

Determinants of Stock-based Incentives: Evidence from Korean Firm-level Data

Sun-Moon Jung and Jae-Young Kim

Firms often use stock-based incentives (SBIs) to attract and motivate talented employees. Thus, the question of how and on what basis to determine SBIs is an important issue for a firm. In this paper, we study determinants of SBIs based on data of Korean-listed firms in 2002-2018. As a measure of SBIs, we use Portfolio Delta, the sum of Stock Delta, which represents incentives from stockholdings, and Stock Option Delta, which represents incentives from unexercised option awards. Our results show that provision of SBIs depends on both firm and individual characteristics. In particular, firm characteristics such as size, risk, and growth prospects of a firm are major determinants of overall SBI provisions. We have also found that, for business executives, individual characteristics such as careers and tenures are important determinants of SBIs. In particular, for top executives, SBIs are employed as substitutes for promotion-based incentives, whereas for newly appointed executives with relatively longer tenures, SBIs are provided as common and general incentives. These findings are consistent with results in the existing literature.

Keywords: stock-based incentives; executive compensation

JEL Classification: M12; M21

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Sun-Moon Jung, College of Business Administration, Seoul National University, (E-mail): sunmoonj22@snu.ac.kr

Jae-Young Kim, Corresponding Author, Department of Economics, Seoul National University, (E-mail): jykim017@snu.ac.kr

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I. INTRODUCTION

Stock-based incentives (SBIs), such as stock option awards, form an important scheme for attracting and motivating talented manpower for business. In advanced economies, many firms use stock grants and option awards to motivate managers to pursue their long-term success by maximizing firm values reflected in stocks.¹ In this study, we examine the determinants of SBIs by analyzing factors that are supposed to affect firms' decision for SBIs based on Korean firm data.

In Korea, use of stock options had declined after reaching a peak in the early 2000s. However, a growing number of Korean firms are reintroducing and reinforcing SBI-based incentive schemes. For instance, SK group has reintroduced stock options into the package of executive compensations of its affiliates such as SK Hynix and SK Telecom. In 2018-2019, SK Hynix granted 190,000 shares of stock options to Seokhee Lee, the chief executive officer of the firm. Many other companies in the ICT and biotech industries in Korea have also reintroduced SBIs and use stock grants and options for incentives.

Despite the growing interest in SBIs in Korea, limited empirical evidence is found on the determinants of SBIs and why they vary across different cases among Korean firms. While a few studies investigate the determining factors of managerial compensation in the Korean setting (Kim, Shin, Chi 2005; Kim, Lee, Seo 2017), those studies do not account for executives' individual characteristics. Our study aims to fill this gap by empirically examining a variety of firm-level and individual-level factors that are supposedly related to SBIs. Our study also investigates whether SBIs in Korean firms serve multiple functions of motivating existing executives and attracting new talent, as studied by Holmstrom (1979) and Arya and Mittendorf (2005), among others.

The question of what factors determine SBIs has been discussed by many researchers. Demsetz and Lehn (1985), Jensen (1986), Holmstrom (1979), and Gaver and Gaver (1993) show that firm characteristics, such as firm size, prospective outcomes, and growth opportunities,

¹ CEOs in S&P 500 firms receive 80% of their total pay as equity-based compensation such as restricted stocks (units), stock options, stock appreciation rights, and others. The importance of equity-based compensation in the total compensation package has continuously grown since the 1990s.

determine the optimal level of incentives. Also, several authors show that individual characteristics of business executives are important for firms to determine SBIs. Dechow and Sloan (1991) discussed the relevance of work experiences, careers, and tenures of the individual executives in determining incentives. Managerial ability is also studied as an important factor to determine the incentives and compensation level by Arya and Mittendorf (2005); Hales, Wang, and Williams (2015); Carter, Franco, and Tuna (2019). In addition, Gibbons and Murphy (1992), Gibbs (1995), and Ederhof (2011) discussed the problem of lack of promotion-based incentives for top-level executives.

In this study, we perform empirical analysis on the determinants of SBIs based on data of Korean-listed firms that awarded stock options to their executives in 2002-2018. We use Delta as a measure of SBIs, which is the amount of change in the dollar value of stockholdings and options to the 1% change in the firm's stock price as in Core and Guay (1999) and Coles, Daniel, and Naveen (2006). Delta captures how sensitively the manager's wealth changes with the firm's performance, which provides a powerful motivation to maximize the shareholder value. Further explanations of Delta and empirical strategy to measure Delta in our study are presented in Section 3.

We also use individual characteristics of executives such as work experience and performance disclosed in the firm's annual reports. From our empirical work, we can obtain information on the "sorting function" of stock option incentives for matching qualified managers with the firm (Arya and Mittendorf (2005); Hales, Wang, and Williams (2015)) as well as the motivation function of incentives (Holmstrom (1979); Core and Guay (1999)). To the best of our knowledge, our study is the first attempt to examine both the sorting and motivation functions with regard to incentives for the executives of Korean firms.

Our empirical findings show that firm characteristics are major determinants of SBIs for executives. In particular, we have found that larger, less risky, and growing firms are more likely to extend SBIs to their executives. However, the importance of each factor varies across sectors. For instance, growth opportunities play a significant role in high-tech industries while monitoring costs and measures against idiosyncratic risks are more important in non-high-tech industries. We have also found that stock-based incentives are stronger for top-level executives such as CEOs, which are good substitutes for promotion-based incentives for them. Furthermore, our results show that SBIs

increase with the executive tenure, implying that work horizon is relevant for determining SBIs. However, option incentives are more salient for executives with a shorter tenure, conforming to the result of recent studies that options serve as a sorting mechanism unlike the stock grants.

To explore attraction and selection functions of stock-based incentives, we conduct analysis for sub-samples for newly appointed executives. We categorize the new executives into four sub-groups: executives promoted internally, executives from the affiliate firms in the same business group, executives from the firms in the same or related industries, and executives from different industries. We conjecture that uncertainty about the executive-firm fit increases as the executives are from remote areas. We conjecture that, to attract executives with high records and ability, firms should propose stronger incentives. Consistent with this conjecture, we have found that firms grant more SBIs to new executives from outside compared to those from inside or affiliated groups.

Interesting cases are found for politically connected executives or managers who were previously high-level officials in governments or judicature. These executives are to conduct duties of specific objectives such as forming networks with policy makers and government officials and acquiring better access to intangible social capital.² Our empirical findings show that firms tend to provide less SBIs than direct compensations to them, which is related to their duties for firms.

To ensure the robustness of our findings, we controlled for corporate governance factors such as board and ownership structures, which may affect decision for SBIs for a set of given economic factors. In addition, we controlled for the firm fixed effects to remove possible endogeneity from omitted firm-specific factors.

Our study contributes to the literature of SBIs in the following aspects. First, our study provides empirical evidence for Korean-listed firms that use SBIs to attract and sort talented individuals for their managers as well as to align managers' interests to shareholders'. This result confirms the recent finding of Arya and Mittendorf (2005)

² Descriptive statistics in Section 3 show that politically connected directors account for only 1% of the total number of directors who are granted with stock options.

and Hales, Wang, and Williams (2015) from non-Korean data that a set of incentive contracts can be used as attraction and selection mechanism. Second, our empirical evidence has important implications with regard to the underlying motives for executive compensation, which was debated in Bebchuk and Fried (2003) and Gabaix and Jenter (2017). Our findings support the point that firms determine SBIs based on economic factors, including firm characteristics and managers' individual factors, rather than based on other factors such as managers' self-interest.

The rest of the paper is organized as follows. Section 2 reviews the literature and discusses issues of our analysis. Section 3 explains the data and empirical framework. Section 4 presents our estimation results and discussions. Concluding remarks are provided in Section V.

II. LITERATURE ON DETERMINANTS OF EXECUTIVE INCENTIVES

A. Incentive Pays as Motivation and Selection Mechanism

In modern corporations where the ownership and management are separated, incentive pays are effective motivation for executives to achieve high performance (Jensen and Murphy 1990). Most frequently used form of SBIs are stock grants and option awards. As the firms grant more stocks to their executives, their wealth are more closely tied to the firm's stock price (Core and Guay 1999). Stock options not only tie the executives' wealth to the firm's stock price, but also encourage the executives to take more risk in business decisions that would increase the upside potential of the firm's stock price (Coles, Daniel, Naveen 2006).

Recent studies on executive incentives show that SBIs are effective in attracting talented managers as well as in matching the right talents with the firm (Eriksson and Villeval 2008; Arya and Mittendorf 2005; Hales, Wang, and Williams 2015). The importance of a right person in the right place cannot be overemphasized. A manager with high capability utilizes resources more efficiently, leading to higher outputs per input and better performance of the firm with eventual reduction of the costs of incentive pays (Demerjian, Lev, Mcvay 2012; Edmans, Gabaix, Landier 2009).

Managers with better future prospects are more likely hired by

firms offering higher incentive pays (Eriksson and Villeval 2008; Arya and Mittendorf 2005; Cadsby, Song, Tapon 2007). Thus, the certainty equivalent of a given salary of managers of high ability are lower than that of managers of low ability. Hence, costs of incentive pays are cheaper for managers of high-ability than those of low ability.

In Korea, the use of SBIs has declined since it peaked in the early 2000s before the financial crisis. Recently, however, an increasing number of firms have again began employing SBIs, especially in high-tech industries such as ICT and bio-related industries. For instance, the SK Group resumed the stock-option incentives for executives in its affiliated firms such as SK Hynix, SK Telecom, and SK D&D in 2017³. In 2018-2019, SK Hynix granted 190,000 shares of stock options to Seokhee Lee, the CEO of SK Hynix. Celltrion and other bio firms in Korea granted about half a million stock options to 37 executives and employees in 2018.⁴ One of Celltrion's department heads earned \$700 million won by exercising stock options.⁵ Kakao disclosed in May 2020 that 323 of their executives and employees were granted with stock options, which amount to 155 billion Korean won.⁶ These firms devote special effort to attract and motivate talented workers by granting stock options. Figure 1 shows the trend of stock option grants of Korean-listed firms over the period of 2002-2018.

Despite of this trend of SBIs in the Korean business environment, limited empirical work has been done on what determines SBIs in Korean firms.⁷ While a few studies used firm-level data (Kim, Shin, Chi 2005; Kim, Lee, Seo 2017) to analyze the determinants of stock option incentives in Korean firms, they fail to account for individual characteristics as the determining factors of SBIs. Kim, Shin, Chi (2005) document that firms' growth opportunities, size, financial leverage, liquidity constraint, and the managers' cash compensation are significantly associated with SBIs. While they use an individual-level

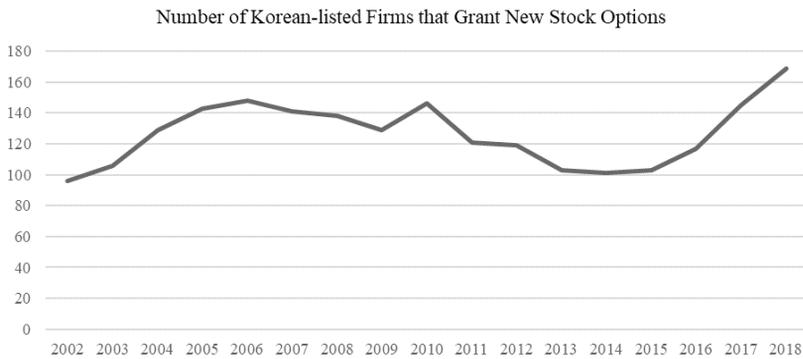
³ <https://www.sedaily.com/NewsView/1RWWH5BRAM>

⁴ <https://news.joins.com/article/23771286>

⁵ https://www.chosun.com/site/data/html_dir/2020/08/14/2020081403432.html

⁶ https://biz.chosun.com/site/data/html_dir/2018/03/26/2018032600020.html

⁷ It may be due to decreasing importance in executive compensation package until the middle of the 2010s.

**FIGURE 1**

TREND OF STOCK OPTION GRANTS IN KOREAN-LISTED FIRMS

determinant (*e.g.*, cash compensation amount), the measure is at best a crude proxy of managers' risk aversion because the compensation design is shaped by, and does not shape, the risk aversion. Kim, Lee, Seo (2017) document that firms' financial characteristics, profitability, and growth opportunities are significantly associated with SBIs. As Arya and Mittendorf (2005) argues, individual-level analyses incorporating executive-specific information is essential for examining the attraction/selection functions of incentive pays. Information asymmetry on managerial ability, arising from the executive's personal work experience and careers, and manager-firm match often makes it difficult for a firm to make decision on incentives. Core and Guay (1999) pointed out that incentive decisions are affected by both the firm and individual characteristics. We use data containing information on both the firm and individual levels in our study.

B. Empirical Literature on Executive Incentives

Empirical studies on executive incentives document that firm characteristics determine the level of incentives. (1) The firm size affects the optimal level of incentives. Larger firms attract more talented managers (Smith and Watts 1992) since the marginal productivity of managerial efforts is greater for these firms than smaller firms (Edmans, Gabaix, Landier 2008). (2) A volatile business environment of the firm affects the optimal level of incentives. More volatile environment

increases the monitoring costs, leading to higher level of optimal incentives. On the other hand, more volatile performance increases the compensation risk of the managers (who are risk averse), reducing the intensity of incentives (Demsetz and Lehn 1985). (3) Firms with greater growth opportunities benefit more from managerial efforts, providing stronger incentives to executives (Smith and Watts 1992; Gaver and Gaver 1993). Low growth opportunities, combined with free cash flows, can create agency problems (Jensen 1986). Consistent with these predictions, Core and Guay (1999) find that firm characteristics such as size, idiosyncratic volatility, growth, and free cash flows explain the cross-sectional variations in CEO incentives (measured by portfolio Delta) in U.S. listed firms during 1992-1997.

Individual characteristics of each executive are also important for determining incentives. First, executive tenure is important because uncertainty about his/her ability resolves over time. In addition, as the executive has worked for a longer time, his/her wealth reduces the risk aversion. In either case, Core and Guay (1999) hypothesize that CEO tenure is positively correlated with the incentive level. However, tenure may not always lead to stronger incentives for two reasons. For executives at lower position than CEO, longer tenure at the current position may be due to failure in promotion, indicating low ability. Moreover, as firms try to attract talented managers with stock-based incentives (as in high-tech industries), executives may be granted stronger incentives in their earlier years in the firm. By similar reasons, several papers show that stronger incentives induce talented managers to self-select into the firm (Eriksson and Villeval 2008; Arya and Mittendorf 2005). In any case, it is an important empirical question whether or not the length of tenure leads to stronger incentives.

Second, feasibility of promotion-based incentives of an executive is a relevant factor that determines explicit current incentives for the executive (Gibbons and Murphy 1992; Gibbs 1995; Ederhof 2011). For instance, CEOs are already at the top position for whom promotion-based incentives are limited. Stronger explicit incentives of SBIs could well be provided for such top-level managers. Third, job characteristics and duty differ across executives so that the firm needs to have heterogeneous compensation packages. An interesting case is with executives who are "politically connected," having had careers as top government officials (*e.g.*, ministers and vice ministers) or law officials (*e.g.*, prosecutors and judges). A politically connected manager serves

a special role of forming networks and building up social capital for the firm. Thus, we expect that politically connected directors would be granted with different set of incentives than other managers or executives.

Finally, the incentive pays of an executive may be dependent on personal background and work experience. When a firm recruits a new executive, it faces a great deal of uncertainty about his/her managerial ability and manager-firm fit (Carter, Franco, Tuna 2019). One way to avoid such uncertainty is to promote insiders to executives. However, firms often need to bring in new blood for various reasons. Recent studies suggest that firms can attract talented managers by proposing a “menu” of different compensation packages. Arya and Mittendorf (2015) analytically show that only the high-ability managers self-select into stronger incentives. In line with the analytical prediction, experimental study by Hales, Wang, and Williamson (2015) show that employees with better future prospects choose the compensation package with greater stock-based compensation.

In sum, previous studies suggest that the economic determinants of executive incentives are twofold: (1) the firm characteristics such as firm size, idiosyncratic risk, growth, free cash flows and (2) individual characteristics of executives such as tenure, promotion-based incentives, political connections, personal background and work experience. Considering these factors firms design executive incentives to motivate and attract talented executives.

III. EMPIRICAL ANALYSIS

A. Data

To examine the determinants of stock-based incentives in Korean firms, we use the data of firms listed on the Korean Stock Exchange and KOSDAQ that grant stock options to their executives. Since the data on executive stock options are only available from 2002 and since financial statements are available until 2018, we consider data from 2002 to 2018. We obtain the executive stock option data, executive characteristics, and financial statements from the TS2000 database. Also, we obtain data on stock prices, stock returns, and dividends from the DataGuide database. Out of a total 27,454 firm-executive-year observations during 2002-2018, we construct a sample of 14,666

TABLE 1
SAMPLE/SUBSAMPLES

Panel A. Sample/subsamples

Whole sample: panel data on firm-executive-year observations granting stock options to executives in 2002-2018	14,666
Subsample of New Executives	1,610
Subsample of High-tech Industries (ICT and Bio-tech)	5,617
Subsample of Financial Industry	943

Panel B. Top-Five Industries of Stock Option Grants

Industry	Number of Observations	Percentage
Manufacturer of electronic components, computer, visual, sound and communication equipment	4,829	32.93
Manufacturer of machinery and equipment	1,975	13.47
Professional service providers	1,053	7.18
Manufacturer of motor vehicles	661	4.51
Manufacturer of transport equipment	555	3.78

*Industry classification follows two-digit Korean Standard Industry Classification.

observations, excluding observations with missing information on executive characteristics and control variables. In the sample of 14,666 observations, we have a subsample of 1,610 observations for newly appointed executives. Furthermore, we have 5,617 observations from high-tech industries (ICT and bio-tech firms) and 943 from the financial industry. Table 1 shows details of our data and sample or subsamples.

B. Measurements

A) Measurement of Stock-based Incentives

We measure the stock-based incentives of each executive with *Portfolio Delta*, change in the dollar value of the executive's stock and options for a 1% change in stock price. *Delta* is frequently used as the empirical proxy of equity incentives in the prior literature (Hall and Liebman 1998; Core and Guay 1999; Coles, Daniel, Naveen 2006; Feng, Ge, Luo, Shevlin 2011; Guay, Kepler, Tsui 2019). Because *Delta* measures how sensitively a manager's firm-specific wealth changes

with the price change, it captures the manager's incentives to boost the stock price.⁸

Portfolio Delta is the sum of *Stock Delta*, incentives from stockholdings, and *Stock Option Delta*, incentives from unexercised option awards.⁹ Computation of *Stock Delta* is straightforward: it is the sum of common stocks and preferred stocks held by executives multiplied by 1% of the stock price at the end of the fiscal year.¹⁰ *Stock Option Delta* is calculated by the procedure in Core and Guay (1999). *Stock Option Delta* equals “*per-option Delta*” times the total number of unexercised option awards. Appendix A describes the formula to calculate *Per-option Delta*. The sum of *Stock Delta* and *Stock Option Delta* is *Portfolio Delta*, which is our measure of stock-based incentives. Consistent with prior studies, we use the natural logarithm of *Portfolio Delta* in our analysis (Core and Guay 1999).

B) Measurement of Firm Characteristics

We measure firm size (Firm Size) with the natural logarithm of market value of equity (Demsetz and Lehn 1985; Baker and Hall 1998; Core and Guay 1999). We measure the firm's idiosyncratic risk (Idiosyncratic Risk) with the standard deviation of the residuals from the market during 36 months prior to the fiscal year end (Demsetz and Lehn 1985; Core and Guay 1999). Also, we measure the firm's growth opportunities (Inverse Growth) with the ratio of book value of equity to market value of equity, the higher value of which indicates smaller growth opportunities (Smith and Watts 1992; Core and Guay 1999). Finally, the firm's agency problems from cash flows are measured as the three-year average of the following:

$$\frac{\text{operating cash flow} - \text{common and preferred dividends}}{\text{total assets}}$$

if the firm's book value of assets exceeds the market value of assets, and zero otherwise (Lang, Stulz, Walking 1991; Core and Guay 1999).

⁸ In the literature, the fair value of the stockholdings and options is used as the proxy of the compensation amount (Cadman, Carter, Peng 2021), while Delta is used as the proxy of the incentive intensity (Core and Guay 1999).

⁹ We only use unexercised options to calculate *Stock Option Delta* because the options lose the incentive effects once the manager exercises and liquidates the options (Core and Guay 1999).

¹⁰ A manager may obtain the firm's stocks either by exercising stock options or by purchasing the firm's stock by him/herself.

C) Measurement of Executive's Individual Characteristics

We measure the executive tenure with two variables: *Tenure within Firm* and *Tenure on Current Position*. Each of the two variables captures different information from the other, so that its association with the executive incentive may be different from that of the other. The longer the relationship of the executive with the employer (*Tenure within Firm*), uncertainty about the managerial ability and preferences decreases. Meanwhile, the longer the years that the executive serves a certain position (*Tenure on Current Position*), less uncertainty may be involved, but it may reflect poor performance and failure of promotion.

A *CEO_dummy*, taking value unity (=1) if the executive is CEO of the firm, is adopted as a measure of strength/weakness of promotion-based incentives. Implicit incentives of promotion opportunities can be replaced by explicit incentives of monetary incentive pays (Gibbons and Murphy 1992; Gibbs 1995; Ederhof 2011), and CEOs have limited incentives from future promotion. We indicate the outside directors with *Outside Director* dummy that takes a value of 1 if the manager is an outside director. Also, we categorize politically connected managers by *Politically Connected Director*, taking a value of 1 if the manager was formerly a top government official or a law official.

To further shed light on the selection/attraction mechanism of incentive pays, we consider data of a subsample of newly appointed executives. We consider a manager as newly appointed when his/her name first appear on the list of executives in the firm's annual reports. We classify new executives based on their careers as disclosed in the firm's annual reports. We categorize the new executive as *Executive from Inside* if he/she has the career only within the current workplace. We categorize the new executive as *Executive from Same Business Group* if he/she had previously worked in the affiliated firms within the same business group.¹¹ These two classes of executives have less uncertainty of managerial ability and manager-firm fit. Also, we categorize the new executive as *Executive from Same/Related Industry* if he/she was previously employed by other firms in the same industry or related industries.¹² Finally, we code the new executive as *Executive*

¹¹ A typical example is that the executive had previously worked for Hyundai Motors and moved to Hyundai Mobis.

¹² A typical example is that the executive had previously worked for Samsung Electronics (division of Device Solution) and recruited by SK Hynix.

from *Remote Industries* if he/she had worked in other firms in unrelated or remote industries.¹³ As the newly appointed executives fall into one of four categories, we include three dummy variables (*Executive from Inside*, *Executive from Same/Related Industries*, and *Executive from Remote Industries*) in our analysis.

D) Control Variables

Previous studies show that the governance structure of a firm may affect firm characteristics and executive compensations (Yermack 1996; Core, Holthausen and Larcker 1999). To control for such effects we include relevant control variables in our model. We include variables for ownership structure such as foreign shareholder ownership (*Foreign Share Ratio*) and indicator of major shareholder taking the CEO position (*Major Shareholder CEO*). We also include the board structure variables such as the number of board members (*Board Size*) and the proportion of independent directors among total board members (*Board Independence*). Also, to control for the firm-specific factors, we include firm-fixed effects in our regression as well as year and industry fixed effects.

C. Empirical Model

We estimate the following pooled OLS regression using our data on firm-executive-year observations:

$$\begin{aligned}
 \log(\text{Portfolio Delta})_{ijt} = & \beta_0 + \beta_1 \text{Firm Size}_{it} + \beta_2 \text{Idiosyncratic Risk}_{it} \\
 & + \beta_3 \text{Inverse _ Growth}_{it} + \beta_4 \text{Free CF problems}_{it} + \beta_5 \text{CEO dummy}_{ijt} \\
 & + \beta_6 \text{Outside Director}_{ijt} + \beta_7 \text{Politically Connected Director}_{ijt} \\
 & + \beta_8 \text{Tenure on Current Position}_{ijt} + \beta_9 \text{Tenure within Firm}_{ijt} \\
 & + \beta_{10} \text{Foreign Share Ratio}_{it} + \beta_{11} \text{Major Shareholder CEO}_{it} \\
 & + \beta_{12} \text{Board Size}_{it} + \beta_{13} \text{Board Independence}_{it} \\
 & + \text{Year FE} + \text{Industry FE} + \text{Firm FE} + \varepsilon_{it-1},
 \end{aligned}
 \tag{1}$$

where i, j, t denote firm, executive, and year, respectively.

Our variables of interests consist of two groups: firm characteristics

¹³ These executives are usually from consulting firms or investment banks who are employed as the head of the strategic planning team or chief financial officers.

and individual characteristics. Firm characteristics include Firm Size, Idiosyncratic Risk, Inverse Growth, and *Free CF Problems*. Individual characteristic variables include *CEO dummy*, *Outside Director*, *Politically Connected Director*, *Tenure on Current Position*, and *Tenure within Firm*. A detailed description on the variables in (1) are provided in Appendix B.

To analyze the data of the subsample of newly appointed executives, we estimate the following pooled OLS regression with 1,610 firm-executive-year observations for new executives:

$$\begin{aligned}
 \log(\text{Portfolio Delta})_{ijt} = & \beta_0 + \beta_1 \text{Firm Size}_{it} + \beta_2 \text{Idiosyncratic Risk}_{it} \\
 & + \beta_3 \text{Inverse_Growth}_{it} + \beta_4 \text{CEO Free CF Problems}_{it} \\
 & + \beta_5 \text{CEO dummy}_{ijt} + \beta_6 \text{Outside Director}_{ijt} + \beta_7 \text{New Executives from Inside}_{ijt} \\
 & + \beta_8 \text{New Executives from Same / Related Industries}_{ijt} \\
 & + \beta_9 \text{New Executives from Remote Industries}_{ijt} + \beta_{10} \text{Foreign Share Ratio}_{it} \\
 & + \beta_{11} \text{Major Shareholder CEO}_{it} + \beta_{12} \text{Board Size}_{it} + \beta_{13} \text{Board Independence}_{it} \\
 & + \text{Year FE} + \text{Industry FE} + \text{Firm FE} + \varepsilon_{it-1},
 \end{aligned} \tag{2}$$

where i, j, t denote firm, executive, and year, respectively.

Our variables of interests are three categorical variables: *New Executive from Inside*, *New Executive from Same/Related Industries*, and *New Executive from Remote Industries*. The category of *New Executive from Same Business Group* is regarded as the basic group. Thus, if the coefficient of β_9 is significantly positive, then it means that new executives from remote industries receive stronger stock-based incentives compared to the basic group. Detailed descriptions of the variables in (2) are available in Appendix B.

A) Descriptive Statistics

Table 2 presents descriptive statistics from our data. Panel A shows the descriptive statistics of variables included in equation (1). The mean value of *Portfolio Delta (unlogged)* is 10,490,268 Korean won, which indicates that values of stockholdings and options of a manager increase approximately by 10 million Korean won with the 1% increase of the firm's stock price, on average. Median value of *Portfolio Delta (unlogged)* is only 2,412,323, suggesting that stock-based incentives are highly skewed.

Among total executive-year observations, 6%, 2%, and 1% are observations for CEOs, outside directors, and politically connected

TABLE 2
DESCRIPTIVE STATISTICS

Panel A. Descriptive Statistics (Full Sample)

Variables	N	Mean	p25	p50	p75	STD
<i>Portfolio Delta</i> _{ijt}	14666	10490268	352727	2412323	11336516	24122207
<i>Log(Portfolio Delta)</i> _{ijt}	14666	12.66	12.77	14.70	16.24	5.67
<i>Stock Delta</i> _{ijt}	14666	1808946	0	0	567041	6891058
<i>Stock Option Delta</i> _{ijt}	14666	8381370	24	1208981	7983620	20775525
<i>Tenure on Current Position</i> _{ijt}	14666	2.45	0.00	2.00	4.00	2.10
<i>Tenure within Firm</i> _{ijt}	14666	3.36	1.00	3.00	5.00	2.62
<i>CEO dummy</i> _{ijt}	14666	0.06	0.00	0.00	0.00	0.25
<i>Outside Director</i> _{ijt}	14666	0.02	0.00	0.00	0.00	0.14
<i>Politically Connected</i> _{ijt}	14666	0.01	0.00	0.00	0.00	0.10
<i>Firm Size</i> _{it}	14666	28.47	26.02	28.57	30.85	2.74
<i>Idiosyncratic Volatility</i> _{it}	14666	2.21	1.93	2.21	2.49	0.39
<i>Inverse Growth</i> _{it}	14666	0.87	0.67	0.86	1.07	0.28
<i>Free CF Problem</i> _{it}	14666	0.02	0.00	0.00	0.01	0.04
<i>Foreign Share Ratio</i> _{it}	14666	0.27	0.07	0.20	0.51	0.22
<i>Major Shareholder CEO</i> _{it}	14666	0.33	0.00	0.00	1.00	0.47
<i>Board Size</i> _{it}	14666	2.19	1.95	2.08	2.48	0.31
<i>Board Independence</i> _{it}	14666	0.43	0.25	0.54	0.57	0.19

Panel B. Descriptive Statistics (Subsample of New Executives)

Variables	N	Mean	p25	p50	p75	STD
<i>Portfolio Delta</i> _{ijt}	1610	13.78	13.35	14.55	16.77	4.21
<i>New Executive from Inside</i> _{ijt}	1610	0.74	0.00	1.00	1.00	0.44
<i>New Executive from Same Business Group</i> _{ijt}	1610	0.02	0.00	0.00	0.00	0.13
<i>New Executive from Same/Related Industries</i> _{ijt}	1610	0.23	0.00	0.00	0.00	0.42
<i>New Executive from Remote Industries</i> _{ijt}	1610	0.02	0.00	0.00	0.00	0.14

directors, respectively. The mean value of *Firm Size*, measured by log of market value of equity is 28.47.¹⁴ *Idiosyncratic volatility* has the mean value of 2.21, *Inverse Growth* has 0.87, and *Free CF Problems* has 0.02. Foreign shareholders own 27% of the stocks on average. Among total observations, CEOs form 33% of major shareholders. Also, 43% of the

¹⁴ Firm size is higher than the mean value of 25.14 from all the listed firms during the same period, which suggests that larger firms are more frequently grant stock options to their executives.

TABLE 3
CORRELATION MATRIX

Correlation Coefficients among Variables Used in Full Sample Analyses (N=14,666)

	Portfolio Delta _{ijt}	Tenure on Current Position _{ijt}	Tenure within Firm _{ijt}	Firm Size _{it}	CEO dummy _{ijt}	Outside Director _{ijt}	Politically Connected _{ijt}	Idiosyncratic Risk _{it}	Inverse Growth _{it}	Free CF Problem _{it}	Foreign Share Ratio _{it}	Major Shareholder CEO _{it}
Portfolio Delta _{ijt}	1											
Tenure on Current Position _{ijt}	-0.12 <.0001	1										
Tenure within Firm _{ijt}	-0.13 <.0001	0.50 <.0001	1									
CEO dummy _{ijt}	0.08 <.0001	0.11 <.0001	0.15 <.0001	1								
Outside Director _{ijt}	0.00 0.58	0.03 <.0001	0.02 0.04	-0.04 <.0001	1							
Politically Connected _{ijt}	-0.02 0.03	0.03 0.00	0.03 0.00	0.03 0.00	0.16 <.0001	1						
Firm Size _{it}	0.10 <.0001	-0.02 0.00	0.06 <.0001	-0.17 <.0001	-0.02 0.01	-0.06 <.0001	1					
Idiosyncratic Risk _{it}	-0.03 <.0001	-0.02 0.01	-0.08 <.0001	0.09 <.0001	0.04 <.0001	0.04 <.0001	-0.67 <.0001	1				
Inverse Growth _{it}	-0.26 <.0001	0.03 <.0001	0.03 0.00	0.04 <.0001	-0.01 0.29	0.00 0.81	-0.42 <.0001	0.20 <.0001	1			
Free CF Problem _{it}	-0.09 <.0001	-0.03 <.0001	-0.05 <.0001	0.03 <.0001	0.01 0.14	0.01 0.22	-0.32 <.0001	0.13 <.0001	0.56 <.0001	1		
Foreign Share Ratio _{it}	0.17 <.0001	-0.10 <.0001	-0.04 <.0001	-0.12 <.0001	0.01 0.27	-0.04 <.0001	0.82 <.0001	-0.66 <.0001	-0.41 <.0001	-0.21 <.0001	1	
Major Shareholder CEO _{it}	0.10 <.0001	0.04 <.0001	-0.05 <.0001	-0.07 <.0001	-0.01 0.25	-0.02 0.05	-0.01 0.25	-0.18 <.0001	-0.14 <.0001	0.01 0.37	0.06 <.0001	1

board members are outside directors.

Panel B exhibits descriptive statistics for main variables in equation (2). Among the total observations of newly appointed executives, 74% are inside-promoted executives, and 2% are from the affiliated firms within the same business group. Furthermore, 23% are from the same or related industries, and the remaining 2% are from remote and unrelated industries.

Table 3 shows values of correlation coefficients among variables. Most of the firm and individual characteristics have significant non-zero correlations with the dependent variable $\text{Log}(\text{Portfolio Delta})$. $\text{Log}(\text{Portfolio Delta})$ is negatively correlated with two tenure variables (*Tenure on Current Position*, *Tenure within Firm*). $\text{Log}(\text{Portfolio Delta})$ is positively correlated with CEO dummy, but negatively correlated with Politically Connected Director. Among firm characteristics, Firm Size, Foreign Share Ratio, and Major Shareholder CEO are positively correlated with $\text{Log}(\text{Portfolio Delta})$ while Inverse Growth and Idiosyncratic Risk is negatively correlated with it.

IV. RESULTS

Our empirical results are presented in Tables 4-6. Table 4, Column (1) shows the estimation results of equation (1) for the whole sample of executive-year observations in 2002-2018. The dependent variable is $\text{Log}(\text{Portfolio Delta})_t$, which captures the intensity of SBIs for each executive. Firm size ($\beta_1 = 0.6555$, $p < 0.01$) and growth opportunities ($\beta_3 = -5.6081$, $p < 0.01$) have positive effects on $\text{Log}(\text{Portfolio Delta})$. This result indicates that larger firms and growing firms grant stronger SBIs to their executives. This result is consistent with the results of previous studies that more talented managers are matched to larger and growing firms where marginal productivity of managerial efforts is higher (Core and Guay 1999; Edmans, Gabaix, Landier 2008; Smith and Watts 1992). Idiosyncratic risk has negative effects on SBIs ($\beta_2 = 0.8594$, $p < 0.01$), implying that volatile environments provide greater compensation risk of incentive pays to managers, reducing the optimal level of incentives (Holmstrom 1979).

Most individual characteristics are significant for SBIs. CEOs are granted with stronger incentives ($\beta_5 = 2.3841$, $p < 0.01$) than lower-level executives, consistent with the result of Gibbons and Murphy (1992) that stronger explicit incentives are provided to executives with

higher ability but with lower chance of promotion-based incentives. The estimation result shows that CEOs on average have 10.85 times stronger SBIs than other executives.¹⁵ Outside directors are granted with weaker SBIs than inside directors ($\beta_6 = -1.27725$, $p < 0.01$). Politically connected directors are also granted with weaker SBIs, reflecting their special role such as building up social capital and networks with politicians ($\beta_7 = -1.0745$, $p < 0.01$). Coefficients of two measures of executive tenure have estimation results of opposite signs. Although longer tenure within the firm leads to stronger SBIs ($\beta_9 = 0.6581$, $p < 0.01$),¹⁶ longer tenure on the current job position is negatively associated with SBIs ($\beta_8 = -0.1399$, $p < 0.05$). This result implies that although longer tenure decreases uncertainty about managerial ability, which reduces the costs of using incentives (Core and Guay 1999), longer tenure at the current position may be an indication of poor ability and failure of being promoted, leading to lower incentives.

Column (2) shows estimation results of equation (2) for the subsample of newly appointed executives. As in Column (1), the dependent variable is *Log(Portfolio Delta)*. We can see a surprisingly higher adjusted R-square of 0.718 in Column (2), compared to 0.372 in Column (1). This result implies that economic factors, such as firm and executive characteristics, are more relevant in explaining SBIs for new executives than for the others.

Idiosyncratic risk for the subsample of newly appointed executives has a positive effect on SBIs ($\beta_2 = 1.7364$, $p < 0.01$), unlike in the full sample. As discussed in Section II, idiosyncratic risk not only contains the compensation risk but also contains the monitoring difficulty. The firm has a great deal of uncertainty about the ability and post-employment performance of new executives. In case of monitoring difficulty, the firm has a motive to provide higher SBIs, which dominates the cost/risk of compensation for new executives. Coefficient on *CEO dummy* is still significant and positive, as in the full sample. The firm size is not significant for SBIs for the data of newly appointed executives.

¹⁵ The value of 10.85 is calculated by $e^{2.3841} \approx 10.85$.

¹⁶ Untabulated test suggests that stronger stock-based incentives for these executives are driven by stockholdings rather than stock options. As executives stay longer within the firm, they accumulate the firm-related wealth (i.e., the firm's stocks), which renders stronger stock-based incentives.

TABLE 4
ESTIMATION RESULTS: DETERMINANTS OF SBIS IN WHOLE SAMPLE

VARIABLES	Dep var: <i>Log(Portfolio Delta) ijt</i>			
	Coef.	Full Sample	Coef.	New Executives
<i>Firm Size</i> _{it}	β_1	0.6555*** (3.465)	β_1	0.3971 (0.891)
<i>Idiosyncratic Risk</i> _{it}	β_2	-0.8594*** (-3.338)	β_2	1.7364*** (2.857)
<i>Inverse Growth</i> _{it}	β_3	-5.6081*** (-10.957)	β_3	-4.1299*** (-4.084)
<i>Free CF Problem</i> _{it}	β_4	2.3340 (1.507)	β_4	5.8356 (1.433)
<i>CEO dummy</i> _{ijt}	β_5	2.3841*** (13.254)	β_5	1.3002** (2.546)
<i>Outside Director</i> _{ijt}	β_6	-1.2775*** (-4.112)	β_6	-0.7579 (-0.847)
<i>Politically Connected Director</i> _{ijt}	β_7	-1.0745** (-2.539)		
<i>Tenure on Current Position</i> _{ijt}	β_8	-0.1399** (-2.073)		
<i>Tenure within Firm</i> _{ijt}	β_9	0.6581*** (6.810)		
<i>New Executive from Same/Related Industries</i> _{ijt}			β_7	0.7953 (1.302)
<i>New Executive from Remote Industries</i> _{ijt}			β_8	1.4719** (2.028)
<i>New Executive from Inside</i> _{ijt}			β_9	0.6116 (1.086)
<i>Foreign Share Ratio</i> _t	β_{10}	0.5757 (0.687)	β_{10}	-0.6215 (-0.359)
<i>Major Shareholder CEO</i> _{it}	β_{11}	0.5575*** (3.036)	β_{11}	-2.8980*** (-4.905)
<i>Board Size</i> _{it}	β_{12}	5.1078*** (18.575)	β_{12}	0.5952 (0.675)
<i>Board Independence</i> _{it}	β_{13}	0.9175 (1.484)	β_{13}	5.7057*** (4.180)
<i>Constant</i>		0.9841 (0.172)		2.9343 (0.261)
Year FE		Yes		Yes
Industry FE		Yes		Yes
Firm FE		Yes		Yes
Number of Observations		14,666		1,610
R-squared		0.372		0.718
Adjusted R-squared		0.350		0.668

t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

New executives from remote or unrelated industries are granted with stronger incentives than other types of new executives ($\beta_9 = 1.4719$, $p < 0.05$). Executive from Remote Industries is awarded with about 4.36 times stronger incentives¹⁷ compared to Executive from Same Business Group and other groups, being reflected by the intercept of the model. Among four types of new executives,¹⁸ Executive from Remote Industries has the greatest information asymmetry between him/her and the new employer. Proposing stronger incentives can induce talented managers to self-select into the firm (Eriksson and Villeval 2008; Arya and Mittendorf 2005) when the firm selects newcomers with insufficient information.

A. Additional Analysis

To see how the incentive scheme differs across various industries, we analyze the data of high-tech and financial firms. Table 5 shows the estimation results of equations (1) and (2) for the data of firms from high-tech industries such as ICT and bio-tech industries. Column (1) in Table 5 shows the results for data of both new and incumbent executives, and the results are qualitatively similar to our findings in Table 4, column (1).

Column (2) of Table 5 shows the results for new executives in high-tech industries. Interestingly, agency problems arising from free cash flows are significant for incentives ($\beta_4 = 39.7344$, $p < 0.01$). This result implies that high-tech firms are especially cautious of distortion in investment decisions arising from agency problems. For instance, if a self-interested manager makes a sub-optimal investment decision, for example, by choosing a second-best project that can benefit him/herself rather than choosing the best one, it can have tremendous adverse effects on the firm value. Among the remaining three groups, *New Executive from Same/Related Industries* is awarded the strongest incentives ($\beta_8 = 1.7236$, $p < 0.05$). New Executives from Remote Industries and New Executives from Inside are granted with only mediocre incentive levels. This result implies that firms provide stronger

¹⁷ The value of 4.36 is calculated by $e^{1.4719} \approx 4.36$.

¹⁸ As discussed earlier, we have four categories of new executives: Executives from Inside, Executives from Same Business Group, Executive from Same/Related Industries, and Executives from Remote Industries.

TABLE 5
ESTIMATION RESULTS: DETERMINANTS OF SBIs IN HIGH-TECH INDUSTRIES

VARIABLES	Dep var: $\text{Log}(\text{Portfolio Delta})_{ijt}$			
	High-Tech Industries			
		(1)		(2)
	Coef	All Observations	Coef	New Executives
<i>Firm Size</i> _{it}	β_1	-2.3507*** (-3.941)	β_1	-1.0587 (-0.608)
<i>Idiosyncratic Risk</i> _{it}	β_2	-0.1275 (-0.192)	β_2	3.7502*** (3.483)
<i>Inverse Growth</i> _{it}	β_3	-10.8476*** (-8.833)	β_3	-6.0190*** (-2.726)
<i>Free CF Problem</i> _{it}	β_4	4.7940 (1.302)	β_4	39.7344*** (4.212)
<i>CEO dummy</i> _{ijt}	β_5	2.7988*** (6.379)	β_5	1.0158 (1.256)
<i>Outside Director</i> _{ijt}	β_6	-2.9366*** (-3.637)	β_6	2.3303 (1.216)
<i>Politically Connected Director</i> _{ijt}	β_7	-0.2143 (-0.220)		
<i>Tenure on Current Position</i> _{ijt}	β_8	-0.3368*** (-2.799)		
<i>Tenure within Firm</i> _{ijt}	β_9	0.8342*** (3.904)		
<i>New Executive from Inside</i> _{ijt}			β_7	omitted
<i>New Executive from Same/Related Industries</i> _{ijt}			β_8	1.7236** (2.469)
<i>New Executive from Remote Industries</i> _{ijt}			β_9	-1.4745 (-0.879)
<i>Foreign Share Ratio</i> _{it}	β_{10}	-1.8684 (-0.748)	β_{10}	-9.8915*** (-2.631)
<i>Major Shareholder CEO</i> _{it}	β_{11}	1.2440*** (3.117)	β_{11}	-2.3437*** (-2.723)
<i>Board Size</i> _{it}	β_{12}	7.2169*** (9.247)	β_{12}	0.4727 (0.266)
<i>Board Independence</i> _{it}	β_{13}	4.2556*** (2.813)	β_{13}	7.9349*** (3.262)
<i>Constant</i>		69.3185*** (4.085)		37.9451 (0.764)
Year FE		Yes		Yes
Industry FE		Yes		Yes
Firm FE		Yes		Yes
Number of Observations		5,617		643
R-squared		0.311		0.721
Adjusted R-squared		0.291		0.676

t-statistics in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE 6
ESTIMATION RESULTS: DETERMINANTS OF SBIs IN FINANCIAL INDUSTRY

VARIABLES	Dep var: <i>Log(Portfolio Delta) ijt</i>			
	Financial Industry			
		(1)		(2)
	Coef	All Observations	Coef	New Executives
<i>Firm Size</i> _{it}	β_1	1.8892*** (3.450)	β_1	5.1243*** (3.162)
<i>Idiosyncratic Risk</i> _{it}	β_2	-2.5614** (-2.379)	β_2	-6.7531** (-2.150)
<i>Inverse Growth</i> _{it}	β_3	1.6198 (0.749)	β_3	12.4616* (1.741)
<i>Free CF Problem</i> _{it}	β_4	6.5707 (1.387)	β_4	28.0256* (1.809)
<i>CEO dummy</i> _{ijt}	β_5	0.6885 (1.575)	β_5	0.6706 (0.490)
<i>Outside Director</i> _{ijt}	β_6	-2.8009*** (-4.728)	β_6	-4.4487** (-2.541)
<i>Politically Connected Director</i> _{ijt}	β_7	0.8613 (1.324)		
<i>Tenure on Current Position</i> _{ijt}	β_8	0.1833 (0.918)		
<i>Tenure within Firm</i> _{ijt}	β_9	1.2068*** (4.724)		
<i>New Executive from Inside</i> _{ijt}			β_7	-2.9173** (-2.183)
<i>New Executive from Same/Related Industries</i> _{ijt}			β_8	-2.7270* (-1.889)
<i>New Executive from Remote Industries</i> _{ijt}			β_9	-3.5209** (-2.043)
<i>Foreign Share Ratio</i> _{it}	β_{10}	-0.0482 (-0.027)	β_{10}	-1.5419 (-0.400)
<i>Major Shareholder CEO</i> _{it}	β_{11}	0.3899 (0.305)	β_{11}	-0.6230 (-0.163)
<i>Board Size</i> _{it}	β_{12}	-0.7085 (-0.563)	β_{12}	-5.5754* (-1.691)
<i>Board Independence</i> _{it}	β_{13}	1.7719 (1.082)	β_{13}	19.1956*** (3.347)
<i>Constant</i>		-35.9948** (-1.974)		-95.0032** (-2.179)
Year FE		Yes		Yes
Industry FE		Yes		Yes
Firm FE		Yes		Yes
Observations		943		147
R-squared		0.4483		0.8213
Adjusted R-squared		0.417		0.761

t-statistics in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

incentives to newcomers with field-specific knowledge and skills, as for *New Executive from Same/Related Industries*.

Table 6 shows the estimation results of equations (1) and (2) for firms in the financial industry such as banks, insurance companies, investment banks, and brokerage firms. Column (1) shows results for the data of both new and incumbent executives. As shown, the CEO dummy is not significant, being different from the results in Tables 4 and 5. Insignificance of the CEO dummy may be due to regulations on executive compensation in financial firms, which is documented in the Guidance for Compensation System in Financial Investment Companies by the Financial Supervisory Service.

Column (2) of Table 6 shows results for new executives for firms in the financial industry. Coefficients on *New Executive from Inside*, *New Executive from Same/Related Industries*, and *New Executive from Remote Industries* are all significantly negative. These findings suggest that *New Executive from Same Business Group*, which is not in the dummy, is awarded with the strongest SBIs. A possible explanation is as follows: In a financial group, key persons from the core affiliate (or holding company) are dispatched to other affiliates in the same group. For instance, Shinhan Bank is the core affiliate of Shinhan Financial Group, and senior executives from Shinhan Bank are sent to other affiliates. The affiliates are serious about aligning their interests with the key personnel.

V. CONCLUDING REMARKS

We have examined a variety of factors that are supposed to affect the SBIs for executives in Korean-listed firms. Based on executive compensation data, we construct an empirical measure of SBIs, which measures the sensitivity of a manager's firm-specific wealth (stocks and options) to the changes in the firm's stock price ("portfolio delta"). We have found that various firm characteristics and executive individual characteristics are significantly associated with SBIs. In particular, firm size, idiosyncratic risk, and firm growth explain the cross-sectional variations in SBIs. In addition, executives' job position (*e.g.*, CEO, outside director, and politically connected director) and background experience (*e.g.*, inside promotion, background in affiliated firms, and work experience in related or remote industries) also have significant associations with stock incentives.

Our study broadens the understanding of incentive pays for executives in Korean firms. While an increasing number of Korean firms are introducing or resuming stock-based incentives in recent years, we do not have enough empirical evidence on how Korean firms determine SBIs as well as why SBIs vary across different cases of Korean firms. Our findings suggest that Korean firms take account of various economic factors to align the interests and preferences of executives with those of shareholders (*i.e.*, motivation function) and to attract and select the talented managers under the uncertainty of managerial ability (*i.e.*, attraction and selection function). These findings are consistent with the optimal contracting hypothesis of Edmans, Gabaix, and Jenter (2017).

Our study has an important policy implication for SBIs. Although the media and regulators often highlight the downside of stock-based compensations such as short-termism and internal inequality within firms, the purpose of employing SBIs is worth noting. Our findings suggest that executive incentives in Korean firms are determined mainly by economic reasons. SBIs in Korean-listed firms are used to maximize the firm value by utilizing human resources more efficiently.

Our study also has limitations. Our empirical analyses are based on a sample of firms that grant SBIs to their executives. The documented associations between the determining factors and SBIs are conditional on the firm's decision to award SBIs. In other words, our empirical findings suggest that the firms consider the determining factors to measure the incentive intensity once they decide to award SBIs. Thus, we should be careful before generalizing the results to other populations.

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Appendix A. Calculation of Per-option Delta

Stock Option Delta equals “per-option Delta” times the total number of unexercised option awards. Appendix A describes the formula to calculate *Per-option Delta*.

Per – option Delta = $e^{-\delta T} N(d_1) \times (S / 100)$, where

$d_1 = [\log(S/X) + (r - \delta + \sigma^2 / 2)T] /$

$d_1 = [\log(S / X) + (r - \delta + \sigma^2 / 2)T] / \sigma\sqrt{T}$, and

S : price of underlying stock, which is the stock price at the end of the fiscal year

X : exercise price of option, as disclosed on the firm’s annual report

δ : expected dividend rate over the life of the option approximated by the dividend yield rate at the end of the year when the option was granted

T : time-to-maturity of the option in years

r : risk-free interest rate approximated by 10-year term Korean treasury bond

N : cumulative probability function for the normal distribution

σ : expected stock-return volatility over the life of the option approximated by standard deviation of stock returns during 120 days prior to the year end when the option was granted

Sum of *Stock Delta* and *Stock Option Delta* is *Portfolio Delta*, which is our measure of stock-based incentives.

Appendix B. Variable Definition

Variables	Definition
$\text{Log}(\text{Portfolio Delta})_{ijt}$	Natural logarithm of <i>Portfolio Delta</i> ijt
<i>Portfolio Delta</i> ijt	Sum of <i>Stock Option Delta</i> ijt and <i>Stock Delta</i> ijt
<i>Stock Option Delta</i> ijt	Dollar change of unexercised stock option value corresponding to 1% change in the firm's stock price; Manager j 's stock option value was calculated based on Black-Scholes option pricing model, as described in Section III.
<i>Stock Delta</i> ijt	Manager j 's stockholdings value * 1% of stock price at the end of the fiscal year
<i>Portfolio Delta</i> ijt	Log (sum of <i>Stock Option Delta</i> ijt and <i>Stock Delta</i> ijt)
<i>CEO dummy</i> ijt	Indicator that takes 1 if the manager j is CEO
<i>Outside Director dummy</i> ijt	Indicator that takes 1 if the manager j is an outside director
<i>Politically Connected Director dummy</i> ijt	Indicator that takes 1 if the manager j is politically connected director; A manager is politically connected if he/she was the top official in government agencies or was the law official
<i>Tenure on Current Position</i> ijt	Log (years that manager j has worked at current position in this firm)
<i>Tenure within Firm</i> ijt	Log (year that manager j has worked in this firm)
<i>Firm Size</i> it	Log (market value of equity of the firm)
<i>Idiosyncratic Risk</i> it	Log (idiosyncratic risk of the firm); Idiosyncratic risk is the standard deviation of residuals from CAPM from monthly returns of prior 36 months
<i>Inverse_Growth</i> it	Book value of assets/Market value of assets; Market value of assets = Total Liabilities + Market value of equity
<i>Free CF Problem</i> it	A firm is value firm if Book-to-Market > 1. For value firm, Free CF Problem = three-year average cash slack; cash slack = (operating cash flows - dividends)/total assets; For growth firm, Free CF Problem = 0
<i>Foreign Share Ratio</i> it	Total shares owned by foreign investors/Total shares outstanding
<i>Major Shareholder CEO</i> it	Indicator that takes 1 if the CEO is also the major shareholder
<i>Board Size</i> it	Log (Number of registered directors)
<i>Board Independent</i> it	Num of outside directors/Total num of directors;
<u>New Executives Analysis</u>	
<i>New Executive from Inside</i> ijt	Indicator that takes 1 if the newly appointed executive is promoted from inside
<i>New Executives from Same Business Group</i> ijt	Indicator that takes 1 if the executive is from the firms within the same business group
<i>New Executive from Same/Related Industries</i> ijt	Indicator that takes 1 if the executive is from same or related industries
<i>New Executives from Remote Industries</i> ijt	Indicator that takes 1 if the executive is from unrelated industries

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