risk of two assets is almost zero, then the more profitable asset is reasonable. Here, in the Korean market, the interest rate of Korea National Housing Bonds I is relatively higher than that of Korean Treasury Bond [46]. Market risk premium is calculated based on the EWI (Equally Weighted Index) data of KOSPI from 1980 to 2012. KOSPI data is available only after 1980 from KIS-value. Because KOSPI is the most representative form of Korean stock market, the EWI prevents excessive impacts on the market as a whole from the rapid volatility of large companies with large market capitalization. Park et al. [44] and Ko et al. [46] also used EWI for another regulated industry in telecom to calculate Korea market risk premium. Lastly, to draw beta, the core of the CAPM model, β values were calculated for 10 periods of stock prices. The β-value of CAPM was calculated based on company-wide data of the top 30 listed defense companies, so there might be noise that contradicts the real β-value. This can be a potential limitation of the lagged cost of equity capital. Each period was based on the moving average of five-year weekly stock prices. Daily fluctuations can overstate the stock price variation and monthly data cannot reflect the real movement of stock price [43]. We employed a medium level of movement, which was weekly data. A five-year beta was used for to two reasons. First, five years is representative of the usual business cycle of manufacturing. Second, the Korea credit risk in 2002 and global financial risk in 2008 can influence stock prices. Five years of beta can mitigate the unusual stock price from two main economic shocks.

4.3. Descriptive Statistics

In Table 6 panel A, the average defense sales were 1222 hundred million won. The five-year average beta was 0.970, and average lagged cost of equity capital was 15.1 percent. As the average beta was less than 1, the defense industry was less risky than the market. The average debt ratio was 64%, which was a very low level compared to other industries in Korea. According to Bank of Korea statistics from 2009 to 2012, the average recorded debt ratios of Korean manufacturing companies were 116.79%, 108.28%, 109.19%, and 101.04%, respectively [47]. The average market-to-book value ratio was 2.1. Correlations between each cost element and cost adjustment variables (CA_1 or CA_2) are in Table 7. As most of the base allocations in defense cost accounting fields had been based on labor, the correlations between labor cost adjustment factors and the dependent variables were somewhat higher. For example, correlation between CA_2 and DLC was 0.639, the largest among variables of Model 5. In Table 7 panel A, the respective Pearson correlation between CA_1 and ROA, $SIZE$, and MTB was negative. ROA and $SIZE$ were negative and significant. In Table 7 panel B, direct costs correlations were stronger than indirect costs compared in the same cost category, except overhead cost. For example, 'Corr (CA_2, DMC) = 0.54' > 'Corr (CA_2, IMC) = 0.45', 'Corr (CA_2, DLC) = 0.63' > 'Corr (CA_2, ILC) = 0.50'.

Table 6. Descriptive Statistics.

Panel A: Descriptive Statistics of Cost Adjustment Motivation Variables						
	N	**S.D**	**Mean**	**Median**	**Max**	**Min**
Defense sales(mil, ₩)	177	212,380	122,282	30,063	1,187,026	110
CA_1	177	0.2050	0.0921	0.0171	1.4218	0.0000
CEC	177	0.0704	0.1519	0.1462	0.2991	0.0445
Beta	177	0.5098	0.9700	0.9471	2.0453	0.0015
LEV	177	0.2484	0.6377	0.6068	1.6755	0.0987
ROA	177	0.1053	0.0200	0.0222	0.5218	−0.5359
$SIZE$	177	2.0804	24.0095	24.2155	27.7524	18.9344
MTB	177	1.2607	2.1345	1.6778	5.5795	0.4436
$GROWTH$	177	0.7451	0.2216	0.0543	5.4634	−1.2984
Total asset(mil,₩)	177	6,763,403	4,458,799	1,704,823	30,637,882	22,297
Panel B: Descriptive Statistics of Cost Adjustment Elements						
	N	**S.D**	**Mean**	**Median**	**Max**	**Min**
CA_2	777	0.2080	0.0484	0.0171	2.3113	−1.1249
Direct	777	0.2032	0.0005	0.0000	2.3785	−2.1663
Indirect	777	0.3111	0.1860	0.0950	3.1143	−1.5504
DMC	777	0.3059	0.0126	0.0000	4.2788	−2.2657
IMC	777	0.4152	−0.0343	0.0000	3.4649	−3.6462
DLC	777	0.2086	−0.0119	0.0000	1.4515	−2.1869
ILC	777	0.3346	0.1408	0.0087	2.4914	−0.6996
DOC	777	0.3591	−0.0381	0.0000	3.3469	−2.3373
IOC	777	0.3050	0.1645	0.0584	2.7759	−0.6928
SGA	777	0.5165	0.2515	0.1532	3.9735	−4.1935

See variable definitions in Table 3.

Table 7. Pearson Correlation.

Panel A: Pearson Correlations for Models 1, 2, and 3						
	$CA_{1i,t}$	$CEC_{i,t-1}$	$ROA_{i,t}$	$SIZE_{i,t}$	$LEV_{i,t}$	$GROWTH_{i,t}$
$CEC_{i,t-1}$	−0.091					
$ROA_{i,t}$	**−0.438**	0.006				
$SIZE_{i,t}$	**−0.297**	**0.282**	**0.241**			
$LEV_{i,t}$	**0.178**	−0.029	0.037	0.027		
$GROWTH_{i,t}$	**0.167**	0.041	**0.255**	**−0.201**	−0.031	
$MTB_{i,t-1}$	−0.030	**−0.209**	−0.065	−0.079	0.036	−0.122

Panel B: Pearson Correlations for Models 4 and 5									
	$CA_{2i,t}$	$Direct_{i,t}$	$Indirect_{i,t}$	$DMC_{i,t}$	$IMC_{i,t}$	$DLC_{i,t}$	$ILC_{i,t}$	$DOC_{i,t}$	$IOC_{i,t}$
$Direct_{i,t}$	**0.842**								
$Indirect_{i,t}$	**0.787**	**0.432**							
$DMC_{i,t}$	**0.541**	**0.685**	**0.233**						
$IMC_{i,t}$	**0.453**	**0.443**	**0.308**	**0.176**					
$DLC_{i,t}$	**0.639**	**0.726**	**0.391**	**0.282**	**0.385**				
$ILC_{i,t}$	**0.506**	**0.351**	**0.670**	**0.200**	**0.156**	**0.391**			
$DOC_{i,t}$	**0.508**	**0.658**	**0.158**	**0.322**	**0.267**	**0.406**	**0.165**		
$IOC_{i,t}$	**0.581**	**0.444**	**0.723**	**0.263**	**0.192**	**0.371**	**0.704**	**0.167**	
$SGA_{i,t}$	**0.527**	**0.223**	**0.741**	**0.160**	**0.103**	**0.163**	**0.313**	0.054	**0.341**

Note: Correlations significant at the 5% level are marked in bold. See variable definitions in Table 3.

4.4. Empirical Results

In Table 8 panel A, the OLS result showed how cost of equity capital influenced cost adjustment. Model 1 copied the variables from prior research on cost adjustment and proved the usefulness of the main research model. Results were that each variable matched the predicted signs and significances. *ROA* and *SIZE* were negative and significant as expected. *LEV*, *GROWTH*, and *MTB* were positive and significant as predicted. The parameter signs of the interaction term *CEC*PROF* were observed positive as expected in Models 2 and 3, but significant only in Model 3. However, in Model 2, the VIF of variable *PROF* and $CEC \times PROF$ was 14.31 and 12.52, respectively. As a result, the explanatory variable was insignificant because of multicollinearity originating from the relationship between the dummy variable *PROF* and interaction term $CEC \times PROF$. Therefore, to minimize multicollinearity, Model 3 was constructed by excluding the *PROF* variable. In Model 3, all the parameter signs were as predicted, and the explanatory variable $CEC \times PROF$ was positive and significant at the 10% level, supporting hypothesis 1 (H1). This means if shareholders required an increase in cost of equity capital, the executive aggressively conducted cost adjustment. In other words, the companies run by professional managers, in which the shareholder's influence is great, would actively conduct cost adjustments if they failed to meet the target profit. Untabulated results also indicated that $CEC \times PROF$ of Model 3 was still positive and significant at a 10% level when CA_1 excluded the negative observations, but *CEC*PROF* of Model 3 was positive, but insignificant, when CA_1 did not take an absolute value.

In Table 8 panel B, the direct costs were expected to be used more than indirect costs as a method of cost adjustment. The standard coefficients of *Direct* and *Indirect* were 0.617 and 0.520 and significant at 1%, which meant direct cost was a more influential factor in cost adjustment than indirect cost. Hypothesis 2 was supported as expected. This showed different results with those of the study by Shin et al. [16] who argued that, rather than material cost or labor cost, indirect costs cause the main problem in costing. Unlike cost adjustment in commercial companies that use complicated indirect costs, defense companies mainly use direct costs for cost adjustment, presumably because allocation bases are direct costs in the defense industry.

In Table 8 panel C, Model 5 was used for verifying the main method of cost adjustment. We found how much each cost element had an impact on cost adjustment. It was examined by the size of standardized coefficients. The result was that cost adjustment was conducted most in SG&A and least in indirect labor costs, with the SG&A and direct labor cost being the greatest (SG&A > direct labor cost > direct material cost > direct overhead cost > indirect overhead cost > indirect material cost > indirect labor cost). Unlike the prediction that direct labor cost would be most commonly used as cost adjustment, SG&A was used the most for cost adjustment. As a result, hypothesis 2a (H2a) was not supported. This was because the defense companies were assumed to actively cover the under-compensated SG&A, as 7%–9% of ceiling existed in SG&A budgeting. In other words, the under-compensated SG&A was supposed to be actively shifted to other costs. The defense companies' level of compensation in general expense is below 1%–3% compared to commercial listed companies, considered to general expense ceiling in defense costing and listed companies average general expense level together. Bank of Korea economic statistics shows that the large commercial manufacturing firms' average level of general expenses were 10.01% from 2010 to 2012 [46]. For example, the depreciation expense of a marketing staff dormitory, which is deemed to be a part of SG&A, can be intentionally classified as the depreciation cost of production of the worker dormitory, which is an indirect manufacturing overhead cost. However, if we consider production costs only, direct labor costs are most frequently used in cost adjustment because the direct labor costs are widely used as the allocation base. Based on our cost verification experience, the company usually inflated its costs by manipulating labor hours, mainly by ignoring learning rates.

Table 8. Tests for the cost adjustment motivation and methods.

Panel A: Regression for Cost of Equity Capital Influence on the Cost Adjustment							
	EST	**Model 1**		**Model 2**		**Model 3**	
		Coeff	**T**	**Coeff**	**T**	**Coeff**	**T**
Intercept	?	0.654	1.19	2.496	2.47	1.693	2.09
CEC	?			−1.567	−1.22	−2.228	−1.88 *
PROF	?			0.387	1.32		
CEC × PROF	**+**			**0.582**	**0.44**	**1.797**	**1.84 ***
ROA	-	−2.531	−6.81 ***	−2.622	−6.96 ***	−2.630	−6.97 ***
SIZE	-	−0.036	−1.73 *	−0.109	−2.48 **	−0.068	−2.17 **
LEV	+	0.424	2.48 **	0.272	1.49	0.303	1.67 *
GROWTH	+	0.223	3.65 ***	0.188	2.94 ***	0.207	3.31 ***
MTB	-	−0.136	−2.63 ***	−0.144	−2.77 ***	−0.138	−2.66 ***
N		177		177		177	
Adj-R^2		0.2710		0.2821		0.2786	
F Value		4.48		4.14		4.24	

Panel B: Cost adjustment Influences Compared between Direct Cost and Indirect Cost Groups				
	EST	**Model 4**		
		Coefficient	**T**	**Standard Coefficient**
Intercept	?	−0.016	−6.99 ***	0
Direct	+	0.631	58.20 ***	**0.617**
Indirect	+	0.347	49.06 ***	0.520
N			777	
Adj-R^2			0.9291	
F Value			5082.21	

Panel C. Verification of Cost Adjustment Relationship by Standard Coefficients				
	EST	**Model 5**		
		Coefficient	**T**	**Standard Coefficient**
Intercept	?	−0.003	−0.75	0
DMC	+	0.170	14.49 ***	0.251
IMC	+	0.083	9.64 ***	0.167
DLC	+	0.270	13.82 ***	**0.270**
ILC	+	0.025	1.77 *	0.040
DOC	+	0.123	11.86 ***	0.213
IOC	+	0.140	8.88 ***	0.205
SGA	+	0.133	19.46 ***	**0.330**
N			777	
Adj-R^2			0.8057	
F Value			460.64	

Notes: This table reports the results of regressions, over a period of 10 years from 2003 to 2012. Explanatory variables are marked in bold. The estimated regressions are represented as follows: $CA_{1i,t} = a_{i,t} + \beta_1 ROA_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \beta_4 GROWTH_{i,t} + \beta_5 MTB_{i,t-1} + Year_{i,t}{}^{dummy} + Ind_{i,t}{}^{dummy} + \varepsilon_{i,t}$ (Model 1), $CA_{1i,t} = a_{i,t} + \beta_1 CEC_{i,t-1} + \beta_2 PROF_{i,t} + \beta_3 CEC_{i,t-1} \times PROF_{i,t} + \beta_4 ROA_{i,t} + \beta_5 SIZE_{i,t} + \beta_6 LEV_{i,t} + \beta_7 GROWTH_{i,t} + \beta_8 MTB_{i,t-1} + Year_{i,t}{}^{dummy} + Ind_{i,t}{}^{dummy} + \varepsilon_{i,t}$ (Model 2), $CA_{1i,t} = a_{i,t} + \beta_1 CEC_{i,t-1} + \beta_2 CEC_{i,t-1} \times PROF_{i,t} + \beta_3 ROA_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 LEV_{i,t} + \beta_6 GROWTH_{i,t} + \beta_7 MTB_{i,t-1} + Year_{i,t}{}^{dummy} + Ind_{i,t}{}^{dummy} + \varepsilon_{i,t}$ (Model 3), $CA_{2i,t} = a_{i,t} + \beta_1 Direct_{i,t} + \beta_2 Indirect_{i,t} + \varepsilon_{i,t}$, (Model 4). $CA_{2i,t} = a_{i,t} + \beta_1 DMC_{i,t} + \beta_2 IMC_{i,t} + \beta_3 DLC_{i,t} + \beta_4 ILC_{i,t} + \beta_5 DOC_{i,t} + \beta_6 IOC_{i,t} + \beta_7 SGA_{i,t} + \varepsilon_{i,t}$ (Model 5). *, **, and *** denote significance at the 0.1, 0.05, and 0.01 levels, respectively. See variable definitions in Table 3

5. Robust Test

Ridge Regression

The relationship between cost of equity capital and cost adjustment was verified as described above, but we needed to improve reliability by re-verifying the results of Model 3 in order to clearly solve the multicollinearity arising from using an interaction term. Therefore, by using ridge regression, we looked at the relationship between each variable, maintaining VIF properly. Though ridge regression has limitations such that ridge value selection may be arbitrary or parameters may be affected by the ridge value, it is generally considered a supplement tool to solve multicollinearity [48]. A description of the parameters for Model 6 are as follows:

$$CA_{1i,t} = a + \beta_1 CEC_{i,t-1} + \beta_2 PROF_{i,t} + \beta_3 CEC_{i,t-1} \times PROF_{i,t} + \beta_4 ROA_{i,t} + \beta_5 SIZE_{i,t} + \beta_6 LEV_{i,t} + \beta_7 GROWTH_{i,t} + \beta_8 MTB_{i,t-1} + Year_{i,t}{}^{dummy} + Ind_{i,t}{}^{dummy} + \varepsilon_{i,t}. \quad \text{(Model 6)}$$

Model 6 is the same as Model 2 except for the use of ridge regression. Ridge value was used for the initial value, which was 0.6, so that all VIF coefficients became less than 3. The result of Model 6 was positive and significant at a 10% level in Table 9, when the VIF values of both the *PROF* and *CEC*PROF* were 2.44 and 2.65, respectively. The positive and significant β_3 supported Hypothesis 1. Due to the limitations in ridge regression, it seemed to have been derived as an insignificant result, regarding other variables such as *ROA*, *LEV*, and *MTB*, unlike the result of Model 2. Therefore, it was necessary to pay attention when interpreting the ridge regression results.

Table 9. Ridge regression results for cost adjustment motivation regarding the cost of capital.

	EST	Model 6	
		Coefficient	T
Intercept	?	0.576	1.85
CEC	?	−0.357	−0.94
PROF	?	−0.044	−0.73
CEC × PROF	**+**	**0.547**	**1.83 ***
ROA	-	−0.211	−1.13
SIZE	-	−0.024	−1.84 *
LEV	+	0.114	1.41
GROWTH	+	0.063	2.30 **
MTB	-	−0.015	−0.77

Notes: This table reports the results of ridge regression, over a period of 10 years from 2003 to 2012. Explanatory variable is marked in bold. The estimated regressions are represented as follows: $CA_{1i,t} = a_{i,t} + \beta_1 CEC_{i,t-1} + \beta_2 PROF_{i,t} + \beta_3 CEC_{i,t-1} \times PROF_{i,t} + \beta_4 ROA_{i,t} + \beta_5 SIZE_{i,t} + \beta_6 LEV_{i,t} + \beta_7 GROWTH_{i,t} + \beta_8 MTB_{i,t-1} + Year_{i,t}{}^{dummy} + Ind_{i,t}{}^{dummy} + \varepsilon_{i,t}$ (Model 6). *, **, and *** denote significance at the 0.1, 0.05, and 0.01 levels, respectively. See variable definitions in Table 3.

6. Conclusions

We have covered the practice of earnings management through cost adjustment by using OLS and ridge regression. We came up with hypotheses to explain the hidden motivation behind cost adjustment, namely, cost of equity capital hypothesis: as the shareholders demand greater income, the manager of the company has a greater incentive to set a higher target profit to meet the required rate of return, and defense firms try to achieve this through cost adjustment. Unlike the previous studies measuring earnings management with indirect proxies, such as discretionary accrual or abnormal production cost, we measured the size of cost adjustment directly with the cost gap between submitted cost by manufacturers and identified cost by DAPA. In addition, it turned out that, other than SG&A, direct costs were the main vehicle for cost adjustment, with direct labor cost being the most significant part of it. The cost adjustment in the defense industry was successfully proved to be true. A subsequent study is needed to establish a detailed control mechanism for cost adjustment related to direct cost, taking into account the size of standard coefficient per cost elements.

The purpose of this article from a government point of view is to draw attention to the need for establishing the appropriate price control mechanism in the defense industry. The regulatory parties need to consider cost adjustment possibilities when negotiating with the firms in the defense industry and setting the standard. The government should increase the utilization rate of defense companies and continuously provide an appropriate production volume in order to eliminate the incentive for companies to adjust their cost, and they can improve their overall sustainability.

The significance of this article from the corporate point of view is as follows. Due to the narrowness of the Korean defense market, Korean defense companies are already aware that it is essential to secure cost comparativeness in defense products. However, cost comparativeness is deteriorating because of adjusted costs needed to meet short-term target profits. As a result, cost adjustment would have a significantly negative impact on the long-term sustainability of the company.

In this article, we verified the short-term relationship between cost of equity capital and cost adjustment. Earnings management is the period-by-period managing activity with various short-term objectives for the company. However, some managing activities related to earnings may seldomly happen with a longer window, and the effect of capital cost on cost adjustment may be different, which warrants further study.

Author Contributions: S.S. and J.P. designed the research framework and wrote the paper. S.S. and J.L. analyzed the data. S.S. and J.L. guided this work and provided extensive revisions during the study.

Funding: This work was supported by the Hanyang University.

Acknowledgments: Helpful comments were provided by Kim, Jin-Soo, Hanyang University and Kim, Kyung-Mu, 1st Lieutenant, ROKAF.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. SIPRI. Available online: https://www.books.sipris.org/files/FS/SPIRIFS1604.pdf (accessed on 12 August 2016).
2. *Defense Acquisition Program Administration Internal Report*; DAPA: Gwacheon-si, Korea, 2014.
3. *Defense Acquisition Program Administration Internal Report*; DAPA: Gwacheon-si, Korea, 2008.
4. Rogerson, W.P. Overhead Allocation and Incentives for Cost Minimization in Defense Procurement. *Account. Rev.* **1992**, *67*, 671–691.
5. KDIA. Available online: http://www.kdia.or.kr/content/3/2/4/view.do (accessed on 13 December 2015).
6. Defense News. Available online: https://www.defensenews.com/industry/2018/10/04/t-x-loss-casts-shadow-over-south-korean-arms-exports/ (accessed on 19 February 2019).
7. Hepworth, S.R. Smoothing periodic income. *Account. Rev.* **1953**, *28*, 32–39.
8. Gordon, M.J. Postulates, principles and research in accounting. *Account. Rev.* **1964**, *39*, 251.
9. Beidleman, C.R. Income smoothing: The role of management. *Account. Rev.* **1973**, *48*, 653–667.
10. Moses, O.D. Income smoothing and incentives: Empirical tests using accounting changes. *Account. Rev.* **1987**, *62*, 358–377.
11. Tucker, J.W.; Zarowin, P.A. Does income smoothing improve earnings informativeness? *Account. Rev.* **2006**, *81*, 251–270. [CrossRef]
12. Bowen, R.M.; DuCharme, L.; Shores, D. Stakeholders' implicit claims and accounting method choice. *J. Account. Econ.* **1995**, *20*, 255–295. [CrossRef]
13. De Jong, A.; Mertens, G.; van der Poel, M.; van Dijk, R. How does earnings management influence investor's perceptions of firm value? Survey evidence from financial analysts. *Rev. Account. Stud.* **2014**, *19*, 606–627. [CrossRef]
14. Healy, P.M. The effect of bonus schemes on accounting decisions. *J. Account. Econ.* **1985**, *7*, 85–107. [CrossRef]
15. Roychowdhury, S. Earnings management through real activities manipulation. *J. Account. Econ.* **2006**, *42*, 335–370. [CrossRef]
16. Leuz, C.; Nanda, D.; Wysocki, P.D. Earnings management and investor protection: An international comparison. *J. Financ. Econ.* **2003**, *69*, 505–527. [CrossRef]
17. Cheng, Q.; Warfield, T.D. Equity incentives and earnings management. *Account. Rev.* **2005**, *80*, 441–476. [CrossRef]
18. Bergstresser, D.; Philippon, T. CEO incentives and earnings management. *J. Financ. Econ.* **2006**, *80*, 511–529. [CrossRef]

19. Jones, J. Earnings management during import relief investigation. *J. Account. Res.* **1991**, *29*, 193–228. [CrossRef]
20. Phillips, J.; Pincus, M.; Rego, S.O. Earnings management: New evidence based on deferred tax expense. *Account. Rev.* **2003**, *78*, 491–521. [CrossRef]
21. Dhaliwal, D.S.; Gleason, C.A.; Mills, L.F. Last-chance earnings management: Using the tax expense to meet analysts' forecasts. *Contemp. Account. Res.* **2004**, *21*, 431–459. [CrossRef]
22. Badertscher, B.A.; Phillips, J.D.; Pincus, M.; Rego, S.O. Earnings management strategies and the trade-off between tax benefits and detection risk: To conform or not to conform? *Account. Rev.* **2009**, *84*, 63–97. [CrossRef]
23. Kim, J.-B.; Sohn, B. Real earnings management and cost of capital. *J. Account. Public Policy* **2013**, *32*, 518–543. [CrossRef]
24. Lee, J.-S. The Information Asymmetry and the Cost Stickiness Behavior in the Defense Industry. Ph.D. Thesis, The Graduate School of Kwangwoon University, Seoul, Korea, 2014.
25. Kim, D.-U.; Jung, H.-R. A Study on Cost Structure of Korean Defense Firms. *Q. J. Def. Policy Stud.* **2012**, *97*, 109–143.
26. Yoon, S.-M. Does Korean Defense Industry Manage Earnings? Master's Thesis, Graduate School of SNU, Seoul, Korea, 2006.
27. Ahn, T.-S.; Heo, E.-J. Costing and Pricing Rules and Their Impact on the Incentives of Defense Contractors. *Korean Account. J.* **2003**, *12*, 35–60.
28. Tomas, J.K.; Tung, S. Cost Manipulation Incentives under Cost Reimbursement: Pension Cost for Defense Contracts. *Account. Rev.* **1992**, *67*, 691–711.
29. Shin, H.-Y.; Koh, K.-S.; Lee, M.-Y. A Study on the Improvement of Defense Contracts and Cost Accounting Systems. *J. Account. Financ.* **2007**, *25*, 133–160.
30. Forbes. Available online: http://www.forbes.com/forbes/1997/0210/5903097a.html (accessed on 26 August 2016).
31. *Defense Acquisition Program Administration Internal Report*; DAPA: Gwacheon-si, Korea, 2012.
32. Park, J.-Y.; Kim, S.-H.; Kim, D.-H. The effect of defense industry contract types on earnings management. *Korean J. Account. Res.* **2014**, *19*, 75–97.
33. Plumlee, M.A. Discussion of the Effect of Information on Uncertainty and the Cost of Capital. *Contemp. Account. Res.* **2016**, *33*, 775–782. [CrossRef]
34. Subrahmanyam, A.; Titman, A. Feedback from Stock Prices to Cash Flows. *J. Financ.* **2002**, *56*, 2389–2414. [CrossRef]
35. Koo, J.H. The Effect of Earnings Management and Corporate Governance on the Cost Behavior. Ph.D. Thesis, The Graduate School of Sung Kyun Wan University, Seoul, Korea, 2009.
36. Watts, R.L.; Zimmerman, J.L. *Positive Accounting Theory*; Prentice-Hall: Englewood Cliffs, NJ, USA, 1986.
37. DeFond, M.L.; Jiambalvo, J. Debt Covenant Violation and Manipulation of Accruals. *J. Account. Econ.* **1996**, *17*, 145–176. [CrossRef]
38. Dechow, P.M.; Sloan, R.; Sweeney, A. Detecting earnings management. *Account. Rev.* **1995**, *70*, 193–225.
39. Watts, R.L.; Zimmerman, J.L. Toward a Positive Theory of the Determination of Accounting Standards. *Account. Rev.* **1978**, *53*, 112–134.
40. DeAngelo, H.; DeAngelo, L.; Skinner, D.J. Accounting choice in troubled Companies. *J. Account. Econ.* **1994**, *17*, 113–144. [CrossRef]
41. Skinner, D.J.; Sloan, R.G. Earnings surprises, growth expectations and stock returns or don't let an earnings torpedo sink your portfolio. *Rev. Account. Stud.* **2002**, *7*, 289–312. [CrossRef]
42. Dechow, P.M.; Sloan, R.; Sweeney, A. Causes and consequences of earnings manipulation: An analysis of firms subject to enforcement actions by the SEC. *Contemp. Account. Res.* **1996**, *13*, 1–36. [CrossRef]
43. Edwards, A.; Schwab, C.; Shevlin, T. Financial Constraints and Cash Tax Savings. *Account. Rev.* **2016**, *91*, 859–881. [CrossRef]
44. Park, J.-H.; Sohn, S.-K.; Jin, S.-H. A Study on the Optimum level operating Margin for Korean Defense Industry. *Bus. Educ. Res.* **2015**, *29*, 455–475.
45. Modigliani, F.; Miller, M.H. The Cost of Capital, Corporation Finance and the Theory of Investment. *Am. Econ. Rev.* **1958**, *48*, 261–297.

46. Ko, C.-Y.; Jung, H.; Park, J.-H. Estimating the Divisional Cost of Capital—Focusing on the Telecommunications. *Korean Account. J.* **2014**, *23*, 523–549.
47. ECOS. Available online: http://ecos.bok.or.kr/ (accessed on 12 August 2016).
48. Brambor, T.; Clark, W.; Gloder, M. Understanding interaction models: Improving empirical analyses. *Political Anal.* **2006**, *14*, 63–82. [CrossRef]