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Does R&D Expenditure with Heavy Related Party Transactions Harm Firm Value?

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Abstract: Related party transactions (RPTs) are transactions made among affiliated companies in a conglomerate group. Heavy RPT ratio means high level of dependence of a firm on the captive market within a conglomerate group. This may depress the firm's incentive to invest in R&D and the high level of R&D expenditure of a firm with heavy RPT ratio may not be efficiently led to high level of firm performances. Relating these RPTs with firm's R&D expenditures together, we investigate the impact of RPTs on firm's R&D expenditures and the effectiveness of R&D with heavy RPT ratio on firm performances, subject to such transactions made by Korean conglomerate groups for the period 2000 to 2010. Results show that higher RPT ratio is negatively associated with R&D expenditures; and the positive relationship between R&D and firm values are negatively moderated by increase in RPTs. Classifying the types of R&D expenditures into research expenses and development expenses, the results are differentiated between them. Evidencing the impact of RPTs on R&D spending and the subsequent effectiveness on firm values, this study helps the related parties to understand the nature of RPTs and conglomerate groups, related to R&D and firm performances, and to make relevant decisions.

Keywords: related party transactions (RPTs); conglomerate groups; R&D expenditure; firm values

1. Introduction

This study examines the impact of related party transactions (RPTs) on firms' research and development (R&D) expenditure and firm performances. In particular, we focus on investigating the interactive role of RPTs and R&D expenditure on firm values, questioning whether R&D expenditure with heavy RPTs harms firms' performances. Our study focuses on Korean conglomerate groups and the RPTs data refer exclusively to information on Korean public firms, based on notes made by sample firms on their respective financial statements.

RPTs frequently occur within Korean conglomerate groups and are monitored by Korean government authorities. Under the national Monopoly Regulation and Fair Trade Act, the Fair Trade Commission of Korea designates the largest conglomerate groups of Korea every year to restrict their internal transactions to enable fair trade in the market. Most recently, 47 conglomerate groups were designated to restrict their mutual investment as of April 2016. Among this group, the average internal transaction ratio reached 11.7% of total sales. A total of 1050 firms (82.4%) out of the 1274 affiliated firms in the designated group are involved in internal transactions within their own conglomerate groups. For example, the SK group reported about $29.6 billion of RPTs within the group, and the Hyundai and Samsung groups also announced $27.5 billion and $17.4 billion worth of internal transactions during 2016, respectively, which represents a highly weighted scale in the Korean economy. Furthermore, many Asian conglomerate groups aim to boost rapid growth within short periods through internal transactions among their affiliated companies [1]. Thus, it may be valuable to focus on the impact of

RPTs of Korean conglomerate groups as a representative example of RPTs in conglomerate groups. Although there are much interest and researches into the pros and cons of RPTs, there is no consensus on the impact of RPTs. As such, this study on the role of RPTs, especially relating to firms' R&D investment behaviors and firm performances, will contribute valuable evidence to the body of literature and may help predict the long-term sustainability of firms that engage in this activity.

RPTs involve a firm's related entities, including its shareholders, executives, and affiliated companies. According to prior research, the effect of RPTs has garnered two opposing views. On the one hand, RPTs are valued as a sound economic activity to maximize shareholders' value by sharing efficient transactions between closely related parties (efficient transaction hypothesis). This view argues that RPTs save transaction costs, enjoy economies of scale, and lead to efficient contracting under incomplete information, which is beneficial for all shareholders (e.g., [2–6]). On the other hand, RPTs are criticized as being potentially harmful to the interests of minority shareholders for the sake of benefiting the controlling shareholders (conflict of interest hypothesis). According to this point of view, RPTs undermine the benefits of minority shareholders in the pursuit of improving the interests of controlling shareholders, thereby negatively impacting firm values (e.g., [7–9]). Cheung et al. [10] insisted that RPTs have a negative influence on the firms' abnormal stock returns and this negative impact becomes larger with higher levels of controlling shareholders' ownership. Under these circumstances, this study aims to verify the impact of RPTs on R&D and on the relationship between R&D investment and firm values subject to Korean conglomerate groups.

In this study, we intend to investigate the relationship between RPTs and R&D spending first. Considering RPTs and R&D together, the relationship between the two can be explained in two ways. Since RPTs tie a firm's affiliated companies together as a captive market, the relevant parties can boost sales, save costs, and enjoy beneficial synergy. As it complements the role of R&D investment, it is possible that RPTs could reduce or help firms' investment in R&D. From another viewpoint, when firms engaged in heavy RPTs among its affiliated firms, they can enjoy the benefits from the captive market at others' expenses, these firms would not develop external markets, so that they might reduce R&D expenditure as well.

Furthermore, this study examines the role of RPTs in the relationship between R&D expenditure and firm values. Many prior studies have analyzed various aspects of the impact of RPTs. However, the influence of RPTs on the relationship between R&D investment and firm values has not been explored yet. In this study, we scrutinize the influence of R&D in firms with heavy RPT ratio on the firm value. We want to test whether the RPT ratio is a decisive factor in the effectiveness of R&D investment and investigate whether R&D expenditure is positively related to the performance of a company, even with a heavy RPT ratio, or whether a heavy RPT ratio disturbs the effectiveness of R&D.

Yoon [11] tested the relationship between R&D expenditure and RPTs in the Korean market. She reported no significant result in her analysis on the relationship between RPTs and R&D expenditure but found evidence that the additional influence of large conglomerates was a negative factor in the relationship. Compared to her study, our study only focuses on Korean conglomerate groups, and we expand the study to examine the joint impact of RPTs with R&D on firm performances. In addition, we classify R&D expenditure into two different categories, namely research expenses and development expenses. Research expenses refer to the short-term research expenses that are treated as current expenses in accounting. Development expenses are defined as long-term development expenses that are capitalized as assets with their expected future utilities in accounting. Under the Korean GAAP (Generally Accepted Accounting Principles), effective during the sample period, only the R&D expenses for which future benefits are highly realizable could be capitalized. By differentiating between R&D expenditure at current expenses, and capitalized R&D expenditure, we expected to find out which type of R&D expenditure would better explain the influence of RPTs and its relationship with firm performances.

Using a sample of 2061 firms' data over an 11-year period, we find that a higher RPT ratio has a negative association with R&D expenditure. Specifically, when the RPT ratio increases, research

expenses at current expenses decline, but there is no significant relationship with development expenses which are accounted as capitalized expenses as assets. Furthermore, we present that R&D expenditures consumed under heavy RPT ratio do not contribute to an increase in firm values. In distinguishing research expenses and development expenses, RPTs weaken the relationship between research expenses at current expenses and firm values, but there is no significant impact of RPTs on the relationship between development expenses, which are accounted as capitalized expenses as assets, and firm values.

From this study we show the relationship between RPTs and R&D expenditure and distinguish the results by types of R&D expenditure. Next, we describe how RPTs influence the relationship between R&D expenditure and corporate values. In addition, this study presents a specific case of the role of RPTs in the effectiveness of R&D, particularly featuring a specific type of Asian conglomerate groups. The results of this study will help investors, regulators, and government authorities to set desirable policies on RPTs considering the impact in the market. The remainder of the paper consists of theory and hypotheses development in Section 2, research methodologies in Section 3, empirical results in Section 4, and a discussion in Section 5.

2. Theory and Hypotheses Development

2.1. Theoretical Background

RPTs are business deals or transactions between two related parties that have a special relationship with concerned firms. Such special relationship includes firms' shareholders, affiliates, subsidiaries, and others who built specific relations with the firms before their deals or transactions. With RPTs, firms can enjoy some benefits by sharing common resources, saving costs, and reaching economies of scale between the relevant entities. However, this kind of transaction can also create potential conflict of interests because the benefits to the relevant parties could oppose the interests of others. There are two contrasting theoretical arguments about RPTs in the literature (e.g., [2,5,8,10,12]).

Under the efficient transaction hypothesis, some previous researchers insist that RPTs promote synergy, save costs, and solve the problem of incomplete information. Williamson [2] asserted that RPTs can enhance the economic efficiency of a business with benefits from the internal capital market and cheaper transaction costs. Chang and Hong [5] examined the performances of affiliated firms sharing intra-group resources and engaging in internal business transactions within large conglomerate groups in Korea. They reported that affiliated firms benefit from sharing intangible and financial resources and they perform better than others.

However, more studies support the conflict of interest hypothesis, expressing doubts about managerial opportunism and evidence of tunneling through RPTs. Based on this hypothesis, RPTs increase the benefits of controlling shareholders but expropriate the interests of minority shareholders as they seem to be confidentially and exclusively held [13,14]. Gordon and Henry [15] examined the association between RPTs and earnings management, and found that RPTs were associated with a higher level of earnings management [16,17]. Cheung et al. [10] compared the price policies of RPTs with other similar transactions, and found that the sales and purchase prices for RPTs tended to transfer resources from minority shareholders to controlling shareholders. Kohlbeck and Mayhew [12] searched for the stock markets' valuation of the firms that disclosed RPTs. They found that firms are discounted in the market by disclosure of RPTs, whose effect was further influenced by the transaction types and parties involved. Jian and Wong [1] studied RPTs in the Chinese economy and reported that affiliated firms with large conglomerates tended to promote more RPTs and exaggerated their sales with claims of higher values in order to report higher profits.

Based on these arguments, some studies have searched for the determinants of RPTs as well as the impact of RPTs on other economic events. Gordon et al. [8] found that weaker governance systems such as board characteristics, CEO pay–performance sensitivity, and outside monitors are associated with RPTs. Cheung et al. [10] also insisted that firms with weaker corporate governance indulged in more frequent RPTs, with a consequent negative impact on stock prices [7]. Choi and Kim [18] reported

that RPTs increased managers' over-investment and large conglomerates had a higher association with this phenomenon in the Korean economy. It was also stated that RPTs are opportunistically promoted for tax avoidance purpose, especially in firms with a high level of tax payable and in cases where there is no separation between firms' management and ownership [19].

2.2. Impact of Related Party Transactions on R&D Investment

R&D investment is aimed at a firm's future growth opportunities. Firms execute R&D to develop new products and projects, and guide long-term growth strategies. R&D is regarded as a firm's strategic decision to boost its competitive advantage in subsequent years, and decision of R&D expenditure levels involve in many different factors [20–23]. Prior studies search for the determinants that decide firms' R&D expenditure and list up non-linear relationship with size, internal and external organizations of R&D, a firm's financial capabilities, corporate structure, ownership, market structure or environment and others as the factors (e.g., [24–26]).

Sanjai and Welch [24] compared the determinants of R&D in five OECD regions and found some common factors and differences among those countries. In addition, García-Quevedo et al. [25] compared the young firms and mature firms in their relationship with R&D drivers. They found that previous R&D experience is fundamental to determine the difference between mature and young firms. They also revealed that market characteristics play a role to distinct the innovation activities of firms in different ages. Testing the link between a firm's in-house and external R&D and the firm's age, Pellegrino et al. [26] found that in-house R&D is related to the product innovation in the mature and young firms together; and innovation intensity was related to the external sources only in young firms. Jensen and Meckling [27] has stated that managers tended to avoid high-risk investment, as its ownership was lower, in order to avoid private costs and enhance their personal utilities, while managerial ownership or managerial incentive can act as a determinant when defining R&D expenditure [28]. Similarly, Almazan et al. [29] and others reported that CEO compensation influenced the level of R&D expenditure of firms [30–32]. In a recent study, Midavaine et al. [32] reported that board diversity, such as their tenure, education, and gender, also relate to firms' decisions on R&D investment.

Along with these, this study intends to examine RPTs as a determinant of firms' R&D investment. Regarding the impact of RPTs on business practices, there were two opposite views suggested from prior studies. Under the conflict of interest hypothesis, managers or controlling shareholders expropriate minority shareholders' interests through RPTs. Managers would promote RPTs to enjoy their private benefits through RPTs within their captive market but give up extra R&D investment to develop external markets. On the other hand, in the view of the efficient transaction hypothesis, RPTs can save R&D costs. RPTs can help the related parties to easily boost their sales and purchases, save costs, and share technological benefits [33]. In particular, because of the synergistic effect of shared advanced technology and knowledge, they can save their R&D expenses together as a whole. Thus, higher level of RPTs could reduce the level of firms' R&D investment because it could complement the role of R&D investment. In addition, a firm's network resources in an inter-organizational network are an important factor to drive the intensity of the firm's R&D expenditure [33]. Thus, we expect that RPTs of a conglomerate group could also be a factor to determine R&D expenditure as they involve in resources transfer among related parties within the conglomerate group, whether they are results of tunneling or efficient transactions. Under these circumstances, we aim to empirically test the impact of RPTs on R&D expenditure, as we expect a negative relationship between a firm's RPT ratio and R&D expenditure driven from both points of views.

Furthermore, we divided total R&D expenditure into two different categories: research expenses consisting of R&D expenditure at current operating expenses, and development expenses, consisting of capitalized R&D expenditure. Under the accounting standards of GAAP, applied during the sample period, R&D expenditures consisted of research expenses that were dealt as current expenses, and development expenses that were recorded as assets considering their expected future utilities and

certainty. As total R&D expenditure refers to the sum of these two different types of costs, we aimed to distinguish between these two and determine whether the impact of RPTs on R&D expenditure is different for the current expenses of research expenses and capitalized assets of development expenses. We therefore set our Hypotheses 1 as follows:

Hypotheses 1 (H1). *There is a negative relationship between a firm's related party transaction ratio and R&D expenditure.*

Hypotheses 1a (H1a). *There is a negative relationship between a firm's related party transaction ratio and research expenses.*

Hypotheses 1b (H1b). *There is a negative relationship between a firm's related party transaction ratio and development expenses.*

2.3. Influence of Related Party Transactions on the Relationship between R&D Expenditure and Firm Values

Concerned with the relationship between R&D investment and firm performances, most studies report a positive association between the two. Measuring R&D as a proxy for innovation, many studies examined the relationship between R&D and firm performances. Mohnen and Hall [34] reported that innovation is led to the better productivity performance or better revenue per employee performance. Mudambi and Swift [35] found that exploratory R&D from a firm's historic trend is indicative information and it is associated with increased firm performances. Bonanno [36] found that information and communication technology and R&D were productive inputs to determine a firm's efficiency. Cassiman et al. [37] studied the relationship among innovation, exports and productivity. In their study, they found the importance of firm specific characteristics to determine the relationship among them. Hall and Jaffe [38] investigated the relationship between knowledge stocks and market values. They defined the ratio of R&D to assets, the patent yield of R&D and citations to patents as three different knowledge stocks and found them all to be significantly associated with market values. Coad and Rao [20] examined firm growth and R&D expenditure to observe a firm's investment behavior. From the study, they revealed that profit growth had little effect on R&D investment but growth in sales and growth of employment were followed by increase in total R&D expenditures. In addition, Branch [39] found a series of influence from R&D to future profitability and from past profitability to current R&D. He also reported that this relationship is affected by some third factors like government support or exogenous surges. Hirschey [40] evidenced a significantly positive relationship between advertising or R&D and market values, and determined them as useful indicators to anticipate general magnitude of corporate profit and tax misstatement. Hirschey and Weygandt [41] stated that advertising expenses and R&D expenditures gave persistently positive influence on market values, as intangible capital investment for future performances. Bublitz and Ettredge [42] provided an empirical evidence to explain the information contents of advertising and R&D. They found associations of advertising and R&D with forecast errors and abnormal returns; in particular, short-lived relationship for advertising, and long-lived relationship for R&D. Aboody and Lev [43] examined the relationship between R&D and insider gains in order to reveal R&D as a major contributor to information asymmetry between corporate insiders and the outside market. This study features R&D expenditure as a proxy for information asymmetry between managers and other interested parties imposing managerial discretion with its vague accounting practices and vague R&D spending guidelines.

As for the studies on the impact of RPTs on firm values, some studies indicate that RPTs may improve firm values with their synergy to share resources among related parties [2,5]. However, Gordon et al. [8] and Cheung et al. [10] insisted that RPTs can deteriorate firm values due to conflicts of interests between the related parties involved in specific transactions and others. Kohlbeck and Mayhew [12] compared the stock market valuation and firms' overall risk return profile for firms with RPTs disclosure and those without it. They found that firms with RPTs disclosure showed significantly lower valuation and marginally lower subsequent returns than firms without RPTs disclosure. They

also reported that the transactions types and parties of RPTs influenced market perceptions in particular. Generally, heavy RPT ratio features high dependence of the firm on the captive market within the conglomerate group. Unless the firm goes through severer competition than external market with the related parties within the group, they would not need to increase their investment in R&D because they already enjoy benefits of safe and stable captive market. Whether RPTs could save costs, produce synergy and subsequently give positive influence on the firm performances, as efficient transaction hypothesis supported, or there is managerial intention to transfer wealth through tunneling, supported by conflict of interest hypothesis, the incentive for R&D investment might be lower for the firms with heavy RPT ratios. Therefore, it is expected that RPTs would have negative influence on the level of R&D spending and the effectiveness of R&D activities as well.

Under these circumstances, we attempt to test if RPTs could negatively moderate the positive relationship between R&D expenditure and firm performances. If RPTs reduce the opportunity to make transactions with external markets, then the R&D expenditure with heavy RPT ratio would be less effective or ineffective in increasing firm performances against the positive relationship between R&D expenditure and firm performances. In particular, we categorized R&D expenditure into research expenses and development expenses as explained above. Lev and Zarowin [44] found that firms with higher R&D expenditure exhibit a higher level of difference between their market values and book values. They also reported that when the firms capitalized the R&D expenditure which had been previously treated as costs, the relationship between R&D expenditure and firm values became stronger [45]. Aboody and Lev [43] also studied the differential impacts of R&D expenditure on stock prices and stock returns when the R&D expenditure is capitalized or treated as costs. Their results indicate that capitalized R&D had a significant influence on stock prices and stock returns, but there was no significant relationship when it was treated as costs. On the whole, these previous studies indicate that accounting treatment of R&D expenditure as capitalized assets or operating expenses could contain different managerial discretion and informativeness. Thus, it is worth distinguishing different types of R&D expenditure to compare the impact of RPTs on the differentiated R&D expenditure as capitalized assets and operating expenses.

Based on these ideas, we concern RPT ratio would moderate the positive relationship between R&D and firm values as increase in RPTs would feature a firm's dependence on the captive market within the conglomerate group instead of launching competitive external markets. If a firm highly leans on the captive market but records high level of R&D expenditure, we expect the effectiveness of R&D would decrease. Further, we expect that the impact of the RPT ratio on the relationship between R&D expenditure and firm performances would be differentiated according to the types of R&D expenditure, whether they are research expenses or development expenses. To verify these ideas, we draw our set of Hypotheses 2 as follows.

Hypotheses 2 (H2). *The firm's related party transaction ratio negatively moderates the positive relationship between R&D expenditure and firm values.*

Hypotheses 2a (H2a). *The firm's related party transaction ratio negatively moderates the positive relationship between research expenses and firm values.*

Hypotheses 2b (H2b). *The firm's related party transaction ratio negatively moderates the positive relationship between development expenses and firm values.*

3. Methodology

3.1. Sample Selection and Data

All the financial statements and stock market data are extracted from the Data Guide Pro database provided by FnGuide Co. The Data Guide Pro covers all publicly listed firms in Korea and is the equivalent database to CRSP and Compustat in the US. Notably, RPTs data are available exclusively for Korean firms with limited disclosed years. Thus, we attempt to identify all the publicly listed firms

in Korea from 2000 to 2010. We mainly focus on manufacturing firms to make the sample comparable. We identify a 2061 firm-year sample for an 11-year period. The dependent variable of our regression models, RPTs, is calculated as the total amount of operating sales and purchases with related parties, pertaining to a conglomerate group, divided by the total sales. Even though firms disclose other RPTs such as non-operating receivables or debts, we exclude those transactions because they are not associated with our main independent variable R&D efforts. We include related party purchase transactions with sales, as R&D investment is associated with such incentives to replace current materials purchased from other affiliated firms. We use R&D figures obtained from the footnotes of financial statements and disclosed as separated by research expenses and development expenses.

3.2. Regression Model

We adopt GLM regression models as follows to examine our main hypotheses. Model (1) is to test Hypothesis 1 and Models (2) and (3) are used to test Hypothesis 2.

$$rndi_{(i=1\sim3)} = \alpha_0 + \beta_1\, rpt + \beta_2\, size + \beta_3\, lev + \beta_4\, cfo + \beta_5\, grow + \beta_6\, div + \sum industry\ dummies + \sum firm\ fixed\ effect\ dummies \quad (1)$$

$$q = \alpha_0 + \beta_1\, rpt + \beta_2\, rndi_{(i=1\sim3)} + \beta_3\, (rpt \times rndi)_{(i=1\sim3)} + \beta_4\, size + \beta_5\, lev + \beta_6\, cfo + \beta_7\, grow + \beta_8\, eps + \beta_9\, diverse + \beta_{10}\, age + \sum industry\ dummies + \sum firm\ fixed\ effect\ dummies \quad (2)$$

$$q = \alpha_0 + \beta_1\, rpt + \beta_2\, rnd2 + \beta_2\, rnd3 + \beta_3\, (rpt \times rnd2) + \beta_4\, (rpt \times rnd3) + \beta_5\, size + \beta_6\, lev + \beta_7\, cfo + \beta_8\, grow + \beta_9\, eps + \beta_{10}\, diverse + \beta_{11}\, age + \sum industry\ dummies + \sum firm\ fixed\ effect\ dummies \quad (3)$$

where *rpt* = related party transactions ÷ sales; *rnd1* = total R&D expenditure ÷ sales; *rnd2* = research expenses ÷ sales; *rnd3* = development expenses ÷ sales; *q* = Tobin's Q = (market capitalization + debt)÷ asset; *size* = natural log of asset; *lev* = leverage (= liabilities ÷ assets); *cfo* = operating cash flow ÷ assets; *grow* = growth ratio (= (asset − lag asset) ÷ lag asset); *eps* = earnings per share, *diverse* = industry diversification (=$\sum P_n \times$ natural log of $1/P_n$), where P_n = percent of firm revenues derived by product n; *div* = dividend ÷ market capitalization; and *age* = natural log of firm's age.

Model (1) is to identify the effects of RPTs on types of R&D expenditures, and Models (2) and (3) are to identify the combining effect of RPTs and R&D expenditures on Tobin's Q. We decomposed the total R&D expenditure (*rnd1*) into research expenses (*rnd2*), and development expenses (*rnd3*). Other variables are selected to effectively control which may affect dependent variables of R&D expenditures and firm values. First, R&D expenditures are influenced mainly by scales of firm, financial affordability, and future prospects of those spending. Sizable firms tend to be more aggressive on R&D activities [46]. Financial restrictions need to catch in both aspects for cash flows [47] in operating cash flows (*cfo*) and dividend (*div*). We also control financial distress with leverage (*lev*) [24]. Tobin's Q in Models (2) and (3) is affected by firm's capabilities, future prospects, and resources to support them. Current growth ratio (*grow*) [48,49] and by industry diversification [50] represent firm's capabilities. Earnings per share (*eps*) [51] and firm's age [52,53] are to capture potentials to grow in the future. We apply entropy index [54] to measure industry diversification for product mix of each firm. Operating cash flows (*cfo*) and leverage (*lev*) are included to represent how well firms support the future prospects [55].

4. Results

4.1. Descriptive Statistics

Table 1 presents the descriptive statistics of dependent and independent variables for the sample size of 2061 firm-years. The independent variable *rpt* representing the proportion of RPTs to total sales shows a mean value of 0.233, indicating that a subsidiary firm yields 23.3% of total sales through internal transactions among a conglomerate group, which indicates rather heavy dependence on RPTs. We have two main dependent variables as R&D (*rnd1*–*rnd3*) and Tobin's Q (*q*) for H1 and H2, respectively. *rnd1* indicating total R&D expenditure covers 1.4% of total sales, and research expenses

(*rnd2*) are twelve times more expensed than development expenses (*rnd3*). The mean value of *q* is 0.935 and the median value is 0.823. With respect to control variables, the mean value of *size* is 19.533 and the mean value of leverage (*lev*) is 0.414, indicating that total liabilities reach up to 41.4% of total assets, on average, of sample firms. The mean value of *div* is 0.028, indicating that dividend payout ratio to market capitalization is approximately 2.8%. The average of firms' *age* is from 34.5 years, of its natural log, 3.395. The descriptive statistics of the other control variables have generally consistent values with those of prior studies.

Table 1. Descriptive statistics (N = 2061)

Variables	MIN	Q1	Mean	Median	Q3	Max	STD
Related party transactions (*rpt*)	0.000	0.043	0.233	0.144	0.346	1.033	0.246
R&D expenditure (*rnd1*)	0.000	0.003	0.014	0.007	0.019	0.094	0.017
Research expenses (*rnd2*)	0.000	0.002	0.012	0.006	0.018	0.076	0.015
Development expenses (*rnd3*)	0.000	0.000	0.001	0.000	0.000	0.024	0.004
Tobin's Q	0.375	0.676	0.935	0.823	1.052	2.820	0.422
Size	17.192	18.563	19.533	19.262	20.258	23.496	1.347
Leverage	0.078	0.250	0.414	0.425	0.572	0.903	0.206
Operating cash flow	−0.149	0.007	0.051	0.057	0.109	0.286	0.094
Growth ratio	−0.434	−0.026	0.051	0.059	0.146	0.832	0.219
Earnings per share	2.639	6.105	7.080	7.216	8.187	10.328	1.595
Industrial diversification	0.000	0.672	0.959	1.034	1.320	1.899	0.463
Dividend	0.000	0.010	0.028	0.023	0.041	0.164	0.024
Firm's age	0.693	3.258	3.395	3.526	3.784	4.357	0.661

4.2. Correlation Results

Table 2 presents Pearson correlations results among our dependent and independent variables. The coefficients between main variables make it possible to have a general expectation on our hypotheses based on the univariate analysis results. For R&D expenditure variables, (*rnd1–rnd3*) are all significantly positively correlated with Tobin's Q (*q*), indicating that higher R&D expenditure improves firm performances. Concerning coefficients between RPTs (*rpt*) and R&D variable (*rnd1–rnd3*), development expenses only show positive and significant relationship in this univariate test. For our main independent and dependent variables of H2, the coefficient between *rpt* and *q* is 0.026 but it is not significant (*p*-value = 0.247). The other coefficients show consistency with prior studies, as expected. The correlation results figure out expected univariate test results on our hypotheses. However, the results shall be different from the results of our multivariate analysis after considering various control variables.

Table 2. Pearson correlations of variables (N = 2061).

Variables	*rnd1*	*rnd2*	*rnd3*	*Q*	*size*	*lev*	*cfo*	*grow*	*eps*	*diverse*	*div*	*age*
Related party transactions (*rpt*) (2nd line indicates *p*-values)	0.014 0.517	0.007 0.759	0.053 0.016	0.026 0.247	0.048 0.028	−0.016 0.473	0.008 0.721	−0.011 0.634	−0.090 <0.0001	−0.053 0.015	0.034 0.127	−0.033 0.135
R&D expenditure (*rnd1*)		0.951 <0.0001	0.388 <0.0001	0.228 <0.0001	0.003 0.909	0.000 0.984	0.037 0.094	0.067 0.002	−0.096 <0.0001	0.158 <0.0001	−0.153 <0.0001	−0.048 0.031
Research expenses (*rnd2*)			0.128 <0.0001	0.215 <0.0001	−0.023 0.296	0.000 0.995	0.062 0.005	0.102 <0.0001	−0.063 0.005	0.139 <0.0001	−0.144 <0.0001	−0.039 0.080
Development expenses (*rnd3*)				0.103 <0.0001	0.119 <0.0001	0.036 0.106	−0.068 0.002	−0.098 <0.0001	−0.130 <0.0001	0.134 <0.0001	−0.081 0.000	−0.026 0.237
Tobin's Q (*q*)					0.238 <0.0001	0.203 <0.0001	0.272 <0.0001	0.230 <0.0001	0.082 0.000	0.025 0.265	−0.336 <0.0001	−0.191 <0.0001
Size (*size*)						0.222 <0.0001	0.093 <0.0001	0.069 0.002	0.413 <0.0001	0.099 <0.0001	−0.126 <0.0001	0.124 <0.0001
Leverage (*lev*)							0.211 <0.0001	0.473 <0.0001	−0.067 0.002	0.046 0.036	−0.170 <0.0001	−0.044 0.048
Operating cash flow (*cfo*)								0.427 <0.0001	0.177 <0.0001	−0.010 0.658	−0.028 0.201	−0.033 0.132
Growth ratio (*grow*)									0.085 0.000	−0.002 0.931	−0.133 <0.0001	−0.018 0.407
Earnings per share (*eps*)										0.017 0.431	0.103 <0.0001	0.151 <0.0001
Industrial diversification (*diverse*)											−0.031 0.157	0.055 0.012
Dividend (*div*)												−0.037 0.097

cf. Refer to Equations (1)–(3) for the definitions of the variables.

4.3. Multivariate Results

4.3.1. Effects of Related Party Transactions on R&D Expenditure

Table 3 presents the results on the effects of RPTs on R&D expenditure, which we analyze in our Hypothesis 1. Results show the associations of RPTs with each dependent variable and *rnd1* (R&D expenditure as total), *rnd2* (research expenses), and *rnd3* (development expenses). F-statistics are significant (p-value < 0.0001) representing statistical soundness of regression models. We also checked multi-collinearity by Variance Inflation Factor (VIF) values in all empirical models, and confirm that VIFs are less than 3, which is lower than the severe level of 10.

Table 3. Effects of related party transactions on R&D expenditure (N = 2061).

Variables	(1) Dependent = *rnd1*		(2) Dependent = *rnd2*		(3) Dependent = *rnd3*	
	Estimate	***p*-Value**	**Estimate**	***p*-Value**	**Estimate**	***p*-Value**
Intercept	−0.053	0.000	−0.052	<0.0001	0.005	0.286
Related party transactions (*rpt*)	−0.007	<0.0001	−0.005	0.000	0.000	0.906
Size	0.004	<0.0001	0.003	<0.0001	0.000	0.364
Leverage	−0.007	0.001	−0.004	0.048	−0.001	0.155
Operating cash flow	0.001	0.815	0.001	0.578	−0.001	0.092
Growth ratio	0.005	<0.0001	0.005	<0.0001	0.000	0.465
Dividend	−0.018	0.075	−0.022	0.022	0.003	0.362
Industry dummies	Included		Included		Included	
R-square	0.859		0.841		0.715	
F-statistics	<0.0001		<0.0001		<0.0001	

cf. Refer to Equations (1)–(3) for the definitions of the variables.

Table 3(1) shows the relationship between RPTs (*rpt*) and total R&D expenditure (*rnd1*). It shows a significantly negative coefficient of −0.007, which indicates that firms with higher RPTs show less investment in total R&D expenditure. However, the results shown in Table 3(2) and Table 3(3), about the impact of RPTs (*rpt*) on research expenses (*rnd2*) and development expenses (*rnd3*), are different. The impact of RPTs (*rpt*) on research expenses (*rnd2*) shows a negatively significant impact, which is aligned with the result for the total R&D expenditure presented in Table 3(1). Nevertheless, there is no significant impact of RPTs (*rpt*) on the development expenses (*rnd3*), which means that even firms with higher RPTs do not reduce their development expenses out of their total R&D expenditure.

The results on two distinguished R&D types, *rnd2* and *rnd3*, provide an in-depth understanding on the behavior of RPTs. When firms with higher RPTs reduce their R&D expenditure, as shown in Table 3(1), there could be different options to choose for managers to reduce or save along the different types of R&D expenditure. Based on the theoretical views on RPTs, managers would not have an incentive to increase R&D expenditure with increase in RPTs, because they already enjoy their private benefits through RPTs within their captive market and do not attempt to develop external market opportunities, thus decreasing their R&D investment.

When we distinguish between research expenses and development expenses, research expenses are defined as more likely to be short-term expenditure and vaguer spending related to the outcome. Development costs are capitalized R&D expenditure under strict conditions of accounting standards. Thus, they are highly expected to contribute to firms' long-term development and sustainability, and also more directly aligned to the outcome. Therefore, if managers have a choice to reduce research expenses and development expenses, we expected managers might give up research expenses than development expenses considering their different natures. Previous studies found the different impact of capitalized R&D expenditure and R&D at current expenses on performances and support the idea [43,44]. As we found, the negative relationship between RPTs and R&D expenditure is only apparent from the research expenses, and the development expenses shows an insignificantly positive

result. These results imply that the reduction in total R&D expenditure in firms with higher RPTs comes not from their reduction of research expenses but from the development expenses.

4.3.2. Effects of R&D Expenditure with Related Party Transactions on Firm Value

Based on the negative relationship between RPTs and R&D examined through the H1, Table 4 presents the results on the effects of RPTs on the relationship between R&D expenditure and firm values. Table 4(1) represents the impact of total R&D expenditure examined by Model (2) and Table 4(2) presents the joint impact of research expenses (*rnd2*) and development expenses (*rnd3*) with RPTs tested by Model (3). Table 4(3) and Table 4(4) additionally show the individual impact of research expenses (*rnd2*) and development expenses (*rnd3*) on firm values based on Model (2).

These is no significant relationship found between related part transactions (*rpt*) and firm performances (*q*) throughout the set of Table 4, except the negatively significant relationship in Table 4(4). Total R&D expenditure and research expenses (*rnd1* and *rnd2)* have significantly positive impacts on firm performances throughout the tables. In Table 4(1), the interaction term of (*rpt* × *rnd1*) shows significantly negative result as −5.865 of the coefficient. Combining the coefficients for rnd1 (as 2.139) and (*rpt* × *rnd1*) (as −5.865) together, it is found that when RPT ratio is high, R&D expenditure has a negative relationship with firm performances.

In Table 4(2), the results are distinguished as the impact of research expenses and development expenses. The table presents the relative impact of research expenses (*rnd2*) and development expenses (*rnd3*) on firm values. In Table 4(2), research expenses *(rnd2)* show significant and positive impact on firm performances, but RPTs (*rpt*) and development expenses (*rnd3*) present insignificant values on firm performance. For interaction terms, the coefficient for (*rpt* × *rnd2*) is found to be significantly negative with coefficient −9.907, but insignificant for (*rpt* × *rnd3*). These results imply that increase in RPT ratio gives a negative impact on the relationship between research expenses and firm performances, but the impact of RPTs is not found from the relationship between development expenses and firm values.

Table 4. Effects of R&D expenditure with related party transactions on firm values (N = 2061).

Variables	Dependent = Tobin's Q							
	(1) *rnd1*		(2) *rnd2 & rnd3*		(3) *rnd2*		(4) *rnd3*	
	Estimate	***p*-Value**	**Estimate**	***p*-Value**	**Estimate**	***p*-Value**	**Estimate**	***p*-Value**
Intercept	−0.584	0.208	−0.539	0.245	−0.550	0.236	−0.665	0.151
Related party transactions (*rpt*)	−0.026	0.688	0.002	0.971	0.003	0.968	−0.122	0.026
R&D expenditure (*rnd1*)	2.139	0.025						
Research expenses (*rnd2*)			3.023	0.005	2.911	0.005		
Development expenses (*rnd3*)			−3.532	0.326			−1.911	0.579
rpt × *rnd1*	−5.865	0.013						
rpt × *rnd2*			−9.907	0.001	−8.687	0.002		
rpt × *rnd3*			10.206	0.235			1.061	0.895
Size	0.081	0.002	0.078	0.002	0.079	0.002	0.088	0.001
Leverage	0.016	0.815	0.017	0.795	0.016	0.809	0.016	0.811
Operating cash flow	0.097	0.035	0.097	0.035	0.097	0.035	0.097	0.034
Growth ratio	0.044	<0.0001	0.045	<0.0001	0.045	<0.0001	0.043	<0.0001
Earnings per share	0.267	0.001	0.262	0.001	0.265	0.001	0.266	0.001
Industrial diversification	0.006	0.820	0.007	0.797	0.006	0.816	0.004	0.873
Firm's age	0.270	<0.0001	0.272	<0.0001	0.273	<0.0001	0.264	<0.0001
Industry dummies	Included		Included		Included		Included	
R-square	0.730		0.731		0.729		0.731	
F-statistics	<0.0001		<0.0001		<0.0001		<0.0001	

cf. Refer to Equations (1)–(3) for the definitions of the variables.

Table 4(3) and Table 4(4) also support the same results. Table 4(3) shows that research expenses (*rnd2*) with heavier RPTs has a negative relationship with firm performance. Table 4(4) reports that there is no interactive role for RPTs and development expenses (*rnd3*) in firm performances.

Overall, the results indicate that RPTs could deteriorate the effectiveness of R&D on firm performances. In our results, RPTs showed no, or negative, influence on firm performances. R&D consistently positively related to the firm value. When their interactive roles on the firm performances are examined together, higher RPT ratio negatively moderated the association between total R&D expenditure or research expenses and firm performances. The results mean that higher level of R&D expenditure in a firm with heavy RPT ratio does not feature high level of R&D effectiveness on firm values. This could be interpreted as lower competence of firms with heavy RPTs under a captive market without severe external competition or suspicious accounting treatment of R&D expenditure, as it also contains the contents of information asymmetry, without higher incentive for R&D spending under its specific environment. However, to confirm any of these possibilities, further studies are necessary. Heavy RPTs do not harm the relationship between development expenses and firm performances, which again emphasizes the importance of classification of R&D expenditure into the outcome where research expenses are short-term and relatively vague, and development expenses more strongly relate to firms' future performance. Although RPTs play a negative role to harm the firm performance regarding total R&D expenditure, when there are discretionary choices for managers to give up research expenses and development expenses, managers' discretion may be held not to harm firm's long-term performances.

5. Discussion

This study aimed to identify the impact of RPTs on R&D expenditure and on the relationship between R&D and firm values. We first analyzed the associations between RPTs and R&D expenditure, and between RPTs' incurred R&D expenditure and consequent firm valuation. The results provide significant evidence to support the negative aspects of RPTs harming R&D investment and firm values.

5.1. Theoretical Contributions and Managerial Implications

This study may propose a practical insight on the role of RPTs in a firm's innate capabilities, between the conflicts of interest hypothesis and efficient transaction hypothesis on the role of RPTs from prior studies. Prior studies on RPTs stemmed from their tunneling activities [9] and showed the negative effects on firms' values [10], and earnings manipulations [1]. They assumed that RPTs detour transaction channels through which the wealth from minority shareholders to majority shareholders is expropriated. However, others address the efficient role of RPTs in promoting the cost saving impacts and benefits from internal business transactions [2], sharing intangible and financial resources [5], and technological benefits [23] as well as higher performances as a result.

Meanwhile, we posit whether RPTs influence R&D expenditure, which then leads to firm values. Our approach differs from previous studies as we focus on RPTs' genuine ability to enhance or deteriorate firms' capabilities, and not on their indirect role as a transfer channel of wealth expropriations. Furthermore, while preceding studies focus on a short-term perspective of RPTs, this study emphasizes long-term perspectives to identify the associations between RPTs and transient R&D expenditures, and firm values representing future cash flows induced by those R&D expenditures. Moreover, we distinguished research expenses and development expenses of R&D expenditure to identify the role of RPTs in the sustainable growth of firms, considering the different classification of the R&D expenditure as current operating expenses or assets.

This study also suggests practical messages for managers, shareholders, and investors engaged in or concerned with affiliated firms with high RPT ratio. First, the findings of this study provide practical lessons to managers of both affiliated firms and conglomerate headquarters. For the managers and the conglomerate group as a whole, the results suggest that heavy RPT ratio might be a signal for ineffective realization of R&D to firm values. Second, the findings of this study may be used as an indicator for shareholders and potential investors to anticipate the effectiveness of R&D with heavy RPTs as being harmful to the firm value, featuring possible opportunistic behaviors contained on the heavy RPT ratio.

5.2. Limitations and Future Research Directions

Although this study offers theoretical and practical contributions, there exist several limitations that we expect to be able to resolve in future research. First, this study used older (non-recent) testing samples from 2000 to 2010. We were only able to use RPT data of Korean public firms that happened to announce their RPTs. However, the limited period of disclosure of RPTs data is the main cause for these sample restrictions. If equipped with more samples, it will be possible to identify associations of various aspects of RPTs and their effects on firm's innate characteristics. Second, we did not explore other meaningful aspects of RPTs and R&D expenditures. Other associations between RPTs and R&D expenditures and various conditions exist, such as when affiliated firms are in competitive markets or when customer appetite or technologies change fast. Firms in such conditions may show different R&D behaviors, resulting in differential firm values. It may be informative to test the associations between RPTs, R&D expenditures, and specific market conditions where firms with high RPT ratio are players in monopolistic or oligopoly markets. We expect that research would explore these issues in the near future. It is also worthwhile to evaluate the impact of RPTs on other innovative outputs, such as citation weighted patents [56], as more convincing measure to explain the role of RPTs on the expanded innovation activities besides R&D. Lastly, using samples that represent longer period samples, future research may examine how high RPT ratio firms adapt themselves to the changes in advanced technology, customers' preferences, and market trends. We may expect that firms with severe dependence on RPTs are less agile in those transitions, thus resulting in deteriorating financial performances.

Author Contributions: Sangil Kim and Jungmin Yoo configured the original research topic based on their lingering concerns over heavy dependencies on related party transactions of Korean affiliated firms; Sangil Kim analyzed the data and designed research models; and Jungmin Yoo extensively reviewed prior studies and constructed the reasoning of our hypotheses. The authors co-wrote and revised the manuscript, and then confirmed the final submission.

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