Three Essays on Applied Economics and Finance

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by

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The undersigned, appointed by the Dean of the Graduate School, have examined the dissertation entitled

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presented by Hyeonjin Im,

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and hereby certify that, in their opinion, it is worthy of acceptance.

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Contents

List of Tables

List of Figures

Three Essays on Applied Economics and Finance

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ABSTRACT

This dissertation empirically analyzes the financial decision-making of private and public corporations. It comprises four main chapters. The second and third chapters examine how private agents respond to fiscal policies regarding taxes and government investment. The fourth chapter explores public institutional investors' risk management and investment strategies. The final chapter presents the conclusion.

Chapter 2 focuses on capital structure and corporate tax. The motivation for Chapter 2 is to investigate whether tax policy affects the capital structure of Korean firms, which have a distinctive corporate structure in terms of a family-oriented conglomerate. We postulate that firms' responses to tax changes may differ depending on the country-specific corporate structure in Korea, even if corporate tax affects the cost of debt financing. Our findings support that corporate structure in terms of Korean conglomerates matters in debt financing. Using difference-in-differences and difference-in-difference-in-difference, we find that the effect of a tax cut on a firm's debt usage supports the trade-off theory, but the response to a tax rise does not vary based on corporate structure.

In Chapter 3, I examine how government ownership is associated with firms' valuations and performances. As investors and blockholders in firms, government ownership can inefficiently affect firms' performance due to government political influence rather than profit-seeking. However, government ownership can benefit the firm by reduc-

ing resource constraints. The aim of Chapter 3 is to determine whether government ownership always leads to inefficient results using Korean firm data. I provide evidence that government ownership is associated with higher market-oriented values for government-owned firms compared to non-owned firms, and the effect has a non-linear relationship. While the activism of public agents does not provide better monitoring and valuation of firms, I suggest that even if the benefit of government ownership outweighs the cost, the activism of public agents crowds out the private agents' activity.

In Chapter 4, I investigate the factors that lead to different investment behaviors between public institutional investors based on the Public Pension Funds (PPFs) data of OECD countries. Although all financial investors aim to maximize investment profits, PPFs are established for public welfare. The objective of Chapter 4 is to study the main factors that lead to similar and different investment decisions of PPFs compared to other private institutional investors based on modern portfolio theory and behavioral finance. I demonstrate partial acceptance of the risk transfer hypothesis and the effect of institutional conditions on PPF operations. I find no short-term performance persistence as a formulated management practice and accept the efficient market hypothesis in performance. Based on the switched signs of the interaction effect of cultural values and financial factors on risk-taking, I suggest that asset allocation depends on the degree of risk among specific assets conditional on institutional conditions.

Chapter 1

Introduction

Many researchers agree that not only governance structures but also financial components do matter in finance and business. This is why empirical finance literature mainly focuses on corporate finance and governance. Financial factors among corporate may have a similar or symmetric effect on a corporate decision-making process, such as tax avoidance, capital structure, investment, etc. But each corporation faces different valid constraints such as regions, culture, and laws within countries. Even if financial components impact the corporate decision homogeneously, those factors can have a heterogeneous effect because of countries' specific social and governance components. This is why country-specific institutional conditions are essential in determining or changing corporate performance among countries.

Due to country-specific factors, the possibilities of asymmetric effects of financial components among countries make this research study the relationship between firm behaviors and country-specific governance and social components. This leads to the following research question: How do financial components and countries' specific business conditions influence the performance and decisions of the firm? The first study suggests an event study of capital structure in Korea for this research. Modigliani and Miller (1958) [105] address that firm has the incentive to change their leverage ratio as a tax shield. Based on the MM theory, firms' responses for leverage only rely

on financial components and tax rates. Even if Modigliani and Miller study the financial aspects, firms' responses can differ because of countries' specific corporate structures. As Korea is one of the successful small open economies in Asia, the capital structure of firms in Korea can give a chance to study how different business conditions and corporate governance structures affect firms' financial decision-making.

For investigating aspects of governance structure, the second research paper focuses on the effect of government ownership in firms. Asia countries have more vertical governance structures than Westen countries. Even if Shleifer and Vishny (1998) [135] describe government influence as a source of inefficiencies, government ownership may not necessarily have positive effects on performance. Due to positive role of government in terms of soft budget hypothesis, other researchers argue that government ownership can give a chance to use the scarcity of resources within countries. This positive effect makes firms use government ownership to increase their profits. Based on two different arguments for studying the government's effect on the private sector, the second research studies how government investment in the private sector relates to firms' performance in Korea.

The last research is the factors that make different investment behaviors between public institutional investors. Financial literature provides empirical evidence that each institutional investor can have different investment decision-making processes due to different governance structures, sources of funds, and specific social factors. For example, Public Pension Fund (PPF), compared to other private institutions, might not have similar investment attitudes and strategies because PPF was established for social goals rather than private interest. The third research uses institutional Hofstede's cultural factors and financial variables, such as past performance, funding status, and asset portfolio, to consider the effect of financial factors and countries' specific social norms. I provide overall PPF investment behaviors conditional on financial factors and also explore cross countries'

variations using institutional conditions. Also, I will provide empirical evidence to support the association between behavioral finance and modern portfolio theory using cultural dimension as the set of shared beliefs.

To sum up, this thesis covers two primary research goals. One is corporate finance with specific countries' components, and the other is the governance aspect. For the first research, this thesis focuses on capital structure in Korea in Chapter 2. In addition, the governance aspect of private and public corporations. For private corporate, in Chapter 3, I explore how government ownership affects a firm's performance and shows the benefit and cost of government ownership. For the last study, I explore how financial components and countries' institutional conditions of public pensions affect their performance as well as assets composition. Because this thesis presents research in the fields of empirical finance and governance of private and public sectors, this thesis is to explain how countries' specific governance and institutional condition and financial factors influence the performances of private and public sectors.

Chapter 2

Corporate structure and asymmetric impacts of corporate tax on capital structure

2.1 Introduction

What influences corporate capital decision-making? In spite of plenty of research on this inquiry, it remains a central issue in corporate finance. The main theory for this question is Capital Structure Theory (Modigliani and Miller, 1958, 1965 [105,106]) which proposes that corporate tax rates impact firm's capital structure decision. Because debt gives a tax advantage when interest expenses are able to be deducted from taxable income, firms use more debt for increasing their value when corporate tax rises. Theoretically, firms would exploit debt as they can without market inefficiency, transaction costs, and asymmetric information. Imperfect market systems allow firms to choose an optimal capital structure by considering trades off between the marginal costs and benefits of debt.

The aim of this research is to provide some puzzling evidence for the traditional trade-off theory. Because ownership structure within business groups, in our case conglomerate, can lead to heterogeneity in capital structure. Nicodano and Regis (2019) [114] suggest that capital structure in the

firm not only depends on tax but ownership structure within business groups because of the trade-off between tax burden and default costs within business groups. Because Koran business groups as conglomerates have distinctive ownership structures, intercorporate links allow this study to investigate the joint design of debt and ownership structure. Based on the link business groups and tax, the research question is, "Are Korean firms consistent with the traditional trade-off conditional on changes in tax?". We consider tax policies and Korean conglomerates to investigate the trade-off theory in Korea.

While trade-off theory suggests that tax rates play an important role in debt choice of corporate, there are difficulties for estimating the effect of tax rates on a firm's leverage ratio empirically. The standard capital structure theory shows corporate income tax is a major factor in determining debt ratios, but personal income tax rates from stocks and bonds also can affect the capital structure, as can other confounding factors. Previous studies have mainly investigated the relationship between marginal or effective corporate tax rates and leverage simultaneously. Empirically identifying the simultaneous relation between tax rates and leverage is challenging due to a variety of problems of endogeneity and measurement issues. Lin and Flannery (2013) [94] and Wu and Yue (2009) [145] argue that while studies by Scholes et al. 1990 [129], Graham 1996, 1999 [59, 60], and Givoly et al. 1992 [56] find an effect of taxes on capital structure, these studies are not free from other events that possibly impact on firm's capital structure. Devereux, Maffini, and Xing (2018) [43] point out the measurement errors of tax rates, arguing that studies using simple tax rates might lead to a biased estimated tax effect on capital structure.

An alternative explanation of debt ratios is the role of borrowing constraints. Not all firms may use extra debt for their capital structure. Market frictions such as information asymmetry and investment distortion can prevent firms from using further debt when taxes are changed. Because

borrowing constraints should rely on firm characteristics, it is important to identify and control for such firm-specific characteristics. Consequently, it is important when studying capital structure to account for firm-specific constraints and capacity for leverage as well as identifying reliable tax rates.

Rajan and Zingales (1995) [122] indicate that most studies of capital structure often focus on data from the United States. By comparison, applied capital structure theories to other countries are relatively under-explored. Because emerging markets or newly developed countries may have different financing and business conditions than developed countries, studies of capital structure based on the U.S may be different than studies focused on Asia or developing countries. More specifically, developing countries face a more restricted supply of financing sources generally. Therefore, even when firms have an incentive of adjusting leverage under changes in corporate tax rates, the adjustment of leverage may not be similar to the U.S given particular business and financial conditions within developing countries.

For exploring the finding of Rajan and Zingales (1995) [122], Chapter 2 focuses on tax policies in South Korea. South Korea is a newly developed country with a relatively small open economy. This study offers a good case study for investigating the role of tax- and country-specific conditions on capital structure. The South Korean government changed corporate tax rates two times from 2010 to 2020, as shown in Table 2.1.

Table 2.1: Tax Baskets.

From 2018 to Current	Tax base (KRW)	Tax rates
Corporate	0 to 200 million	10%
	200 million to 20 billion	20%
	20 billion to 30 billion	22%
	above 30 billion	25%
From 2012 to 2017	Tax base	Tax rates
Corporate	0 to 200 million	10%
	200 million to 20 billion	20%
	above 20 billion	22%
From 2010 to 2011	Tax base	Tax rates
Corporate	0 to 200 million	10%
	above 200 million	22%

Notes: This table shows the statutory marginal tax rates for different corporate income from 2010 to 2020 in the Korea. In the fiscal years 2012 and 2018 the statutory marginal tax rates had been changed. In 2012, firms in tax brackets 200 million-20 billion face tax cut from 22% to 20% and in 2018, firms in tax brackets above 30 billion receive tax rise from 22% to 25%.

There were two different types of changes in corporate income tax rates, a tax cut in 2012 and tax increase in 2018. Having changes in both directions allow this research to shed light on the response of leverage rates when tax rates rise and are cut. Because firms may face an exogenous changes in the corporate income tax rate as a natural event, our study can provide suitable empirical evidences for comparing previous findings about the effect of corporate income tax on leverage.

We in the Chapter 2 provide a particularly good research case in terms of two points. First, as a newly developed and small open-economy country, South Korea faces different aspects of a firm's financing and business conditions compared to the U.S. and other developed countries. Most previous studies on capital structure use data from the United States or European countries. Wu and Yue (2009) [145] note that firms in emerging markets such as China, or in our case South Korea, have limited financial sources because of less-developed financial markets than in developed countries. Because of these different financial constraints between countries, the use of debt as a tax shield in emerging markets might be different than in developed countries. Thus, the study in Chapter 2 can contribute empirical evidence to applied capital structure for emerging markets and newly developed countries.

The second point is that the Chapter 2 considers a unique corporate structure. South Korea has distinctive conglomerates owned by individuals or their families.[1] Because conglomerate ownership is concentrated in a specific person and family group, owners may directly manage or control several affiliate firms operating in various markets. Earlier studies found South Korean conglomerates used internal capital sources within business groups in ways that led to different debt usage among member firms. Specifically, firms within business groups had higher leverage than other firms, but had lower external leverage. The Korean government has since acted to prevent intra-group equity investment

[1]These types of conglomerates have somtimes been called *chaebols* in earlier studies. In 2002 the South Korean government adopted the terms "conglomerate" or "large business group" as alternate legal terms instead of *chaebol* to describe these structures when it amended the Act in Monopoly Regulations. Th Act addresses such issues as cross-shareholding, equity investment, and guarantee for affiliates' debt for conglomerates (large business groups). Therefore we use conglomerates rather than *chaebols* throughout the paper.

and debt grantees. Lee et al. (2009) [90] point out that (*chaebols'*) internal cash flows (i.e., cash flow of all other group-affiliated firms) did affect firms' investments before the 1997 financial crisis, but not after the crisis. Lee et al. (2009) also show that the government's regulation on firms' capital structures after the crisis deterred conglomerates' use of internal capital sources, encouraging use of public debt markets as an alternative source of capital. However, despite restrictions on the use of internal capital markets, conglomerate-member firms may still have different constraints on their ability to access public debt markets given their family ownership. As a result, a family oriented-conglomerate in South Korea may have different incentives to use debt for increasing a firm's valuation when corporate tax rates change compared to non-conglomerate firms. This study in the Chapter 2 can shed light on whether the impact of corporate tax on capital structure depends on such different corporate structures and business conditions within countries.

Our research is also related to the debate about which trade-off model is better for explaining a firm's capital structure choices; the static or dynamic capital structure. We contribute to this debate by combining a difference-in-difference approach to the static and dynamic trade-off theories to evaluate whether the estimated effects of tax changes on leverage are different. Results of the difference-in-difference, which exploits two different changes in corporate income tax rates in South Korea over the period 2010-2020, show that taxes do affect capital structure choices. Firms decrease long-term leverage by around a 1.8 percentage points regardless of a tax cut. When tax goes up, on the other hand, only firms in large business groups increase their leverage. The heterogeneous results of tax policies support that impact of tax policies on leverage is conditional on corporate structure. The sign of the effect of tax cut on leverage is the same in the static and dynamic models, and its magnitude is larger in the dynamic model. The impacts of tax rise, however, are identical to the trade off theory in the dynamic model, but different in the static model.

To understand why our findings show heterogeneous effects of a tax rise, consider first what happens following a tax increase. At the firm's recent debt level, the marginal tax benefit now is below the marginal default cost and so firm reduces leverage. However, conglomerate shareholders will be more likely to consent debt issue because not only conglomerate is regulated on internal financial usage but also firms belonged to conglomerate have stronger financial capacity to absorb default risk than non-conglomerate firms. This finding supports the idea that corporate structure can create different financial constraints on firms' usage patterns of additional debt. An alternative explanation is that the heterogeneity of effects on debt in the case of a tax increase depends on the shape of the marginal cost curve. Because conglomerate and non-conglomerate firms have different marginal cost curves, the responses of firms can be different in the tax rise. But, this alternative argument is not supported by the same behavior from a tax cut. The heterogeneous response to a tax increase exhibits the effect of financial and business constraints on firm's debt usage in South Korea.

The central assumption to a causal interpretation of difference-in-difference estimates is that treatment and control firms share parallel trends. All tests show that their pre-treatment trends are indeed indistinguishable. The other question, as in any difference-in-difference set-up, is whether post-treatment trends would have continued to be parallel had it not been for the tax change. Our empirical design takes several steps to mitigate these concerns.

The Chapter 2 proceeds as follows: Section 2 reviews related literature and Section 3 discusses our identification strategy and data. Section 4 reports our main results and robustness checks. Section 5 concludes this paper.

2.2 Related literature

Many empirical studies investigate the effects of corporate tax rates on firms' capital structures. Since Modigliani and Miller (1958) [105] studies have explored the implications of the traditional view of capital structure: the static trade-off model shows that firms form an optimal leverage target based on costs and benefits of debt. Myers (1977) [110] points out that static trade-off stories pay less attention to adjustment costs of debt. A single-period capital structure model ignores the firm's optimal capital reconstructing choices in response to fluctuation in asset values over time (Fischer, Heinkel, and Zechner, 1989 [50]). Based on these two points of capital structure, this section first reviews two open-ended debates, whether taxes are a first-order determinant of firms' capital structure choices and which model is better for describing how leverage is chosen, and then reviews other issues.

Graham and Leary (2011) [62] provide a broad review of the empirical evidence regarding trade-off models of the capital structure. Overall, trade-off models have shown an unsatisfying fit to the data. A major concerning rarity of fit is the capital structure puzzle. More recent studies, nevertheless, are more successful in detecting the tax effects. Rajan and Zingales (1995) [122] find that firms in countries with higher corporate tax rates increase debt usage. Booth et al. (2001) [18] discover a positive relation between country-level tax rates and averages of leverage. Similarly, Faccio and Xu (2015) [47] find that a firm's leverage increases on average when the firm faces higher income tax rates in OECD countries that change the top corporate income tax rate. Heider and Ljungqvist (2015) [69] employ variation in state-level corporate income tax rates in the United States and show that one percentage point increase in the state-level corporate income tax rate is associated with 0.38 percentage point increase in corporate leverage. Doidge and Dyck (2015) [46] investigate the effects on corporate policies when corporate tax was imposed on Canadian trusts in 2006, and find

that trusts increased leverage following the changed tax. Devereux, Maffinia, and Xing (2018) [43] use a large sample of UK firms, and they find a positive and substantial long-run tax effect on leverage. Leverage responds more to decreases in the marginal tax rate, and it responds to changes in the marginal rather than the average tax rate. Even if those studies show that capital structure is impacted by taxes as the trade-off theory suggests, it keeps a question whether measurement errors in tax incentives lead to underestimation of the true tax effect on corporate leverage and whether specific corporate structures lead to different debt financing patterns in response to changed tax rates.

On the other hand, using long time periods, Graham et al. (2014) [63] find little statistical association between the statutory corporate tax rates and leverage of unregulated industrial firms in the U.S. MacKie-Mason (1990) [96] states that the reason why studies fail to find plausible or significant tax effects on corporate structure is that leverage ratio are the collective result of years of separate decisions and tax shields have a negligible effect on firms' capital structures. As Fama and French (2002) [48] caution, early approaches on the traditional capital structure are disposed to endogeneity biases because a firm's marginal and effective tax rate may correlate with omitted variables. This is the fact that higher profits locate firms into a higher tax bracket, and high-profit firms may enjoy more advantage of tax shields. But it is equally possible that high-profit firms can use more debt because their cost of debt is lower than that of low-profit firms. Similar points led Myers (1984) [111] to comment that "I know of no study clearly demonstrating that a firm's tax status has predictable, material effects on its debt policy".

Several analytic methods have developed in corporate finance research (e.g., dynamic structure modeling and quasi-experimentation). Even if new approaches provide novel insights, how firms respond to tax changes allows us to consider whether the static or dynamic trade-off models better

explain capital structure decisions. Inevitably both have some form of limitation because of dynamic panel bias, endogeneity, empirical model misspecification, and other potential corporate data issues (whether separately or in combination). However, there is no logical reason to dismiss any given research stream since every method can provide valuable insight in spite of their relevant drawbacks (Hennessy, 2013 [70]). Recent advances in corporate finance research, such as dynamic structure modeling and natural experiments, can mitigate endogeneity and causal inference problems. Most of the previous research focused on a one-sided trade-off model. Exogenous shocks-based studies (MacKie-Mason and Gordon 1994 [97], Givoly et al. 1992 [56], and van Binsbergen, Graham, and Yang, 2010 [140]) find that tax shocks affect debt policies. Other studies (Fama and French, 2002 [48], Flannery and Rangan, 2006 [51] Graham and Leary, 2011 [62], Wintoki et al., 2012 [143], Flannery and Hankins, 2013 [52], Devereux, Maffini, and Xing, 2018 [43]) show dynamic models have good explanatory power for firms' leverage adjustments to target their leverage ratios. There is a novel study which considers both aspects. Lin and Flannery (2013) [94] exploit a difference-in-differences method to identify the effect of personal tax on firms' leverage. They also incorporate the treatment effect of the 2003 tax cut into the partial adjustment, and find tax cut reduces leverage ratio.

Another issue of the static and dynamic trade-off model is when a firm's leverage responds to tax changes. A standard difference-in-difference and general dynamic model assume the firm's leverage responds to current tax changes. Especially, difference-in-difference does not allow pre-trends. Since difference-in-difference compares between treated and control firms that match the tax change, the timing of leverage response to the tax rate matters. Heider and Ljungqvist (2015) [69] find delayed firms' adjustments of their leverage in year $t+1$ when tax goes up in year t. On the other hand, firms do not change their leverage in tax cut periods. To resolve this problem, Heider and Ljungqvist (2015) [69] use the first-differencing treatment model, and show that tax rise increases leverage.

Devereux, Maffini, and Xing (2018) [43] show that in a partial adjustment model tax rates can be persistent. They use lags of tax rate to investigate firms' responses on lags and current tax changes, and find firms attune their leverage to current tax rate as well as lagged tax rates. Based on those studies, this study considers the timing when firm's leverage responds to the changes in tax rates.

Beyond the tax rate effect, the other issue is the relation between corporate structure and financial decisions. In most advanced and emerging economies, commonly, the firm has concentrated ownership. If firms are controlled by an individual, a group of individuals, or a family, the structures are known as conglomerates. Conglomerates are characterized by the common ownership of a group of firms and have complex mechanisms, including pyramid schemes, cross-holdings, and dual-class shares. Because of this corporate structure of conglomerates, there are two views about the pros and cons of the conglomerate. Especially two views are about how capital is allocated within the firm if the firm is in a conglomerate. Stein (1997) [130] suggests that conglomerates may outperform external capital markets by using centralized control over the capital allocation process. On the other hand, Rajan et al. (2000) [121] and Scharfstein and Stein (2000) [128] argue that the resource allocation of firms in the conglomerate is distorted because resources will be allocated to the weaker.

In the recent studies, Buchuk et al. (2014) [27] show that firms have higher leverage, investment, and returns on equity than other firms in Chile when firms can use business groups' internal capital market. Also, they find that the firms which have intra-group investment increase leverage and use lower external leverage than other firms. Almeida et al. (2015) [3] explore capital reallocation among firms in Korean business groups during 1997 crisis and show conglomerates used internal cash from low-growth to high-growth firms within groups, using cross-firm equity investment for mitigating effects of the Asian crisis on investment. Lee et al. (2009) [90] show that internal capital markets within Korean conglomerate business groups slacken the financial restrictions of the group-affiliated

firms, making them allocate capital efficiently within business groups before 1997 crisis. However, the government's regulation on firms' capital structure within business groups encourage Korean conglomerate to abate the usage of internal capital market and to utilize external capital markets *ex-post* crisis. Those studies support the idea that corporate structure can affect leverage in response to the changes in tax rates. However, those studies predate the Korean government's intervention to restrict the use of internal capital markets among conglomerate groups. We contribute to these papers by showing that, even with restrictions on the use of internal capital markets, conglomerates may exercise different debt choices compared to non-conglomerate firms in response to the changes in tax rates. Even though firms belonging to Korean business groups face additional restrictions, they occupy a dominant position in the market and have much better financial strength. Accordingly, Korean corporate structure might still play a role in different pattern of debt usage in response to tax.

Our study differs from the above studies in various notable ways. First, we concentrate on the relatively simple tax cut in 2012 and tax increase in 2018 to test whether corporate taxes affect leverage. Second, we use the difference-in-differences methodology, which is well-suited to investigate shock-based impact of corporate tax cut and increase on firms' leverage ratios. Third, we exploit various dynamic models (OLS, first-difference, and GMM) in the difference-in-difference, which clearly illustrates how corporate taxes impact optimal leverage ratios. Fourth, our study considers country-specific corporate structure for exploring heterogeneous effects of tax rate changes on leverage. Lastly, for robustness, we use alternative taxes (marginal statutory and effective tax rates) and leverages (market leverage, real long-term debt, and debt-to-equity), and find consistent results.

2.3 Sample construction and Identification strategy

2.3.1 Sample construction

We utilize a sample obtained by Korea's Corporate Information Solution (KOCOinfo) and Data Analysis, Retrieval and Transfer System (DART). KOCOinfo and DART are constructed in order to provide the management information, financial data, and stock information of businesses listed on the Korea Exchange (KRX) which contains all public traded firms in South Korea. This paper employs firms' data listed on KOSPI (The Korea Composite Stock Price Index) and KOSDAQ (The Korea Securities Dealers Automated Quotations) in KRX. KOSPI is the main stock market index of Korea. As with the S&P 500 in the U.S, it is made up of the performance of major firms based on the KRX,and KOSDAQ is similar to NASDAQ. The selected sample covers the period from 2010 to 2020.

Table 2.2: Sample construction.

From 2010 to 2020	Observation (%)	KOSPI(%)	KOSDAQ(%)
All public traded firms	19709 (100%)	7791 (100%)	11918 (100%)
Exclude financial industry	18885 (95.8%)	7245 (92.9%)	11640 (97.6%)
Exclude utility industry	18760 (95.1%)	7131 (91.5%)	11629 (97.5%)
Year			
2010	1369	580	789
2011	1443	601	842
2012	1471	610	861
2013	1517	619	898
2014	1582	626	956
2015	1696	644	1052
2016	1770	659	1111
2017	1853	678	1175
2018	1949	695	1254
2019	2028	707	1321
2020	2082	712	1370

Notes: This table reports sample construction. Data source is from the Korea Company Information (KOCOInfo) and DART (Data Analysis,Retrieval and Transfer System). Sample includes all public traded firms (KOSPI and KOSDAQ) in the Korea.

Table 2.2 provides a description of the sample composition. The sample includes only firms that were traded as of the last trading day of 2020, resulting in a sample of 19,709 firm-year observations. Of those, 7,791 firms-year observation are from KOSPI and 11,918 from KOSDAQ. We exclude 824 financial and utility firms from the sample because firms in the financial industry have different financial characteristics and firms in the utilities sector are highly regulated. The result is a sample of 18,760 firm-years of observations. Table 2.3 describes industrial distribution of firms overall and

between years. The percent of firms overall and between industries is almost same. Distribution in Table 2.3 shows that the main sector is manufacturing (66.06%), and next is information (11.40%) in South Korea.

Table 2.3: The distribution of public traded firms.

Industry	Overall Frequency	%	Between Frequency	%
Accommodation and food service	44	0.23	5	0.24
Agriculture, forestry and fishing	57	0.30	6	0.29
Arts, sports and recreation services	94	0.50	10	0.48
Business facilities management	172	0.92	18	0.86
Construction	548	2.92	53	2.52
Disposal activities and material recovery	74	0.39	7	0.33
Education	107	0.57	12	0.57
Information and communication	2139	11.40	254	12.07
Manufacturing	12392	66.06	1398	66.44
Mining and Quarrying	22	0.12	2	0.10
Professional, scientific and technical activities	1205	6.42	145	6.89
Real estate	19	0.10	3	0.14
Transportation and storage	289	1.54	30	1.43
Wholesale and retail trade	1587	8.46	160	7.60
Other personal services	11	0.06	1	0.05
Total	18760	100.00	2104	100.00

Notes: This table describes distribution of public traded firms overall and between industries in the Korea. SIC2 code is defined by the Korea standard industry classification(KSIC).

This study considers South Korea's unique corporate structure of family-owned conglomerates. South Korean conglomerates have several unique characteristics compared to conglomerates in other countries. First, compared to conglomerates in the U.S., the Korean conglomerate has several diversified affiliates and subsidiaries, and have prevailing market power in Korea. For example, based on the Korea Fair Trade Commission (KFTC) 2019 report, the top 10 (top 50) business groups' market share of manufacturing industry sales was 24.7 (41.6)%. This supports that conglomerates in Korea have a huge impact on the Korean economy. Second, conglomerate in South Korea not only occupy a dominant position in Korean market but are effectively controlled by a few families or individuals. Because of a few family-orientated ownership structures, the owner-manager can directly control whole business groups. This distinctive ownership structure in Korea allows the owner-manager to reallocate resources and capital within the conglomerate more easily than in other countries. It may also provide the owner-manger more connections and opportunities for

accessing external resources, since suppliers serving one member firm may have incentive to provide favorable terms to gain business with other member firms, including suppliers of capital. So even if famliy orientated conglomerates face government restrictions on their use of internal capital markets, firms belonging to conglomerates have different incentive and access to debt financing compared to non-conglomerate. This changed corporate financial policy due to specific corporate structure in South Korea may lead to different responses to tax policy from the theories of capital structure.

To control for the distinctive nature of a family controlled conglomerate in Korea, we use data

Table 2.4: Distribution of conglomerate and non-conglomerate by the fiscal years.

	Frequency of firms		
Year	Non-Conglomerate	Conglomerate	Ratios
2010	1,226	143	11.6
2011	1,287	156	12.1
2012	1,301	170	13.0
2013	1,337	180	13.4
2014	1,409	173	12.2
2015	1,517	179	11.7
2016	1,584	186	11.7
2017	1,652	201	13.0
2018	1,724	225	13.0
2019	1,810	218	12.0
2020	1,871	211	11.3
Total	16718	2042	12.2

Notes: This table reports the number of public traded firms from 2010 to 2020 in the Korea. Column 2 shows the number of non-conglomerate and Column 3 shows conglomerate. This table uses the classification criteria of Conglomerate defined by the Korea Fair Trade Commission (KFTC).

from the Korea Fair Trade Commission (KFTC). The KFTC uses the label "enterprise group" to mean a group of companies that is substantially controlled by the same person according to the following criteria, pursuant to the standards prescribed by Presidential Decree[2]; (a) where the same person is a company, a group composed of such person and one or more companies controlled by her or him, (b) where the same person is not a company, a group composed of two or more companies controlled by her or him. The scope of business groups is defined as a company in which the same person, acting alone or together with any of the following persons or entities (hereinafter referred to as "person related to the same person"), holds at least 30% of the total number of shares issued by that company as the largest investor of that company[3]. Based on these criteria, the business group

[2]Article 2 of the Act in Monopoly Regulation and Fair Trade Act from the Government Legislation in the Korea

[3]Article 3 of Act in Enforcement Decree of the Monopoly Regulation and Fair-Trade Act from the Government Legislation in the Korea

Table 2.5: The distribution of conglomerate and non-conglomerate firms in the Korea industry.

Industry: Conglomerate	Overall Frequency	%	Between Frequency	%
Accommodation and food service	11	0.54	1	0.36
Agriculture, forestry and fishing	4	0.20	1	0.36
Arts, sports and recreation services	20	0.98	2	0.73
Business facilities management	31	1.52	3	1.09
Construction	162	7.93	18	6.55
Education	15	0.73	2	0.73
Information and communication	201	9.84	33	12.00
Manufacturing	982	48.09	134	48.73
Professional, scientific and technical activities	236	11.56	32	11.64
Real estate	7	0.34	2	0.73
Transportation and storage	114	5.58	15	5.45
Wholesale and retail trade	256	12.54	31	11.27
Other personal services	3	0.15	1	0.36
Total	2042	100.00	275	100.00
Industry:Non-Conglomerate	Overall Frequency	%	Between Frequency	%
Accommodation and food service	33	0.20	4	0.20
Agriculture, forestry and fishing	53	0.32	6	0.31
Arts, sports and recreation services	74	0.44	9	0.46
Business facilities management	141	0.84	15	0.77
Construction	386	2.31	41	2.09
Disposal activities and material recovery	74	0.44	7	0.36
Education	92	0.55	11	0.56
Information and communication	1938	11.59	239	12.21
Manufacturing	11410	68.25	1331	67.98
Mining and quarrying	22	0.13	2	0.10
Professional, scientific and technical activities	969	5.79	128	6.54
Real estate	12	0.07	2	0.10
Transportation and storage	175	1.05	20	1.02
Wholesale and retail trade	1331	7.96	142	7.25
Other personal services	8	0.05	1	0.05
Total	16718	100.00	1958	100.00

Notes: This table indicates the distribution of conglomerate and non-conglomerate public traded firms overall and between industries in the Korea.

is reported by the KFTC each year.

Table 2.4 shows that the number of conglomerate and non-conglomerate firms from 2010 to 2020. The number of firms in both increases, but the ratio is almost stable around 12%. Table 2.5 indicates industrial distributions of conglomerate and non-conglomerate firms in Korea. The distribution patterns between conglomerate and non-conglomerate are very similar. The top four industries, based on the number of firms, are the same in both groups: first rank is the manufacturing sector, second is information, third is retail, and fourth is scientific activities.

Table 2.6 shows summary statistics of the study variables for the sample firm-year observations. Table 7 indicates separated summary statistics for sample firm-year observations by conglomerate and non-conglomerate. Sample average of book leverage is 11% in Table 6, and Table 2.7 shows average of book leverage is 18.1% for conglomerate and 10.2% for non-conglomerate. Based on assets value in KRW, the mean of total sample is 170.1 in 10 billion in Table 2.6. Table 2.7 shows

Table 2.6: Summary statistics of variables.

VARIABLES	Observation	Mean	SD	Median	Min	Max
Firm leverage						
Long term book leverage	14,516	11.16	10.14	8.303	0	90.59
Long term market leverage	14,446	0.532	0.296	0.574	0	0.998
Long term real debt (10 Billion KRW)	14,516	5.156	2.213	4.986	0	13.46
Firm Characteristics						
Size (Total assets (10Billion KRW))	14,516	170.1	1,067	19.06	0.601	37,824
Tangibility	14,516	0.497	0.177	0.498	0.005	0.983
MTB (Market to book ratio)	14,446	1.73 6	2.699	1.085	0.000	136.55
OCF	14,461	3.933	8.027	4.380	-160.7	62.33
Conglomerate	18,760	0.109	0.311	0	0	1
Tax rate						
Marginal statutory tax	14,516	0.147	0.096	0.20	0	0.25
Zero effective tax before deduction	14,091	0.139	0.093	0.196	0	0.249

Notes: This table presents sample statistics of our dependent variables and controls for firm in sample, which consists of 2104 firms and 18760 observations. Definition of these key variables are provided in Table A1.1. Taxable income is zero if paid tax is negative. After considering loss-making firms, marginal statutory tax and zero effective tax B are computed for sample statistics.

conglomerates holds 1,077.9 assets in 10 billion, on the other hand, non-conglomerate has 42.5 assets in 10 billion. Conglomerate owns 25 times more assets than non-conglomerate. This difference is almost same in tangible assets (595.7 in 10 billion for conglomerate and 21.9 in 10 billion for non-conglomerate in Table 2.7.) as well. Tax rate is also different. Table 2.6 shows effective (statutory) tax and are 14.7%(13.9%) on average, and Table 2.7 describes that effective tax rate (Marginal statutory tax rate) for conglomerate is 17.1% (17.8%) and for non-conglomerate is 13.5% (14.2%). The interest of this paper is the capital allocation of overall firms and response of the conglomerate firms.

Lee et al. (2009) [90] and Shin and Park (1999) [132] show that conglomerates in South Korea not only use debt from external capital market but from internal capital market from affiliated firms during and before 1997 financial crisis. Due to regulation on internal capital sources from affiliated firms, the firms within conglomerates depend more on their own financial abilities than the others for exploiting external capital market, and this different condition can lead disparate debt financing among firms. The descriptive statistics in Table 2.6 and 2.7 support that, on average, the industrial conglomerate has better financial abilities than non-conglomerate. Therefore, we expect that these different firms' characteristics and financial constraint between the firms in conglomerate and non-conglomerate would result in different capital structure decisions.

Table 2.7: Separated summary statistics for conglomerate and non-conglomerate.

	Non-Conglomerate		Conglomerate	
VARIABLES	Observation	Mean	Observation	Mean
longdebt	12,727	10.17	1,789	18.17
Total assets (10 Billion KRW)	12,727	42.54	1,789	1077.8
Assetsgrowth	12,685	9.354	1,776	8.077
Sales (10 Billion KRW)	12,727	36.01	1,789	857.4
Salesgrowth	12,685	9.996	1,776	8.222
Tangible assets (10 Billion KRW)	12,727	21.97	1,789	595.7
Tangibility	12,727	0.488	1,789	0.559
MTB	12,657	1.793	1,789	1.337
OCF	12,685	3.726	1,776	5.405
Marginal statutory tax	12,727	0.142	1,789	0.178
Zero effective tax before deduction	12,433	0.135	1,658	0.171

Notes: This table presents sample statistics of our dependent variables and controls for conglomerate and non-conglomerate in sample, which consists of 2104 firms and 18760 observations.

2.3.2 Identification strategy

Based on the discussion in previous sections, we use a difference-in-difference framework for identification. Our research focuses on firm's leverage ratio in response to the 2012 tax cut and to the 2018 tax increase. The main estimable model for the static trade-off theory as follows

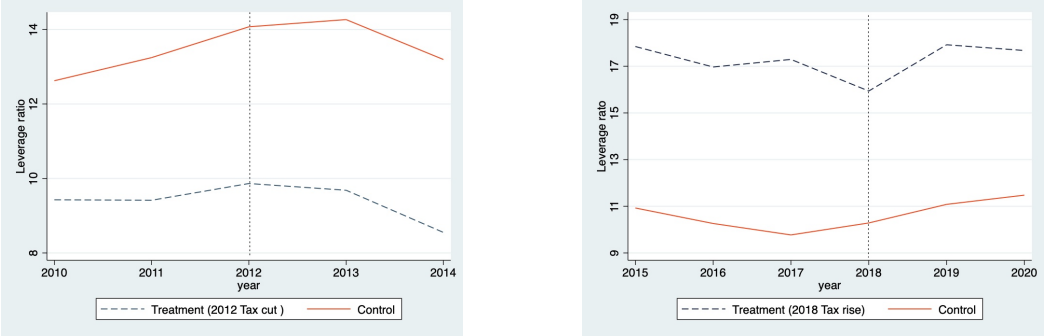
$$Blev_{it} = \delta Post_t \times Treat_{it} + Post_t + Treat_{it} + \beta X_{it} + \tau_i + t_t + \epsilon_{it} \tag{2.1}$$

where $Blev_{it}$ is the leverage ratio of firm i in year, $Treat_{it} \times Post_t$ is the effect of treatment groups after changed tax policies, $treat_{it}$ is dummy variables for firm $i's$ treatment status in 2012 and 2018, $Post_t$ is time trend dummy for tax policies, and X_{it} includes firm's financial characteristics such as size, tangibility, MTB, OCFratio, and conglomerate. τ captures an unobserved firm-specific fixed effect, t_t is a time effect, and the last term ϵ_{it} is error term.

Figures 1 presents the time-series of leverage ratio of treatments and controls for tax cut and tax increase periods, respectively. There was a slight decline in treatment group leverage after the 2012 tax cut, and a clear increase in treatment group leverage after the 2018 tax increase. Those two different changes in leverage ratios are consistent with the theory that the reduction in tax makes firms decrease their debt usage and the rise in tax induces firms to expand their debt. This simple analogy of firms' debt levels before and after tax policies can fail to take into account confounding

effects. Even if debt ratios decreased after the tax cut and increased after tax rise, those changes in leverage consistent with theory could be because of other potential events or factors.

Figure 2.1: Mean book leverage 2009-2020 for Treatment and Control groups.



(a) Tax cut

(b) Tax rise

As discussed in the previous section, key assumptions are needed for the difference-in-difference design to yield a reliable estimate of the influence of tax policies. In the section for falsification test, we discuss the assumptions of difference-in-difference in detail. Briefly, Figure 1.(a) shows an inclined trend of leverage in both groups, and then treatment group's leverage had dropped after tax cut. Figure 1.(b) shows the treatment group in 2018 changed their leverage ratio prominently from decreasing to increasing after tax rise, but control does not. These two different treatment groups' responses on tax policies support that the difference-in-difference can be a useful method for identifying the trade-off theory.

2.4 Empirical results

2.4.1 Evidence of the capital structure

Table 2.8 provides the OLS estimation results from regressions testing the impact of tax policies on capital structure from 2010 to 2020. We implement the separated sample OLS and pooled OLS for investigating whether responses of tax policies on conglomerate are different with non-conglomerate. The coefficients on tax cut are negative and significant at the 1% level in columns (1) and (3) and

are not significant in columns (4) and (6), implying that non-conglomerate reduces debt as a tax shield in response to the tax cut. The results in column (5) show that the coefficient on tax increase is negative and significant at 10% level. Our findings in the tax cut are identical to trade of theory. On the other hand, reduction of conglomerate's leverage following the tax increase suggests that affiliated firms' response is not what the trade-off theory would suggest. The empirical evidences of heterogeneous effect of tax policies on leverage support that the corporate structure is seemingly important factor in capital structure in Korea due to additional regulation on business groups' capital usage and own financial abilities.

Table 2.8: Effect of tax changes on leverage : Conglomerate vs. non-conglomerate.

	Non-Conglomerate			Conglomerate		
	Tax cut 2010-2014	Tax rise 2016-2020	Both 2010-2020	Tax cut 2010-2014	Tax rise 2016-2020	Both 2010-2020
Dep.var: Long-term book leverage ratio						
Tax cut	-1.187***		-1.179***	-2.166		-1.545
	(0.402)		(0.383)	(1.529)		(1.531)
Tax rise		-1.606	-0.696		-1.347*	-0.676
		(1.994)	(2.880)		(0.782)	(0.868)
Size	3.420***	4.470***	4.156***	3.882	6.590***	3.296***
	(0.794)	(0.346)	(0.367)	(2.351)	(1.875)	(1.232)
Tangibility	15.65***	15.16***	15.26***	21.59**	14.33***	19.66***
	(2.105)	(0.996)	(1.149)	(8.544)	(4.728)	(4.469)
MTB	0.113	0.299***	0.248***	0.502	0.0448	0.394
	(0.136)	(0.032)	(0.049)	(0.306)	(0.152)	(0.248)
OCF	-0.057**	-0.102***	-0.089***	-0.189**	-0.050	-0.173***
	(0.024)	(0.015)	(0.016)	(0.078)	(0.070)	(0.051)
Observations	4,694	6,821	12,624	713	907	1,776
R-squared	0.071	0.096	0.103	0.124	0.150	0.138
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
F-test	13.02	54.73	19.58	3.631	4.944	7.161

Notes: This table indicates the changes in book leverage regression to test whether firms change their leverage in response to changes in the Korea corporate taxes between conglomerate and non-conglomerate. For variable definitions and details of their construction in A.1.1. All variables in levels are measured at the end of each year. Tax cut and tax rise are difference-in-difference estimations in the fiscal year 2012 and 2018. All specifications are estimated using the fixed-effect model and include firm effect and year effect. For each model, standard errors are reported in parentheses, and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Since the separated OLS empirically shows the capital structure decision depends on whether the firm is conglomerate or not, as a further examination, we run the pooled OLS with interaction terms of tax policies and conglomerate. Table 2.9 describes the heterogeneity of firms' behaviors in tax policies. The results of Table 2.9 remain consistent with those of Table 2.8, overall, tax cut has a significantly negative impact on leverage at the 1% level regardless of corporate structure. In details, column (1), (2), (5), and (6) indicate the tax cut has homogeneous effect on leverage

ratios and the interaction terms Tax cut × Conglomerate are not significant, suggesting that firms reduce their leverage ratio on average 1.35% regardless of corporate structure in 2012 tax cut. These results support the trade-off theory and are consistent with the results of Table 2.8 as well. On the other hand, tax increase shows heterogeneity. The result in column (4) reports that the coefficient of Tax rise is negative and statistically significant at the 10% level and the interaction term Tax rise × Conglomerate is positive and statistically significant at the 5% level. These results confirm the existence of heterogeneous influence of tax policies on leverage ratios in early findings. However, in column (3) the effect of tax rise disappears if OLS does not control interaction term. The reason why the effect of tax rise is heterogeneous with interaction in columns (3) and (4) is because 77% of firms experiencing the tax increase are conglomerate, corporate structure makes a different impact of tax rise on leverage ratio. This finding supports that country-specific corporate structure can be important factor for determinant of capital structure. When time periods are extended for controlling both policies, the impacts of tax rise in columns (5) and (6) of Table 2.9 disappear.

Table 2.9: Heterogeneous change in leverage in 2012 and 2018.

	Tax cut 2010-2014		Tax rise 2016-2020		Both 2010-2020	
Dep.var: Long-term book leverage						
Tax cut	-1.485***	-1.537***			-1.233***	-1.328***
	(0.359)	(0.364)			(0.351)	(0.356)
Tax cut×Conglomerate		-0.243				-0.138
		(1.052)				(0.624)
Tax rise			0.243	-2.221*	0.170	-0.738
			(0.588)	(1.329)	(0.706)	(1.899)
Tax rise×Conglomerate				2.859**		1.024
				(1.286)		(1.929)
Conglomerate	-3.464***	-3.629***	-0.307	-0.370	-1.608**	-1.722**
	(1.280)	(1.295)	(0.809)	(0.803)	(0.788)	(0.792)
Size	3.204***	3.371***	4.551***	4.557***	3.602***	4.036***
	(0.741)	(0.762)	(0.546)	(0.555)	(0.339)	(0.350)
Tangibility	16.06***	16.23***	15.25***	15.13***	15.79***	15.70***
	(2.108)	(2.107)	(1.642)	(1.646)	(1.116)	(1.113)
MTB	0.102	0.115	0.295***	0.295***	0.224***	0.246***
	(0.126)	(0.130)	(0.0618)	(0.0616)	(0.0488)	(0.0500)
OCF	-0.075***	-0.073***	-0.096***	-0.100***	-0.089***	-0.094***
Observations	5,407	5,407	7,728	7,728	14,400	14,400
R-squared	0.072	0.078	0.094	0.098	0.095	0.108
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
F-test	16.38	12.74	20.09	15.11	31.73	21.64

Notes: This table indicates the heterogeneous changes in book leverage regression to test whether firms change their leverage in response to changes in the Korea corporate taxes between conglomerate and non-conglomerate. For variable definitions and details of their construction in A1.1. All variables in levels are measured at the end of each year. Tax cut and tax rise are difference-in-difference estimations in the fiscal year 2012 and 2018. Tax cut (rise)×Conglomerate is the interaction term of difference-in-difference effect and conglomerate dummy. All specifications are estimated using the fixed-effect model and include firm effect and year effect. For each model, standard errors are reported in parentheses, and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

To sum up, the effects of tax cut on leverage are identical to trade-off theory regardless of Korea's specific business condition and corporate structure, and its effects are persistent. The influences of tax rise on leverage are asymmetric with the theory of capital structure for all firms. On the other hand, conglomerate fits in accordance with trade-off theory. The finding of tax rise supports that firms in conglomerates have more ability to use debt than non-conglomerate. There are two reasons why we find asymmetric influence of inclined tax. First, because the government encourages conglomerate firms to use external financial market rather than internal sources and conglomerate members face different financial choice options compared to non-conglomerate, firms' responses on tax rise can be different. Second, conglomerate member firms have better financial characteristics and as a result can increase debt when tax rate goes up in 2018 though default risk increases. Due to these facts, we conclude corporate structure plays an important role in debt financing in response to tax increases.

2.4.2 Falsification

The issues of difference-in-difference are the parallel-trend and exogeneity of policy. Figure 2.1.(a) might satisfy paralleled trend assumption before implementing tax cut, but Figure 2.1.(b) does not. In Figure 1.(b), the long-term leverage goes down in 2017, and this spike-up leverage ratio casts doubt on the exogeneity of tax policy in 2018. If exogeneity is not valid, difference-in-difference may not estimate reliable results. There are two possible compounding cases which may lead to bias in the impact of tax policy in 2018 on leverage.

The first case is that tax reforms are announced one year early. As a result. firms may change leverage ratio in anticipation of the new policies taking effect. Early announced tax reforms therefore may create a misspecification problem in our research design. For resolving these problems, this paper tests dynamic policy with lag and lead effects and tests whether controls change leverage

Table 2.10: Testing placebo.

	Tax cut 2010-2014		Tax rise 2016-2020		Both 2010-2020	
Dep.var: Long-term book leverage						
Panel A						
Tax cut	-1.069***	-1.389***			-0.999***	-1.145***
	(0.374)	(0.376)			(0.381)	(0.372)
Tax rise			0.284	-0.148	0.0444	-0.311
			(0.590)	(0.628)	(0.705)	(0.701)
Group11	0.752				0.620	
	(0.619)				(0.572)	
Group12		0.808				0.811
		(0.680)				(0.740)
Group21			0.137		-0.181	
			(0.410)		(0.359)	
Group22				-0.391		-0.186
				(0.340)		(0.340)
Observations	5,407	5,407	7,728	7,728	14,400	14,400
R-squared	0.088	0.081	0.103	0.103	0.117	0.117
F-test	13.60	13.71	14.66	14.53	23.11	23.03
Panel B						
Tax cut	-1.045***	-1.375***			-0.974**	-1.120***
	(0.379)	(0.380)			(0.382)	(0.375)
Tax cut ×	-0.557	-0.286			-0.613	-0.608
Conglomerate	(1.028)	(1.049)			(0.626)	(0.625)
Tax rise			-2.325*	-2.729**	-1.175	-1.520
			(1.351)	(1.361)	(1.923)	(1.924)
Tax rise ×			3.052**	3.019**	1.398	1.390
Conglomerate			(1.312)	(1.294)	(1.953)	(1.954)
Observations	5,407	5,407	7,728	7,728	14,400	14,400
R-squared	0.088	0.081	0.104	0.103	0.117	0.117
F-test	12.68	12.74	14.05	13.87	21.24	21.16

Notes: This table indicates whether controls are affected by tax policies. To examination respond of controls, 4 groups are made based on taxable income. In panel A, Group11(21) is in 10% tax brackets, group12 in 25% tax brackets, and group22 in 20% and 10%. In panel B, the results of groups are not reported and are not significant. Tax cut and tax rise are difference-in-difference estimations in the fiscal year 2012 and 2018. Tax cut (rise)×Conglomerate is the interaction term of difference-in-difference effect and conglomerate dummy. All specifications are estimated using the fixed-effect model and include firm effect and year effect. Independent variables and the fixed effects are not reported for brevity. For each model, standard errors are reported in parentheses, and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

ratios as well. The other case is that, in 2017, Korea Council had relaxed the mutual investment provision for conglomerates. This changed mutual-investment policy within affiliated firms may make conglomerate use debt more in 2017. We examine these additional policy shocks in 2017 for considering whether confound factor affects firm's debt decision-making.

First, we use a placebo test for exploring the controls' response to tax policies. Table 2.10 indicates whether tax policy in 2012 and 2018 impact on fake groups. Based on changed tax rules, we make three fake groups (i.e., placebos) affected by tax reforms in 2012 and 2018, and test for those groups' leverages. Group11(21) are firms in 10% tax brackets, Group12 is in 25% tax brackets, and Group22 is in 20% and 10% tax brackets. Briefly, all results show that any fake groups do not change their long-term leverage. The empirical findings for the fakes support the validity of our difference-in-difference assumption. In panel A and B of Table 11, the effect of tax cut and tax

increase are the same as previous results as well. Tax cut is a significantly negative in all results and tax rise is significantly negative in columns (3) and (4) of panel B. Also, interaction term (Tax rise× Conglomerate) in panel B show positive impacts on leverage.

Table 2.11: Testing for reversal, pre-trend and confounding effects.

Dep.var: Long-term	Tax cut		Tax rise	
book leverage	2010-2014	2010-2015	2015-2020	2014-2020
Panel A				
L1.Tax cut	-0.0418	0.0185		
	(0.321)	(0.267)		
Tax cut	-1.219***	-1.413***		
	(0.394)	(0.378)		
F1.Tax cut	0.156	0.193		
	(0.261)	(0.227)		
L1.Tax rise			1.717*	1.475
			(0.942)	(0.935)
Tax rise			-0.251	-0.118
			(0.898)	(0.876)
F1.Tax rise			-0.197	-0.714
			(0.753)	(0.689)
Observations	4,629	5,777	5,500	6,648
R-squared	0.032	0.038	0.063	0.073
F-test	9.367	13.65	24.03	33.29
	Both	Confounding Effect		
	2015-2020	2015-2020		2010-2020
Panel A				
L1.Tax cut	0.174			
	(0.170)			
Tax cut	-1.334***			-1.269***
	(0.360)			(0.326)
F1.Tax cut	0.170			
	(0.159)			
L1.Tax rise	1.074	1.646		
	(1.012)	(1.032)		
Tax rise	0.298	-0.575	-0.0624	0.0188
	(0.919)	(0.947)	(0.803)	(0.665)
F1.Tax rise	-1.010	-0.212		
	(0.689)	(0.808)		
Observations	11,277	5,500	7,728	14,400
R-squared	0.064	0.064	0.059	0.061
F-test	31.58	17.84	30.69	39.13
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Notes: To investigate possible reversal and pre-trend and confounding effect, this table includes one lag and one lead in the base line regression in table 9. Because pre-trend is detected in column (3), column (6), (7), and (8) include a possible confounding effect (relaxed mutual investment and debt agreement for conglomerate) in the fiscal year 2017. The confounding variable is not reported. Tax cut and rise are difference-in-difference estimations in the fiscal year 2012 and 2018. All specifications are estimated using the fixed-effect model and include firm effect and year effect. Independent variables are not reported for brevity. For each model, standard errors are reported in parentheses, and are robust and clustered at the firm level. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Furthermore, we use Time-Varying Treatment Effects with lagged and forward policy shock. In many applications, the effect of the treatment may vary with time since exposure. Researchers can study these effects by including lagged treatment variables in the standard difference-in-difference model. The common strategy is to use an event study framework examining anticipation effects and phase-in effects in a single regression by adding anticipatory effects in difference-in-difference. For testing for anticipated effects of tax policies, we check the effect of lagged and forward difference-in-

difference. Since firms can know about a new tax rule one year early, this paper uses one-year lagged and forward variables for the main diagnosis of anticipated effects. Table 2.11 indicates diagnostic results. In tax cut periods, there is no issue of anticipated effect regardless time periods, but in raised tax period, there is a one-year anticipated effect (L1.tax rise is positive and significant at 10% level) in column (3). This finding supports the fact that spike-up leverage ratio can lead identification issue in our study. For more tests, we extend time windows because the trend of leverage ratio stated to go down from 2014. The result extended time from 2014 to 2020 in column (4) shows that there is not any anticipated issue.

We check another factor (relaxed mutual investment and debt agreement within affiliated firms) that affect long-term leverage. In 2017, Korea relaxed the restriction on mutual investment for conglomerates. This changed mutual-investment policy may encourage conglomerates to use debt more after 2017. Also, it can explain the spike up of Treat's leverage since 2017. Because conglomerate was a main target of tax burden in 2018, changed mutual investment policy can change the effect of tax rise. We use a dummy variable for the 2017 policy and test anticipated tax policies' effects with relaxed mutual investment. Column (5) in Table 2.11 supports that statistically this paper cannot find the anticipated effect of tax policy after controlling the mutual investment dummy. Column (6) shows that anticipate effect of tax rise is disappeared when the mutual investment dummy is included. Columns (7) and (8) also empirically support that the impacts of tax rise and tax cut are identical to previous findings after with the mutual investment dummy.

Overall, we do not find possible falsifications from fake groups, anticipated and forwarded effects, and confounding factors. The empirical evidence statistically supports our use of difference-in-difference, and that our results can have a causal interpretation.

2.4.3 Robustness of results

In this section, we provide three robustness checks on the main results. To clarify whether our main results are sensitive to restricting positive income sample, we first estimate a truncated regression model and use alternative dependent variables (Heider and Ljungqvist, 2015 [69]) and independents (effective and statutory tax rates). Table 2.12 illustrates the results of the positive income sample. We obtain similar results of tax cut in columns (1), (2), (5), and (6). The influences of tax cuts are significantly negative, and their magnitudes increase regardless of time periods and interaction terms. Tax rise has a significantly negative influence on leverage in the previous result, on the other hand, tax rise is not significant in column (3) and (4) of Table 2.12. Interaction term Tax rise $\times$ Conglomerate is positive and significant, and the magnitude of interaction is also larger than the result in Table 2.9. The different finding with the previous is that in the truncated sample there are asymmetric changes in the magnitude of tax policies. As a tax shield, firms more respond to the tax increase. In detail, firms in the restricted sample reduce less debt on tax cut compared to the results of the full sample and use more debt on tax rise. One possible reason is that since sensitivities of tax effects on debt should vary with profits, firms with positive income have a good financial ability, and they reduce less debt in tax cut periods for making better financial conditions. In tax rise periods, affiliate firms can borrow more debt due to the firms' better financial ability than non-conglomerate even if the firms belonging to conglomerates face more restricted financial constraints.

As a further test, we use market leverage, real long-term debt, and debt-to-equity. Results in Table 2.13 are similar to Table 2.9. Table 2.13 shows the tax cut has significantly negative effects on all alternative leverage ratios in columns (1), (3), (4) and (7) of panels A and B. For full-time periods, only market leverage significantly decreases regardless of the interaction term, and all in-

Table 2.12: Robustness: Positive income

	Tax cut 2010-2014		Tax rise 2016-2020		Both 2010-2020	
Dep.var: Long-term book leverage						
Tax cut	-0.816**	-0.820**			-1.017***	-1.008***
	(0.367)	(0.371)			(0.380)	(0.382)
Tax cut×		0.086				-0.231
Conglomerate		(0.952)				(0.638)
Tax rise			0.386	-2.305	0.012	-1.174
			(0.555)	(1.444)	(0.708)	(1.942)
Tax rise×				3.146**		1.362
Conglomerate				(1.454)		(1.965)
Observations	3,974	3,974	5,218	5,218	10,113	10,113
R-squared	0.101	0.101	0.160	0.161	0.141	0.142
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
F-test	10.60	9.822	20.49	19.58	18.61	16.92

Notes: To investigate robustness, this table uses positive taxable income sample in the base line regression in Table 9. Tax cut and tax rise are difference-in-difference estimations in the fiscal year 2012 and 2018. Tax cut (rise)×Conglomerate is the interaction term of difference-in-difference effect and conglomerate dummy. All specifications are estimated using the fixed-effect model and include firm effect and year effect. Independent variables are not reported for brevity. For each model, standard errors are reported in parentheses, and are robust and clustered at the firm level. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

teractions are not significant for tax cut regardless independents. Tax rise has a positive effect on market leverage in column (3) in panel A. Interaction term of Tax rise x Conglomerate in column (5) in panel B has a positive and significant.

Table 2.13: Robustness: Alternative dependents

	Market Leverage			Real long-term debt			Debt to Equity		
	2010-2014	2016-2020	2010-2020	2010-2014	2016-2020	2010-2020	2010-2014	2016-2020	2010-2020
Panel A									
Tax cut	-0.020**		-0.025***	-0.073*		-0.060	-7.459***		-3.661
	(0.009)		(0.009)	(0.041)		(0.040)	(2.368)		(2.260)
Tax rise		-0.009	0.033**		-0.010	0.001		0.357	1.647
		(0.010)	(0.013)		(0.052)	(0.055)		(2.572)	(2.847)
Observations	5,407	7,728	14,400	5,407	7,728	14,400	5,227	7,485	13,936
R-squared	0.128	0.141	0.185	0.245	0.249	0.325	0.045	0.086	0.069
F-test	23.17	39.13	51.25	40.76	70.86	106.4	6.528	10.45	8.663
Panel B									
Tax cut	-0.021**		-0.026***	-0.073*		-0.063	-7.485***		-3.543
	(0.009)		(0.009)	(0.042)		(0.040)	(2.394)		(2.250)
Tax cut	0.019		0.021	0.001		0.065	0.556		-2.590
×Conglomerate	(0.019)		(0.013)	(0.081)		(0.060)	(3.440)		(4.194)
Tax rise		-0.035	0.013		-0.187	-0.080		-4.447	1.126
		(0.021)	(0.031)		(0.122)	(0.131)		(4.943)	(6.120)
Tax rise		0.030	0.022		0.207*	0.096		5.622	0.557
×Conglomerate		(0.021)	(0.031)		(0.111)	(0.133)		(4.289)	(6.019)
Observations	5,407	7,728	14,400	5,407	7,728	14,400	5,227	7,485	13,936
R-squared	0.128	0.141	0.185	0.245	0.249	0.325	0.045	0.086	0.069
F-test	21.24	35.96	46.85	37.36	65.75	96.26	6.089	9.855	8.292

Notes: To further robustness testing, columns (1), (2) and (3) models market leverage; columns (4), (5) and (6) models real long-term debt inflated in 2010; and columns (7), (8) and (9) long-term debt to equity ratios, respectively. All specifications are estimated using the fixed-effect model and include firm effect and year effect. Independent variables and the fixed effects are not reported for brevity. For each model, standard errors are reported in parentheses, and are robust and clustered at the firm level. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

For the last robustness check, we exploit alternative measurements for tax rates such as effective tax and marginal tax. To identify firm's response to the changes in taxes on leverage, our study employs dummies. If firms face inclined (declined) effective (marginal) tax rates at t compared to t-1, dummy is 1 and 0 otherwise. Using different tax measurements makes this study compare the

response of changes in tax rates over time with results of difference-in-difference. Table 2.14 describes the results of alternative tax variables. Previous evidence in Table 2.9 shows that tax cut and rise reduce leverage and asymmetric effect of tax rise if firms are belonged to conglomerate. In Table 2.14, the results of the effective tax rates show that increased and decreased effective tax rates reduce leverage ratios in column (1). When interactions are controlled, increased effective tax dummy is significantly negative in column (2). Because interaction terms are not significant in column (2), there is no heterogeneous effect of effective tax rates. Declined final marginal tax rates positive impact on leverage at the 1% level. Increased marginal tax rates are negative and significant at the 1% level.

Table 2.14: Robustness check: Alternative independents

	Zero Effective tax B		Statutory Marginal Tax	
Dep.var: Long-term book leverage				
Decreased Effective TaxB	-0.456*	-0.415		
	(0.260)	(0.271)		
Decreased Effective TaxB×Conglomerate		-0.602		
		(0.893)		
Increased Effective TaxB	-1.195***	-1.085***		
	(0.261)	(0.273)		
Increased Effective TaxB×Conglomerate		-1.090		
		(0.886)		
Decreased Marginal Tax			0.617***	0.577***
			(0.145)	(0.146)
Decreased Marginal Tax×Conglomerate				0.685**
				(0.311)
Increased Marginal Tax			-0.519***	-0.596***
			(0.163)	(0.175)
Increased Marginal Tax×Conglomerate				0.867*
				(0.467)
Observations	14,400	14,400	14,400	14,400
R-squared	0.107	0.107	0.106	0.106
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
F-test	27.80	25.23	26.71	24.41

Notes: Decreased (increased) effective taxB is 1 if effective tax rate increases (decreases) at t, and 0 if otherwise. Decreased (increased) marginal tax is 1 if marginal tax rate increases (decreases) at t, and 0 if otherwise. All specifications are estimated using the fixed-effect model and include firm effect and year effect. Independent variables are not reported for brevity. For each model, standard errors are reported in parentheses, and are robust and clustered at the firm level. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Also, interactions of decreased (increased) marginal tax and conglomerate are significantly positive in column (4). Increased (decreased) marginal tax rates show the heterogeneous (homogeneous) effect of tax rate on leverage ratios. Briefly, effective tax dummies give identical results, but we cannot find the effect of heterogeneity. And increased marginal tax dummy and interaction are partially identical to difference-in-difference results in Table 2.9. When marginal tax rate is inclined all

firms decrease leverage but conglomerate increase leverage, on the other hand, decreased marginal tax dummy and interaction encourage firms to increase leverage.

2.4.4 Dynamic Capital structure

Empirical Model

We consider a partial adjustment model from the capital structure literature to investigate firm's steady adjustment to their optimal leverage ratios, our study includes the treatment effect of tax policies into the partial adjustment model to analyze the size of its impact. The literature estimates that leverage is highly persistent over time as a result of adjustment costs (Devereux et al., 2018 [43], Flannery and Ragan, 2006 [51], Flannery and Hankins, 2013 [52], Lin and Flannery, 2013 [94]). To identify this adjustment process, we use a general dynamic adjustment model of leverage (Devereux et al., 2018 [43] and Flannery and Hankins, 2013 [52])

$$Blev_{it} = \lambda Blev_{it-1} + \beta X_{it} + \tau_i + t_t + \epsilon_{it} \tag{2.2}$$

It is clear to incorporate a treatment effect (e.g., tax cut and tax rise) into this model. Suppose a firm's optimal leverage ratio changes after the 2012 tax cut and the 2018 tax rise, and let D be a variable for capturing difference-in-difference of tax policies. Then Eq. (2.2) is modified to be

$$Blev_{it} = \lambda Blev_{it-1} + \delta D_{2012,2018} + \beta X_{it} + \tau_i + t_t + \epsilon_{it} \tag{2.3}$$

where $\lambda Blev_{it-1}$ is lag leverage and the control variables are defined as before. We include the firm and year fixed effects in all the regressions because they are important in the study of capital structure with panel data. However, the dynamic panel model is biased because the lag dependent is correlated with the error term (Devereux et al., 2018 [43], Flannery and Hankins, 2013 [52] Lin and Flannery, 2013 [94]). Thus, to address this issue, we estimate three advanced regressions such as the

first difference (Anderson and Hsiao, 1981 [4]), the difference GMM (Arellano and Bond, 1991 [8]), and the system GMM (Blundell and Bond, 1998 [14]) to avoid biases related with OLS and FE. Even if the OLS (FE) produces an upward (downward)-biased coefficient for the lagged dependent variable (Bond, 2002 [16] and Nickell, 1981 [113]), we explore OLS and FE as well. This is because, as Flannery and Hankins (2013) [52] point out, with data limitations (imbalance or missing) and in the presence of second-order serial correlation, fixed effect provides the most accurate estimates for the dynamic panel model.

Firstly, we apply the instrumental variables approach (Anderson and Hsiao, 1981 [4]) to the dynamic panel model by using a difference of lag variables. Additionally, lag independent variables at $t-2$ are used as instruments for the difference and system GMM (Lin and Flannery, 2013 [94]). However, if there is first-order serial correlation in ϵ_{it} and controls (size, MTB, OCF ratio, and tangibility) are not strictly exogenous, using further lags as instruments is reliable. For further examination, our study tests a serial correlation of error terms. First and second-order serial correlations are mainly detected with error terms and controls. For this issue, we use lagged two and more periods of controls as instruments. As Devereux et al. (2018) [43] and Wintoki et al. (2012) [143] point out that using lag variables can lead to weak instruments, our study provides the validity of IVs test using the Hansen J test.

Results

Table 2.15 reports the estimation results based on Eq. (3). First, we apply the OLS, the fixed effect, and the first difference (Anderson and Hsiao, 1981 [4]) estimators. The instrumenting strategy for the First Difference is the first difference of the lags of firm size, tangibility, MTB, OCF ratio, and the lags of leverage are used as set of instruments for $Blev_{it-1}$. In columns (1), (4), and (7) of panel A, the estimation yields significantly negative estimates for coefficients on tax cut. Tax

rise is not significant in panel A. When both tax policies are considered, columns (6) and (9) show that tax cut significantly reduce leverage ratios, but tax rise is not. Our findings are similar to previous results in Table 2.9. Additionally, we test heterogeneity of influence of tax policies on leverage. Panel B in Table 2.15 shows that overall tax cut significantly reduces leverage. Interaction of Tax cut x Conglomerate has negative effect of on leverage and show homogeneous effect of tax cut in column (1) and (3) of panel B. On the other hand, FE and FD provide that tax rise have an asymmetric influence on leverage. In detail, in columns (5), (8), and (9) in panel B, effect of tax rise is negative and significant and interactions have a significantly positive impact on leverage. The empirical findings of dynamic FE and FD are similar with the statistic capital structure of Table 2.9. Therefore, accounting for firm's gradual leverage adjustment does not change our main results.

Table 2.15: Dynamic panel models

	OLS			Simple FE			First Difference		
	2010-2014	2016-2020	2010-2020	2010-2014	2015-2020	2010-2020	2010-2014	2016-2020	2010-2020
Dep.var: Long-term book leverage									
Panel A									
$Blev_{it-1}$	0.648***	0.621***	0.631***	-0.005	0.046*	0.233***	0.197***	0.244***	0.260***
	(0.022)	(0.016)	(0.013)	(0.029)	(0.026)	(0.018)	(0.040)	(0.036)	(0.029)
Tax cut	-0.761**		-0.393	-1.395***		-0.997***	-1.437***		-1.135***
	(0.385)		(0.336)	(0.393)		(0.349)	(0.465)		(0.424)
Tax rise		-0.274	0.336		0.213	0.166		-1.121	-0.556
		(0.685)	(0.478)		(0.587)	(0.598)		(0.922)	(0.870)
Observations	4,731	7,194	13,086	4,731	7,194	13,086	3,534	6,643	11,267
R-squared	0.603	0.565	0.586	0.076	0.098	0.161	.	.	.
Firm FE	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
F-test	325.6	501.5	553.7	11.76	14.39	29.38	.	.	.
Chi2-Test	.	.	.	.	.	.	170.0	398.0	602.3
Panel B									
$Blev_{it-1}$	0.648***	0.621***	0.631***	-0.006	0.047*	0.233***	0.295***	0.245***	0.260***
	(0.022)	(0.016)	(0.013)	(0.030)	(0.026)	(0.018)	(0.101)	(0.042)	(0.035)
Tax cut	-0.708*		-0.366	-1.257***		-0.968***	-1.394***		-1.140***
	(0.387)		(0.337)	(0.398)		(0.351)	(0.478)		(0.420)
Tax cut	-1.283*		-0.701*	-1.167		-0.716	-1.546		-0.293
×Conglomerate	(0.778)		(0.421)	(1.093)		(0.564)	(1.150)		(0.589)
Tax rise		-0.821	0.282		-2.351*	-1.259		-4.009***	-3.371***
		(1.248)	(1.132)		(1.301)	(1.624)		(1.091)	(0.971)
Tax rise		0.645	0.0572		2.998**	1.637		3.476***	3.427***
×Conglomerate		(1.177)	(1.161)		(1.244)	(1.643)		(0.963)	(0.940)
Observations	4,731	7,194	13,086	4,731	7,194	13,086	3,534	6,643	11,267
R-squared	0.604	0.565	0.586	0.079	0.099	0.161	.	.	.
Firm FE	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
F-test	301.4	463.8	504.1	11.05	13.82	26.94	.	.	.
Chi2-Test	.	.	.	.	.	.	78.96	202.6	337.5

Notes: All specifications are estimated using the fixed-effect model and include firm effect and year effect. Independent variables and the fixed effects are not reported for brevity. For each model, standard errors are reported in parentheses, and are robust and clustered at the firm level. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

In Table 2.16, the GMM (difference and system) estimations are reported. As discussed previously, we use lag variable $t-2$ for difference equation based on the serial correlation test of error terms. Also, other controls are treated as endogenous. Note that if the error term is not serially correlated, we would accept the alternative hypothesis that there is AR(1) type of serial correlation

in error term. In Table 2.16, AR(1) and AR(2) type of serial correlation are detected, but there is no AR(3) type of serial correlation (not reported). The results suggest that the third and further lags of variables are valid instruments. Also, the overidentifying restriction condition is rejected in column (1) by the J test, that casts doubt on the validity of the instrument variables employed in the estimation.

Table 2.16: Dynamic panel models: GMM estimations

	Difference GMM			System GMM		
	2010-2014	2016-2020	2010-2020	2010-2014	2015-2020	2010-2020
Dep.var: Long-term book leverage						
Panel A						
$Blev_{it-1}$	0.109*	0.242***	0.277***	0.307***	0.311***	0.341***
	(0.064)	(0.035)	(0.026)	(0.044)	(0.028)	(0.019)
Tax cut	-1.556***		-1.029***	-1.265***		-0.919***
	(0.405)		(0.349)	(0.384)		(0.339)
Tax rise		0.907	1.137		0.762	1.474**
		(0.719)	(0.696)		(0.672)	(0.638)
Observations	3,534	6,643	11,267	4,731	7,194	13,086
AR 1	0.000	0.000	0.000	0.000	0.000	0.000
AR 2	0.585	0.031	0.036	0.763	0.016	0.016
Hansen J	0.117	0.000	0.000	0.039	0.000	0.000
Chi2-Test	119.5	203.1	435.1	472.1	318.9	1173
Panel B						
$Blev_{it-1}$	0.106*	0.243***	0.276***	0.304***	0.312***	0.340***
	(0.064)	(0.035)	(0.026)	(0.044)	(0.028)	(0.019)
Tax cut	-1.534***		-1.020***	-1.174***		-0.900***
	(0.412)		(0.351)	(0.387)		(0.340)
Tax cut	-0.650		-0.207	-1.577		-0.514
×Conglomerate	(1.238)		(0.542)	(1.065)		(0.536)
Tax rise		-2.692***	-2.608***		-3.209***	-2.344***
		(0.876)	(0.839)		(0.897)	(0.831)
Tax rise		4.264***	4.472***		4.529***	4.409***
×Conglomerate		(0.883)	(0.884)		(0.869)	(0.834)
Observations	3,534	6,643	11,267	4,731	7,194	13,086
AR 1	0.000	0.000	0.000	0.000	0.000	0.000
AR 2	0.568	0.032	0.037	0.770	0.017	0.016
Hansen J	0.110	0.000	0.000	0.031	0.000	0.000
Chi2-Test	122.7	222.2	459.3	467.6	342.1	1194

Notes: For investigation dynamic model, difference and system GMM are used. The second lag of leverage and other control variables are used in the set of instrument. All specifications are estimated using the fixed-effect model and include firm effect and year effect. Independent variables and the fixed effects are not reported for brevity. For each model, standard errors are reported in parentheses, and are robust and clustered at the firm level. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Column (1) in Table 2.16 rejects the AR(2) and overidentifying tests, the difference GMM for tax cut is valid. The tax cut is significant and decreases leverage around 1.55% which is close to 1.48% in Table 2.9. The mean of tax cut is -1.55% that translates to a reduction of 0.0155/(1-0.109)=1.73% in leverage ratio. This effect is larger than 1.48% in Table 2.9. After controlling interaction term, the results are not changed. Even if the other results would not reject AR(2) and overidentification, tax cut and tax rise show negative signs significantly. The interaction of tax rise and Conglomerate

show positive impact of leverage ratio at the 1% level, and it supports heterogeneity of tax rise. But, it is not robust. Overall, the impact of tax policies in the partial adjustment model is identical to static capital structure.

Table 2.17: Dynamic panel models: GMM estimations

	Difference GMM			System GMM		
	2010-2014	2016-2020	2010-2020	2010-2014	2015-2020	2010-2020
Dep.var: Long-term book leverage						
Panel A						
$Blev_{it-1}$	0.185*	0.330***	0.483***	0.426***	0.491***	0.612***
	(0.0963)	(0.0808)	(0.0782)	(0.0601)	(0.0835)	(0.0659)
Tax cut	-3.934***		-1.587	-2.562**		-2.907
	(1.335)		(3.388)	(1.109)		(3.336)
Tax rise		4.380**	5.134**		4.047**	4.197**
		(1.908)	(2.160)		(2.024)	(2.121)
Observations	3,534	6,643	11,267	4,731	7,194	13,086
AR 1	0.000	0,000	0.000	0.000	0.000	0.000
AR 2	0.760	0.285	0.208	0.349	0.034	0.008
Hansen J	0.745	0.362	0.342	0.276	0.296	0.179
Chi2-Test	67.75	147.5	229.8	298.6	167.4	546.7
Panel B						
$Blev_{it-1}$	0.171*	0.330***	0.484***	0.424***	0.489***	0.613***
	(0.0991)	(0.0812)	(0.0780)	(0.0596)	(0.0840)	(0.0665)
Tax cut	-4.235***		-1.492	-2.456**		-2.930
	(1.463)		(3.406)	(1.121)		(3.386)
Tax cut	-4.527		-0.614	5.785		0.764
×Conglomerate	(9.019)		(8.305)	(7.013)		(7.694)
Tax rise		4.573	2.654		11.24	0.745
		(11.88)	(14.00)		(13.77)	(13.32)
Tax rise		-0.210	2.715		-7.315	3.602
×Conglomerate		(12.20)	(14.13)		(13.75)	(13.14)
Observations	3,534	6,643	11,267	4,731	7,194	13,086
AR 1	0.000	0.000	0.000	0.000	0.000	0.000
AR 2	0.796	0.286	0.213	0.361	0.032	0.008
Hansen J	0.710	0.327	0.300	0.307	0.307	0.123
Chi2-Test	66.22	147.4	233.1	265.2	164.6	563.4

Notes: For investigation dynamic model, difference and system GMM are used. The third and further lags of leverage and other control variables are used in the set of instrument because in Table 2.16 serial correlation and overidentification are not rejected. All specifications are estimated using the fixed-effect model and include firm effect and year effect. Independent variables and the fixed effects are not reported for brevity. For each model, standard errors are reported in parentheses, and are robust and clustered at the firm level. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

As discussed in the previous GMM estimations, our empirical findings would not be reliable due to AR(2) and overidentification. To resolve these problems, our study employs $t-3$ and more lags as instrument sets for two GMM to estimate more valid results for tax policies. As a result of no high order serial correlation and no overidentification, the estimations in Table 2.17 are valid. The results of GMM are different from previous results of the static and dynamic capital structure. Columns (1) and (4) of Panel A and B in Table 2.17 show tax cut is significant and negative impact on leverage. Tax cut is not significant when tax rise is controlled in column (3). Tax rise is not significant without interaction term in Table 2.9, but Panel A in Table 2.17 indicates that tax rise is significant and

has positive impact on leverage ratios. This is identical to trade-off theory. When the interaction term is controlled, tax rise is positive and not significant. Also, interactions are not significant. The findings of tax rise and interactions are different from the findings of static trade-off in Table 2.9, without interactions the effect of taxes are in line with the trade off theory.

To sum up, with serial correlation and overidentification issues, the effects of tax policies in the partial adjustment model are identical to the static model. Both difference and system GMM do show heterogeneous impact of tax rise on leverage for conglomerate firms. After resolving those two issues, tax cut shows the same results in static and dynamic models. On the other hand, tax rise and interactions show different sign in the dynamic model. More specifically, tax cut reduces leverage and tax rise increases, and its results match trade-off theory.

2.5 Conclusion

Capital structure theory suggests that a tax rate cut (rise) decreases (increases) long-term leverage. But, whether tax makes firms change capital allocation is still controversial because empirical findings differ when researchers use different countries, industries, and periods. In Chapter 2, we investigate whether the tax changes give consistent results with the trade-off theory in Korea using a trade-off between tax burden and corporate structure. We provide empirical evidence that the effects of corporate tax on the firm are inconsistent with the trade-off theory, but the Korean conglomerate plays a role consistent with the trade-off theory. This finding suggests that conglomerate is a key to solving the capital structure puzzle.

Specially, the first goal of Chapter 2 is to estimate the response of leverage with respect to two changes in corporate tax policies: a decrease in 2012 and an increase in 2018. Based on reliable firm-level amounts of tax and income, we investigate the theories of capital structure by using difference-in-difference. Second, because corporate structure (a family controlled conglomerate) in Korea plays

a key role in allocating capital in firms, the study in Chapter 2 shows whether response of tax policy on leverage depends on the corporate structure. Empirical findings show that tax cut in 2012 reduces long-term leverage. In contrast to previous studies, tax rise in 2018 has an opposite effect (declined leverage in tax rise) on leverage ratios. In addition, we find the heterogeneous response of the firms belonged to conglomerates on tax rise. Conglomerate in South Korea uses more debt when the tax rate is increased. This empirical finding is aligned with previous evidence that affiliate firms face less default risk compared to non-conglomerate, therefore conglomerate enjoys tax shields in tax rise periods. The distinguishing empirical finding of Chapter 2 is that the firms in conglomerates have different financial choice options due to regulation on usage of internal capital market. As a result, the firms belonging to a conglomerate show asymmetric behaviors in tax rise periods compared to the other firms. Third, in Chapter 2 we also find similar results in the dynamic panel model. Tax cut reduces leverage, but tax rise depends on the models. GMM is identical to the trade-off theory, but the others (Fixed effect and First-Difference) are not. Finally, by repeating regressions with potential compounding factors, lags and leads, and pre-trend, we attempt to exclude the possible spurious correlation problems. Also, we in Chapter 2 uses alternative proxies for leverage and tax rate and finds paralleled results. To sum up, Chapter 2 we find strong empirical evidences that tax policies change the capital allocation, its effect depends on countries' specific corporate structure for the determinant of firm's optimal leverage.

Chapter 3

Government and Firms: Benefit and Cost of government

3.1 Introduction

Since the 1980s, economists and policymakers have pursued small government as an economic agenda under the slogan of deregulation and privatization due to the costs of government ownership in terms of inefficiency. Until now, the stream of privatization has continued, and economists who had pursued a market economy based on the role of firms in the supply-driven economy have continued to support the expansion of private ownership to improve competitiveness. Although privatization has been pursued over the last four decades because of the costs of government ownership as Shleifer and Vishny (1994) [133] noted, the government played a significant role in the market ironically as one of the largest shareholders. This opposite phenomenon called "reverse privatization" implies government ownership's implicit and explicit benefits. It leads our research to analyze the influence of government ownership based on its costs and benefits in empirical corporate finance.

Even if the overall effect of government ownership in firms is inefficient, Maskin (1996) [98] and Kornai (1980) [83] provide the soft budget constraint theory that government can provide

benefits to the firms by slackening financial constraints. Even if the soft budget constraint theory in the centralized market give inefficient results compared to the results in the decentralized market, Maskin (1996) [98] provide theoretical evidence that government can help firm that faces credit constraints in the market by providing a chance for refinancing and operate its business under a certain condition. Also, Maskin and Xu (2001) [99] provide that soft budget constraints can play an important role in the firm during a financial crisis. Consistently, Borisova and Megginson (2011) [19] find that government ownership can provide a lower cost of borrowing funds from the capital market empirically. Because of the benefits of government in firms noted by Maskin (1996) [98], Kornai (1980) [83], and Borisova and Megginson (2011) [19], this research set main object of this study is "Does government ownership in firms induce inefficient always?" If not, I ask, "What condition maximizes the benefits of government and minimizes the cost." Based on these inquiries, this study explore the effect of government ownership on a firm's values and performance.

The influence of government ownership in corporate finance is complex due to its costs and benefits. The cost of government ownership associated with unproductive is grounded on moral hazard and inappropriate corporate governance because the government can seek non-profit-maximizing related to social and political purposes inconsistent with profit maximization of firms (Boubakri et al., 2018 [22]). As a result, government ownership negatively affects firms' profits. On the other hand, government ownership might positively influence firms' profits. For example, government ownership gives a chance to use public resources for firms exclusively because government ownership in firms gives connections with politicians and officials in government. Also, the literature suggests that government ownership may induce better monitoring and governance via regulation. Even if empirical studies examine the loss and gains of government ownership in corporate finance, previous literature cannot confirm whether government as an investor makes progress in firm valuation because owner-

ship structure and performance can be determined together. Specifically, the change in government ownership may be positively associated with market value and performance due to invested firms anticipated to succeed by public agents or investors in the market. Thus, simple causality between government ownership and firm performance is inappropriate. Exploiting instrument variables for ownership variables makes prior research capture the isolated effect of the ownership structure on a firm's performance to determine the direction of causality, even if there are issues related to the validity of instruments (Coles et al., 2012 [38]; Gormley and Matsa, 2014 [58]; Giannetti and Laeven, 2008 [55]).

The complexity of government ownership in corporate finance leads to an undetermined relationship between government ownership and firm valuations, but we believe that prior research supports the possibility of the causal relationship between government ownership and firm valuations. Therefore, we propose to empirically explore the following questions: Does government ownership gives benefits or loss to firms? If government ownership in the market is positive or negative, does impact of government ownership is homogeneous? In this Chapter, we provide evidence for these primary questions, and then we show whether the activism of public institutions induces better monitoring and firms' market values and performances.

For these questions, we compare firms' performance and value based on government ownership among publicly listed firms in Korea from $2016 - 2020$ in the Chapter 3. The reason we look at the Korean public traded firms is that government ownership in Korea drastically increased in 2019. The government-owned firms increased from 639 in 2018 to 966 in 2019. Before 2019, the number of government-owned firms was around 33%, but in 2019 almost 47%. This phenomenon supports the increased influence of government on the firm, and it is the same as "reverse privatization". Also, Korean government owns almost half of public traded firms (47%) in 2019. This increased

government investment in the securities makes this study analyze implicit and explicit benefit and cost of government ownership, and we can shed light on the bright and dark sides of government influence on corporate.

Especially, the magnitude of government ownership is a good proxy variable for the possibility of political influence and government intervention in firms. We have the detailed data for government ownership ratio in Korean public traded firms from 2017 to 2020, therefore, we can illuminates the influence of government ownership on firms' values conditional on the levels of government ownership empirically. Also, even if government ownership induces better monitoring and governance, the increase in ownership levels of government affects firms' value negatively because of the possibility of excessive government intervention for political and social goals unrelated to profit maximization. In other words, the high possibility of government intervention in firms discourages and crowds out private interests due to public interests. Because the Korean government increased investment in the domestic stock market in 2019 and reformed the role of public institutions in 2018, this study can contribute to whether increased government power in the market reduces or improves firms' performance and valuations.

This study provides empirical implications associated with the literature on the activism of public institutions. In 2018, the Korean National Assembly passed the modified Act related to the National Pension Fund (NPS)'s role, even if there are debates about the costs and benefits of activism of the NPS. This study focuses on the impact of public institutional ownership and government policy on Korean-listed firms with detailed data. This allows our study to look into specific episodes of the impact of government ownership based on a political issue within the country. As Stiglitz et al. (1993) [136] stated, common thoughts about government control can induce an even worse scenario because of either corruption or inappropriate objectives and interventions. Thus, this study can

shed light on whether government policy regarding activism of the NPS reduces or increases the costs and benefits of government ownership in corporate finance.

The Korean Government intervenes in corporate governance through the National Pension Service (NPS) and government-affiliated banks such as Korea Development Bank (KDB). Since the Korean Government invests through the NPS and KDB, the Korean government employs voting rights as a shareholder through public agents rather than directly intervening in the management of firms. Although public institutional investors' opinions and investment propensity affect the asset composition, there is a possibility of the influence of government intervention in corporate management because the government designates the boards of public institutions. Therefore, public institutional investment decisions possibly depend on the government's political goals. In addition, because the government weighs on social responsibility and welfare more than private interests, the impact of government ownership on firms' valuation can be changed, conditional on the magnitude of government ownership. Hence, we will first explore government ownership's effects on firms' valuation based on the National Pension Services' investment data. Our research investigates how domestic policy issues are associated with government ownership and firms' value by focusing on the Government policy of the NPS in 2018 as an active shareholder[1].

Compared to previous studies that provide the negative impact of government ownership on firm performance, this research finds the opposite (positive) result of government ownership on firms' value and performance. On average, firms owned partially by the government have a chance of more valuation in the market than non-government-owned firms. Our research in the Chapter 3 offers that the benefit of government ownership could overcome the costs. The curvilinearity suggests that the price of government ownership goes up. Also, the switched sign of government ownership conditional

[1]In 2018, the Korean government had legislated the Stewardship code for enhancing a role of the NPS. On July 30, 2018, the Fund Management Committee (FMC) of the NPS sanctioned the Principles on Stewardship of the NPS. The purpose of the stewardship code is to provide guidelines for institutional investors with equity holdings in listed firms to exercise their voting rights following the fiduciary duties expected of an asset manager.

on the activism of public institutions implies that government intervention in the market crowds private activity out in the market. This study is closely related to Beuselinck et al. (2017) [12] and Boubakri et al. (2018) [22]. First, we provide identical empirical results that government ownership and firms' value are positively associated. Second, our evidence also supports the curvilinear effects of government ownership on firms' market value (Boubakri et al., 2018 [22]). The main contribution to prior literature is that marginal benefits and costs of government ownership are different conditional on ownership magnitude, but the sum of benefits and costs are homogeneous among government-owned firms. Also, we propose a passive role of government in the market because the activism of public institutions on corporate outcomes via government ownership creates a negative relationship between corporate governance structure and its value.

Our empirical approach faces endogeneity. As noted by Borisova et al. (2015) [21], the government's investment decision will not be randomly selected, and our research has a reverse causality. We consider the concern of selected government investment and test based on empirical strategies (Borisova et al., 2015 [21]; Boubakri et al., 2018 [22]; Chen et al., 2018 [31]). We use the Heckman selection model, endogenous treatment regressions, and DID. These robustness checks propose consistent empirical evidence supporting empirical findings that government ownership positively affects firms' market valuations overall and address its non-linearity and heterogeneous effects conditional on the magnitude of government ownership and policy.

The rest of the paper in the Chapter 3 is arranged as follows. Section 2 provides institutional background on government control and develops our hypotheses based on previous literature. Section 3 describes the sample and empirical strategy. Sections 4 and 5 show results. Section 6 concludes.

3.2 Institutional Background and Hypothesis development

3.2.1 Institutional Background

National Pension Service (NPS) in Korea was founded in 1988 for the obligatory contributions of the Koreans. The NPS launched investment outside of stocks and bonds in 1999 as a conservative investor. Based on 2020 reports of NPS, the NPS owns assets valued at KRW (Korean Won) 834 trillion in KRW (680 billion USD) as of the end of 2020, and is the world's third-largest public pension fund. The NPS invested 176.7 trillion KRW (145 billion USD) in domestic equity at the end of 2020. The reported assets portfolio of NPS shows the NPS owns 21.2% of domestic equity, representing about 7.4% of Korea's total stock market capitalization. Specifically, the total investment of domestic equity is divided into 8.6% (169.8 trillion KRW) for KOSPI[2] and 1.4% (5.4 trillion KRW) for KOSDAQ[3] in terms of total stock market capitalization. Because not only the NPS assets values are larger than the sum of total assets of top10 domestic private institutional investors, but the total investment of domestic equity of the NPS is more eminent than other investors in Korea, the NPS's investment decision can have a massive impact on the domestic capital market.

The issue is the NPS might be highly politicized compared to other institutional funds because government designates the chair and board members. According to the National Pension Act, the Minister of Health and Welfare decides the National Pension Fund Management Committee (FMC) as the final decision maker. Because the NPS plays a significant role in stabilizing and promoting not only public welfare but the national economy, the NPS cannot be free from politics. In other words, due to the NPS's dominant market position in the Korean capital market compared to other investors and its governance structure associated with politics, the primary concern is government's influence on the use of the NPS's voting. This concern is rooted in the fact that the government

[2]The stock market of public traded firms in the Korea exchange, it is representative stock market index of Korea like the S&P500.

[3]The second trading board of Korea exchange benchmarked from NASDAQ,

can control private firms' managerial decisions through NPS's voting. Even if the NPS activism will be supported publicly as a tool for improving firms' corporate governance, opponents of the NPS activism cast doubt on government intervention in the market through the NPS because of the possibility of discouraging the market mechanism. Also, Carney and Child (2013) [28] focus on corporate governance in Esat Asia between 1996 and 2008 and find that the main factor of changes in corporate governance is the political aspect. Therefore, the influence of government controls through the NPS in Korea can provide one East Asia empirical evidence of government ownership.

In 2018 Korean Government allowed the National Pension Service to pursue an active role in corporate governance by legislating the Stewardship Code.This unique economic condition associated with corporate governance gives a chance to shed light on government ownership's impact on a firm's performance is conditional on policy. As Romano (1993) [126] noted, because agents in public pensions operate funds without a personnel incentive to maximize fund valuation, the motivation and effectiveness of public pension might be in line with political issues. Woidtke (2002) [144] also supports that the valuation effect of institutional pension on firms depends on the goal of the institutions' administrations. Woidtke (2002) [144] finds empirical evidence that public pension ownership reduces firm valuation.

However, Boubakri et al. (2018) [22] show that government control yields additional market evaluation to firms in Asia and has non-linear effects. Beuselinck et al. (2017) [12] find that government ownership in Europe during the global financial crisis carries less reduction in firms' value than non-owned. In addition, Wang and Mao (2015) [142] show that the number of politicians in the public pension board is related to the election, social responsibility, and portfolio composition. These empirical researches support the existence of the cost and benefits of government ownership because of the political facet.

Based on these empirical findings, we can argue that government ownership through the Korean National pension fund (NPS) has possible positive and negative impacts on firms' market value and performance. In the next subsection, we develop hypotheses grounded on previous literature on government ownership and firms' value and performance.

Additionally, the role of institutional investors and block holder is still debated. Historically, the definition of blockholder was introduced in the 20th century because institutional investors, such as pension funds and mutual funds, began to play a larger role in the stock market, and their ownership in firms became significant. Recently if institutions have more than 5% of the firm's shares, then they have to file to disclose investment intentions and plans for firms. Even if there is no theoretical reason when 5% is determined as the threshold based on the Williams Act of 1968 in the U.S, 5% was a response to a wave of hostile coercive takeover attempts, primarily cash tender offers. Because Korea adapts the 5% rule based on the U.S case, in Korea there is also theoretical reason why 5% is used for threshold.

Even if there is no theory about 5%, empirical evidence shows that the effect of blockholders in firm using 5%. For example, the incentive alignment hypothesis (Jensen and Meckling (1976) [75] suggest that larger shareholders have great power and a strong incentive to improve shareholder value maximization, but the theoretical evidence between large owners and firm value is still ambiguous. However, because the size of ownership is related to risk-taking, blockholders can provide positive and negative feedback on the firms performance in the market. Negative feedback—blockholder ownership drops following increases in firm value—may occur if blockholders are more inclined to sell shares in a firm when its share price is high. Positive feedback effects from the firm value on blockholder ownership may occur if blockholders have a strong preference to remain in control (the control preference hypothesis), since a higher market price makes it possible to finance a given

level of investment by issuing a smaller amount of stock to outside owners. For these reasons, the effect of blockholder based on 5% is undetermined. However, Bar-Isaac and Shapiro (2020) [10] and Meirowitz and Pi (2022) [103] show the role of blockholder in voting in the firm. Especially, Meirowitz and Pi (2022) [103] show that as the number of shareholders gets large the probability of making the decision that is better for the firm is bounded away from 1 because information aggregation fails. Even if blockholders can not affect the capital market directly, they can influence the market by affecting determining the decision-making of firms.

In addition, blockholders are heterogeneous. They include hedge funds, mutual funds, pension funds, individuals, and other corporations. Each has its own determinants, incentives, and consequences. Most research, however, treats all blockholders as homogenous. In this study, public institutional investors as the agent of government are mainly considered as blockholder in firms. Because public institutional investors can use laws or regulations to enforce their goal to firms compared to other private blockholder, it can give a different signal to the market. Even if private institutional investors have a lower effect on the market, public institutional investors can strongly affect the market. Therefore, in this study, public institutional investors can have a direct effect on the capital market conditional on the size of ownership. Therefore, we investigate the effect of government ownership using NPS investment in firm.

3.2.2 Positive and Negative aspects of Government ownership

The effect of government ownership as a shareholder has a long debate because of the social and market power of the government. Still, previous literature suggests mixed evidence on the market evaluation of government ownership in corporate finance and governance. The prior research shows that government ownership through public pension are politically oriented because the investment of public agents depends on the ideologies or political careers of board members, as Hess and Impavido

(2003) [68], Huang and Xiao (2012) [74], Romano (1993, 1995) [126] [127], Wang and Mao (2015) [142], and Woidtke(2002) [144] noted. Especially, Romano (1993) [126], Wang and Mao (2015) [142] and Hess and Impavido (2003) [68] show that investment decision of public pension reflects board political- and socio- desires and political pressure. Woidtke (2002) [144] and Lee (2015) [89] find empirical evidence that ownership of public agents and its activism reduce firms' performance due to socio- and political- facets. These researches are in agreement with the negative aspects of government ownership because of the rent-seeking of politicians from firms rather than maximizing profits (Shleifer and Vishny, 1994 [133]). Also, in the aspect of crowding private activity out in the market, Firth et al. (2013) [49] find that the high level of Chinese government fiscal intervention decreases market valuation, profitability, and productivity of firms.

Other studies using country-level data provide a similar outcome. For example, Ben-Nasr et al. (2012) [11] estimate the cost of equity based on firms in 38 countries and show increased costs in government ownership. Also, Ben-Nasr et al. (2012) [11] provide empirical findings that the cost of equity is associated with political aspects and government. Borisova et al. (2012) investigate the relationship between government ownership and corporate governance quality in the EU and find that government ownership reduces corporate governance quality when firms are in less protected counties' legal systems. Chen et al. (2017) [30] support that state ownership in the EU is negatively related to firms' investment efficiency. Borisova et al. (2015) [21] find that government ownership in Asia can increase the cost of debt, but its direction depends on economic conditions. These consistent negative empirical findings suggest the following hypothesis for the cost of government ownership in corporate finance:

H1a. Government ownership affects negatively firm value and performance.

On the other hand, the literature that sheds light on the market value of government ownership shows its implicit and explicit benefits conditional on the economic status quo. During the economic recession, the role of government in corporate finance is returned. The government provided liquidity, tax benefits, and other compensations to firms during the financial crisis to assist with financial troubles. This phenomenon is called the soft budget constraint (SBC), as Kornai (1980) [83] and Kornai et al. (2003) [84] noted. Similarly, Beuselinck et al. (2017) [12], Boubakri et al. (2018) [22], and Borisova et al. (2012, 2015) [20] [21] show positive influences of government ownership and controls by focusing on financial cost during financial crisis. These results are consistent with a significant comparative advantage in slacking financial constraints called the Soft Budget because of government ownership. Also, Brown and Huang (2020) [26] use White House visitor data 2009 − 2015 periods and show positive impacts of government on stock returns. Brown and Huang (2020) [26] find that the benefits of government ownership are from access to scarce resources and reallocation through regulations. Cull et al. (2015) [40] find paralleled empirical evidence of the benefits of the government-connected firm using Chinese firms and show that firms with government connections face slackened barriers to accessing financial resources more than others.

By reason of conflict with wealth-maximization, as Shleifer (1998), [135] pointed out, the general aspect of government ownership is negatively associated. However, this study does not consider government ownership's conditional impact, such as institutional quality. The unconditional consequence overlooks the fact that government agents can use block share purchases at a premium to the prevailing market price (Holland 2019 [72]), leading to the misinterpretation of the government's role. Especially, Holland (2019) [72] finds that investors' response is positively related to government investment, and shareholder wealth goes up in the market using 70 countries between 1987 and 2013. Similarly, Boubakri et al. (2018) [22] show that government also wants to raise the value of their

assets corresponding with other large institutional investors, and the government can improve the quality of corporate governance as a growing institutional investor.

Succinctly, the positive influence of government ownership on firm value and performance suggests the next hypothesis:

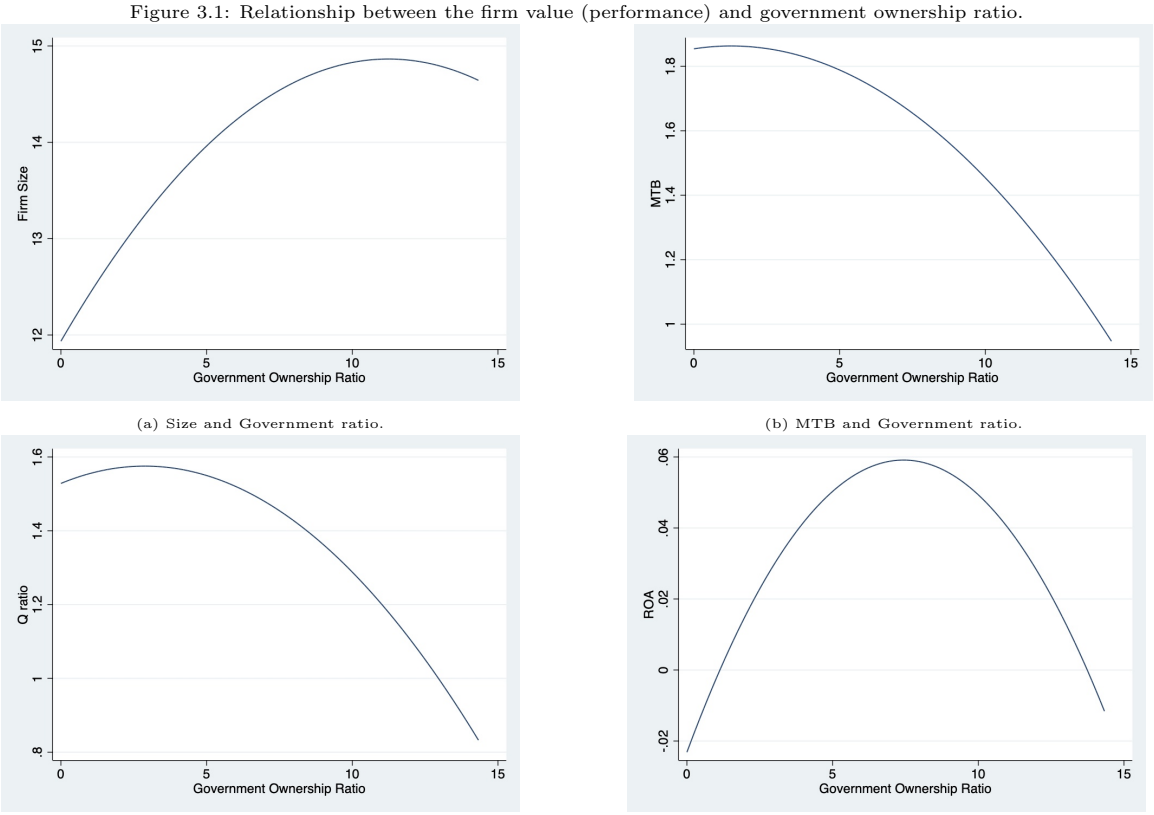
H1b. Government ownership affects positively firms value and performance.

3.2.3 The non-linearity and asymmetric impact of government ownership

Is there such a thing as optimal government ownership in corporate governance? Supply-side economist provides a non-linearity idea about government fiscal policy (tax) and economic performance. Due to the increment of costs (the decrement of benefits) of government ownership in corporate governance, there is a possibility of a non-linear relationship between government ownership and firm valuation (e.g., corporate governance quality declines (Ben-Nasr et al. 2012 [11]) and increases (Borisova et al. 2012 [20])) as government ownership increases. In addition, Holland (2019) [72] classifies types of government and shows that the impact of government ownership depends on the scope of ownership because an enhanced voice guarantees government political purpose in firms. Similarly, Boubakri et al. (2018) [22] and Sun et al.(2002) [137] describe the curvilinear relationship (inverted-U shape) between government ownership and firm market value. Also, Boubakri et al. (2018) [22] exploit the government ownership ratio and its square and show that the government ownership ratio is positively significant and the square term is negatively significant. Boubakri et al. (2018) use 10%, 30%, and 50% as cutoffs of government ownership and provide empirical findings that MTB (Market to Book ratio) is a significantly positive (negative) associated with government ownership from 30% to 50% (above 50%).

Based on Boubakri et al. (2018) [22], we investigate the curvilinearity relationship between a firm

Figure 3.1: Relationship between the firm value (performance) and government ownership ratio.



(a) Size and Government ratio.

(b) MTB and Government ratio.

(c) Q ratio and Government ratio.

(d) ROA and Government ratio.

value(performance) and ownership ratio. Figure 3.1 shows the relationship between government ownership ratio and the firm's values (performance) such as Firm size, Market to Book, Tobin's Q, and ROA. Figure 3.1 suggests the possible non-linearity in this study, as Boubakri et al. (2018) [22] pointed out. Figure 3.1 shows Size starts to decrease around 10%, MTB and Tobin's Q around 3%, and ROA around 8%. Even if empirical turning points depend on measurements for performance and valuations, Figure 3.1 makes this research explore the non-linear effect of government ownership on firm performance and value. We propose the following hypothesis:

H2. The government ownership has non-linear influence on firm value and performance

In addition, we consider a legal financial constraint called the 5% rule based on the Enforcement

Decree of the Financial Investment Services and Capital Markets Act ("FSCMA"). This Act mandates that an investor owning 5% or more stocks issued by KRX-listed firms report to KRX within five business days from the trade date[4]. Due to this legal constraint, the 5% rule is one possible condition to induce heterogeneity in the relationship between government ownership and firm value (performance). We propose the following hypothesis for conditional heterogeneity of government ownership based on the 5% rule:

H3. Government ownership has an homogeneous impact on firm value and performance regardless the 5% rule.

Even if the 5% rule can be the legal constraint to make heterogeneous impact of government ownership on firms, since empirical turning point is around 10% in Figure 3.1.(a), around 3% in Figure 3.1.(b) and (c), and around 8% in Figure 3.1.(d), the trade-off between the costs and benefits of government ownership based on the 5% rule might be undetermined in some cases. Thus, we test whether $< 5\%$, $5\% \geqslant$ and $< 10\%$, and $\geqslant 10\%$ of government ownership have identical marginal effects. We propose two hypotheses for exploring nonidentical marginal impact conditional on the size of government ownership:

H4a. Government ownership have identical marginal impacts on firm performance conditional on $< 5\%$, $5\% \geqslant$ and $<10\%$, and $\geqslant 10\%$.

H4b. Government ownership has nonidentical marginal impacts on firm performance conditional

[4]Article 147 of the Financial Investment Services and Capital Markets Act (FSCMA) requires an investor who holds 5% or more of the total outstanding equity securities of listed firms should file reports about the purpose and status to the Financial Supervisory Commission (FSC) and the Korea Exchange (KRX). This rule is called the 5% rule. This rule protects investors, encourages market transparency, and guarantees majority shareholders defensive actions against hostile takeovers of the target firm.

on $< 5\%$, $5\% \geqslant$ and $<10\%$, and $\geqslant 10\%$.

3.2.4 The policy impact of government ownership

Korean National Assembly allowed the NPS to join the Korean Stewardship Code in July 2018 and guaranteed its active role in the market. Because the Stewardship Code enhances Environmental, Social, and Governmental (ESG) aspects in firms, the Minister of Health and Welfare should consider the ESG and sustainability factors for long-term and stable profits of the fund. Therefore, this Act approved government intervention in the market and enhanced the NPS's monitoring. Kang and Chun (2022) [76] argue that the NPS started to engage with government-owned firms more actively due to the Code. In 2019, the NPS announced voting rights for 96 listed firms in advance and cast opposition voting rights to 46 firms. Because most institutional investors prefer a closed-door dialogue before using their rights, Kang and Chun (2022) [76] argue that the impact of the activism is possibly more influential than officially observed. Therefore, we need to consider two possible impacts of this Code. First, the Code in 2018 allows the NPS to join firm management actively as the institutional investor, as a result this Code can dampen firms' activities in the market. In addition, the activism of the NPS can improve corporate governance quality due to enhanced monitoring. To close this section, we propose the following hypothesis for policy impact in 2018:

H5a. The activism of the NPS has a negative impact of government ownership on firm value and performance.

H5b. The activism of the NPS has a positive impact of government ownership on firms value and performance.

H5c. The activism of the NPS improves the quality of monitoring.

H5d. The activism of the NPS shrinks the quality of monitoring.

3.3 Sample and Empirical strategy

3.3.1 The sample construction and variables

To explore the valuation effects of government ownership, we obtain government ownership data from the National Pension Service in Korea from 2017 to 2020. This data contains information about the ratio of government ownership through the NPS. Because the NPS reports investment amount and ratio of ownership of publicly traded firms in Korea, we match the government ownership data with financial data from Data Analysis, Retrieval and Transfer System (DART) after excluding financial and utility firms based on the Korea Standard Industrial Classification [KSIC] 2 digit codes (35 for the utility industry and 64 −66 for the financial industry) from the sample. We construct a final sample of 7912 firm-year observations representing 2104 firms from 2017 to 2020. Table 3.1 describes the industrial distribution of firms overall and between years based on two digits codes.

Table 3.1: The distribution of public traded firms.

	Overall		Between	
Industry	Frequency	%	Frequency	%
Agriculture, forestry and fishing (01 - 03)	23	0.29	6	0.29
Mining and Quarrying (05 - 08)	8	0.10	2	0.10
Manufacturing (10 - 34)	5262	66.51	1398	66.44
Disposal activities and material recovery (36 - 39)	28	0.35	7	0.33
Construction (41 - 42)	210	2.65	53	2.52
Wholesale and retail trade (45 - 47)	622	7.86	160	7.60
Transportation and storage (49 - 52)	116	1.47	30	1.43
Accommodation and food service (55 - 56)	20	0.25	5	0.24
Information and communication (58 - 63)	934	11.80	254	12.07
Real estate (68)	10	0.13	3	0.14
Professional, scientific and technical activities (70 - 73)	521	6.58	145	6.89
Business management and support (74 - 76)	69	0.87	18	0.86
Education (85)	46	0.58	12	0.57
Arts, sports and recreation services (90 - 91)	39	0.49	10	0.48
Other personal services (94 - 96)	4	0.05	1	0.05
Total	7912	100.00	2104	100.00

Notes: This table describes the distribution of publicly traded firms and between industries in Korea. SIC2 code in parentheses is defined by the Korea standard industry classification (KSIC).

Table 3.2 describes the decomposed distribution of firms based on government ownership by the

fiscal year. Table 3.2 shows that government ownership drastically increased in 2019. We notice that government-owned firms increased from 639 in 2018 to 966 in 2019. Before 2019, the number of government-owned firms was around 33%, but in 2019 almost 47%. This phenomenon supports the increased influence of government on the market. Even if non-government-owned firms are still more than government-owned firms, we can argue that government ownership in Korea might have a massive economic impact on corporate finance and the capital market after 2018. Also, the observed current government ownership is identical to the world phenomenon in terms of "reverse privatization". The main point in Table 3.2 is that the number of government ownership above 5% is almost stable, and the number of firms below 5% baskets is inclined drastically in 2019. Because inclined equity holdings of the NPS are highly dependent on firms in below 5% baskets, we catch that the 5% of rule as a breakpoint might play a key role in Korea's corporate finance and governance.

Table 3.2: Distribution of government ownership among firms by the fiscal years.

Year	Non-Government Ownership	Government Ownership	Ratios	5% <	$\geqslant$ 5% <10%	$\leqslant$ 10%
2017	1,209	644	34.7	403	153	88
2018	1,310	639	32.7	397	167	75
2019	1,084	944	46.5	627	179	90
2020	1,173	909	43.6	675	155	77

Notes: This table reports the number of publicly traded firms from 2017 to 2020 in Korea. Column 2 shows the number of non-government ownership, and Column 3 shows the number of government ownership. Column 4 is the government ownership ratio, and Column 5(6 and 7) is the numbers of government ownership below 5% (from 5% to 10% and above 10%).

Measuring firm's market value and performance

Based on previous literature (Boubakri et al.,2018 [22]; Chen et al.,2020 [32]), we exploit firm value using MTB, where the market value of assets over the book value of assets, and Tobins' Q (Firth et al.,2013 [49]; Ravid and Sekerci, 2020 [124]; Woidtke, 2002 [144]) where the sum of the market value of equity plus the book value of total liabilities over the book value of assets. Those two variables reflect market-based measurement. Due to considering industrial characteristics, we use industry-median adjusted Tobin's Q as the dependent variable. For performance, we use ROA (Firth et al., 2013 [49]; Ding et al., 2018 [44]), where net income to total assets, and stock returns. Stock

returns capture market reaction to government ownership, and ROA indicates historical account base performance. We use market and account measurements both. Thus, our independents will capture market-oriented firms' reactions to expectation aspects and firms' responses in accounting.

Table 3.3: Descriptive Statistics.

Variables	N	Mean	SD	Min	Max
ROA	6,386	-0.006	0.118	-0.528	0.206
Returns	7,560	-0.027	0.458	-1.509	1.417
MTB	6,372	1.814	1.909	0	10.888
Tobin's Q	6,372	1.442	1.050	0.436	6.296
Gov-Own	7,912	0.395	0.489	0	1
Gov-Own0	7,912	0.271	0.444	0	1
Gov-Own5	7,912	0.125	0.330	0	1
Gov-Own5-10	7,912	0.082	0.275	0	1
Gov-Own10	7,912	0.042	0.201	0	1
GovRatio	7,912	1.540	3.075	0	14.33
GovRatio0	7,912	0.438	1.036	0	4.99
GovRatio5	7,912	1.102	3.057	0	14.33
GovRatio5-10	7,912	0.605	2.055	0	9.99
GovRatio10	7,912	0.496	2.393	0	14.33
Salesgrowth	6,367	6.844	32.41	-61.70	165.31
Leverage	6,386	10.84	9.834	0	45.10
CF	6,367	3.555	7.425	-20.82	21.96
Size	6,386	12.50	1.489	9.994	17.220
Tangibility	6,386	0.495	0.180	0.092	0.882
Loss	7,912	0.284	0.451	0	1

Notes: This table presents a description of the sample's regression variables, consisting of 2104 firms and 7912 observations over the 2017 − 2020 period. The definition of those variables is in the Appendix A2.1.

Measuring government ownership

We exploit mainly two government ownership variables. The first variable is the Gov-own dummy. The variable is 1 if the government has firm(i)'s share and 0 otherwise. We split the Gov-own dummy into Gov-own0 and Gov-own5 dummy based on the magnitude of government ownership due to 5% rule. Gov-own0 is 1 if $0 \leqslant$ government ownership $<5\%$, Gov-own5 is 1 if government ownership $\geqslant 5\%$, and 0 otherwise. For further investigation, we use additionally separated dummies. Govown5-10 is 1 if $5\% \leqslant$ government ownership $<10\%$, Gov-own10 is 1 if government ownership $\geqslant 10\%$, and 0 otherwise. The second variable is the GovRatio, and it is the continuous variable. We make GovRatio0, 5, 5-10, and 10 for different government ownership ratios by following the Gov-Own0, 5, 5-10, and 10 approaches. To capture the non-linearity, we use the square term of ratio defined as GovRatiosq. GovRatiosq0 (5, 5-10, and 10) is the square therm of GovRatio0 (5, 5-10, and 10).

Measuring firm's characteristics

We control for Sales Growth, the difference natural logarithm of sale t and $t-1$; Size, the natural logarithm of total assets; Tangibility, the ratio of tangible assets to total assets; Leverage, the ratio of long-term debt to total assets; CF, operating cashflow to total assets times 100; Loss, an indicator variable if net income is negative; and Conglomerate, an indicator variable if firm belongs in a family-oriented conglomerate.

3.3.2 Empirical strategy

We use a reduced fixed effect framework for identification. Our research focuses on a firm's performance and value in response to government ownership. The main estimable model is as follows

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 Govown_{it} + \tau_i + t_t + \epsilon_{it} \tag{3.1}$$

where Y_{it} is the ROA, Returns, MTB, and TobinQ; $GovOwn_{it}$ is the proxy variables for government ownership discussed above, X_{it} includes the firm's financial characteristics, such as Size, Tangibility, Leverage, CF, Loss of income and Conglomerate. τ captures an unobserved firm-specific fixed effect, t_t is a year fixed effect, and the last term ϵ_{it} is the error term.

3.4 Results

3.4.1 Effect of Government Ownership: The base result

We operate univariate tests first. We do not include firms' specific characteristics but Government ownership dummies (Gov-Own, Gov-Own0, Gov-Own5, Gov-Own5-10, and Gov-Own10), government ownership ratio (GovRatio, GovRatio0, GovRatio5, GovRatio-10, and GovRatio10), square term of government ownership ratios, and firm and year fixed effects. Table 3.4 shows the

results of the Government Ownership dummies and marginality test. We find that Gov-Own has positive effects on MTB and Tobin's Q in Panel A. Specifically, Gov-Own has a significantly positive impact on MTB in Column (3) and Tobin's Q in Column (4) at 1% levels. However, we do not find a statically significant impact on ROA in Column (1), Returns in Column (2), and industry-median adjusted Q in Column (5). These empirical results suggest that government ownership influences firms' market valuation

Table 3.4: Effect of Government Ownership: Base result.

Panel A	ROA	Returns	MTB	Tobin's Q	Adj Q
Gov-Own	0.004	0.026	0.237***	0.148***	0.101
	(0.003)	(0.023)	(0.054)	(0.026)	(0.074)
Observations	6,386	7,560	6,372	6,372	6,372
R-squared	0.010	0.097	0.039	0.059	0.018
F-test	9.897	134.9	50.05	75.21	34.17
Panel B					
Gov-Own0	0.004	0.021	0.232***	0.146***	0.098
	(0.003)	(0.023)	(0.054)	(0.026)	(0.075)
Gov-Own5	0.013**	0.107***	0.403***	0.232***	0.221**
	(0.005)	(0.039)	(0.096)	(0.046)	(0.085)
Observations	6,380	7,554	6,366	6,366	6,366
R-squared	0.010	0.097	0.040	0.060	0.007
F-test	8.645	108.9	41.03	60.98	11.24
P-value $\beta_1 = \beta_2$	0.083*	0.010**	0.043**	0.029**	0.017**
Panel C					
Gov-Own0	0.004	0.021	0.230***	0.145***	0.097
	(0.003)	(0.023)	(0.054)	(0.026)	(0.075)
Gov-Own5-10	0.014**	0.097**	0.378***	0.221***	0.210**
	(0.005)	(0.040)	(0.097)	(0.047)	(0.086)
Gov-Own10	0.009	0.176***	0.552***	0.298***	0.285***
	(0.007)	(0.055)	(0.114)	(0.053)	(0.088)
Observations	6,380	7,554	6,366	6,366	6,366
R-squared	0.010	0.098	0.041	0.061	0.007
F-test	7.391	90.77	34.60	51.01	10.39
$\beta_1 = \beta_2 = \beta_3$	0.055*	0.007***	0.011**	0.008***	0.003***
$\beta_1 = \beta_2$	0.048**	0.028**	0.085***	0.061**	0.033**
$\beta_1 = \beta_3$	0.711	0.025**	0.003***	0.002***	0.001***
$\beta_2 = \beta_3$	0.182	0.008***	0.030**	0.045**	0.058**

Notes: This table shows the univariate regression results for the relationship between Government Ownership and a firm's value and performance. ROA is the returns of total assets, Returns are the stock returns, MTB is market to book value, Q (for Tobin's Q) measures market valuation, and Adj Q is industry-median adjusted Q. Gov-Own is 1 if the government has firms' shares, and 0 otherwise. Gov-Own0 is 1 if the government owns $< 5\%$, Gov-Own5 is 1 if the government owns $\geqslant 5\%$, Gov-Own5-10 is 1 if $5 \leqslant$the government owns $< 10\%$, Gov-Own10 is 1 the government owns $\geqslant 10\%$, and 0 otherwise. All variables in levels are measured at the end of each year and are defined in appendix A2.1. Financial and utility firms are excluded. Firms' characteristics are excluded, and fixed effects are included. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Due to financial regulation called the 5% rule, we split the Gov-Own dummy into Gov-Own0 ($<5\%$) and Gov-Own5 ($\geqslant 5\%$) and test whether the impacts of Government ownership on firm values and performance difference in the market. Panel B in Table 3.4 shows that Gov-Own0 ($<5\%$) is significantly positive at 1% levels in Column (3) for MTB and in Column (4) for Tobin's Q, and these results are the same as the Panel A results. Gov-Own5 ($\geqslant 5\%$) shows a significant positive

relationship in all Columns. To be specific, if the government owns the firms' share $\geqslant 5\%$, the firm performance in terms of ROA at 5% level and Returns at 1% level and market values in terms of MTB and Tobin's Q (Adj Q at 5% level) at 1% levels significantly increase. The reported marginality test accepts different intercepts, and the magnitude of coefficients of Gov-Own5 (0.40 for MTB) is larger than Gov-Own0 (0.23 for MTB). Overall, as a stakeholder, government ownership increases firms' market value compared to non-government-owned firms and gives different marginal benefits conditional on ownership range.

Even if the 5% rule is the base criteria legally, Figure.3.1 suggests heterogeneous inflection points. The observed non-linearity of government ownership implies the cost of government ownership. Therefore, we split the Gov-Own5 dummy into Gov-Own5-10 ($\geqslant$5% and <10%) and Gov-Own10 ($\geqslant$10%) for studying the negative relationship between government ownership and firms' performance and value conditional on the magnitude of ownership. Panel C in Table 3.4 indicates that Gov-Own5-10 has positive effects on all columns, the same as in Panel B. ROA, Return, and Adj Q at 5% levels and MTB and Tobin's Q at 1% levels are positively significant. Gov-Own10 is also significantly positive at 1% levels in Returns, MTB, Tobin's Q, and Adj Q. The test for the different intercepts is not rejected in the market base measurements overall. These results confirm the different marginal benefits of government ownership for market-oriented firms' performance and valuations.

For further testing, we use the ownership ratio and its square term to capture the non-linearity effect of the government ownership ratio and explore the impact of the government ownership ratio conditional on the 5% rule. Table 3.5 in Panel A shows that GovRatio increases market-based firms' values and performance, and the square term reduces market value. We confirm the non-linearity hypothesis. Especially, GovRatio has positive effects on firm value in terms of MTB, Tobin's Q, and Adj Q at 1% levels in Columns (3), (4), and (5) and on performance in terms of Returns at 5% level in

Table 3.5: Curvilinear Effect of Government Ownership: base result.

Panel A	ROA	Returns	MTB	TobinQ	Adj TobinQ
GovRatio	0.003	0.028**	0.121***	0.079***	0.090***
	(0.001)	(0.011)	(0.024)	(0.015)	(0.019)
GovRatiosq	-0.000	-0.001	-0.005***	-0.004***	-0.004***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Observations	6,381	7,556	6,367	6,367	6,367
R-squared	0.010	0.098	0.041	0.061	0.008
F-test	8.260	108.8	44.22	61.79	11.45
P-value $\beta_1 + \beta_2 = 0$	0.096*	0.012**	0.000**	0.000***	0.000***
Panel B					
GovRatio0	-0.001	0.063**	0.209***	0.137***	0.169***
	(0.004)	(0.026)	(0.059)	(0.030)	(0.049)
GovRatio0sq	0.000	-0.011*	-0.024*	-0.015**	-0.022**
	(0.000)	(0.005)	(0.013)	(0.007)	(0.010)
GovRatio5	0.003**	0.030**	0.102***	0.064***	0.076***
	(0.001)	(0.012)	(0.024)	(0.014)	(0.017)
GovRatio5sq	-0.0002**	-0.001	-0.004**	-0.002***	-0.003***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)
Observations	6,381	7,556	6,367	6,367	6,367
R-squared	0.010	0.098	0.041	0.063	0.009
F-test	6.426	78.29	31.77	45.12	8.599
$\beta_1 = \beta_3$	0.221	0.209	0.052*	0.011**	0.039**
$\beta_2 = \beta_4$	0.307	0.105**	0.116	0.073*	0.077*
$\beta_1 + \beta_2 = 0$	0.932	0.012**	0.000***	0.000***	0.000***
$\beta_3 + \beta_4 = 0$	0.018	0.012**	0.000***	0.000***	0.000***
$\beta_1 + \beta_2 = \beta_3 + \beta_4$	0.207	0.260	0.045**	0.007**	0.034**
Firm & Year FE	Yes	Yes	Yes	Yes	Yes
Firm Characteristics	No	No	No	No	No

Notes: This table shows the univariate regression results for the relationship between Government Ownership Ratio and the firm's value and performance. ROA is the returns of total assets, Returns is the stock returns, MTB is market to book value, Q (for Tobin's Q) measures market valuation, and Adj Q is industry-median adjusted Q. GovRatio is the amount of share owned Government. GovRatio0 is GovRatio if Govratio$<$5%, GovRatio5 is GovRatio if GovRatio$\geqslant$5%, GovRatio5-10 is GovRatio if 5$\leqslant$GovRatio$<$10%, GovRatio10 is GovRatio if GovRatio$\geqslant$10%, and 0 otherwise. GovRato(i)sq and GovRatio(i)sq are the square terms of GovRatio5-10 and 10. Results that include GovRatio5-10, GovRatio10, and square terms are reported in Appendix A2.1. Financial and utility firms are excluded. Firm characteristics are excluded. Firm and year-fixed effects are included. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Column (2). The square term diminishes firms' market values in terms of MTB, Tobin's Q, and Adj Q at 1% levels in Columns (3), (4), and (5). This findings are opposite with Woidtke(2002) [144] but empirically identical to Boubakri et al. (2018) [22]. In addition, the test for $GovRatio + GovRatiosq$ supports that the benefits of government ownership overcome its costs.

As we noted inverted U shape in Figure.3.1 and signs of GovRatio square term in Panel A, GovRatio may lead to different impacts on firms' value conditional on its range due to the 5% rule. We use the split Ratio variable into GovRatio0, GovRatio5, GovRatio5-10, and GovRatio10 (variables' description is in Appendix A2.). We find dummies have increased coefficients when government ownership increases in Table 3.4, but dummies may have an upper biased because Figure.3.1 suggests an inclined slope if GovRatio is in $< 5\%$ or $< 8\%$ and declines in other ranges. Even if Gov-Own dummies support that more government ownership is better in the market valuation, the marginal effect of the percentage changes in GovRatio provides a more precise relationship between firms'

market valuation and government ownership. We expect reduced bias for the impact of government ownership.

Panel B in Table 3.5 accepts a positive effect of government ownership and a non-linear effect regardless of the 5% rule. Panel B in Table 3.5 accepts a positive effect of government ownership and a non-linear effect regardless of the 5% rule. Precisely, GovRatio0 and GovRatio5 have a positive impact on Returns at 5% levels in Column (2) and MTB, Tobin's Q, and Adj Q at 1% levels in Columns (3), (4), and (5). Noteworthy, the coefficients of GovRatio5 are not similar to the results of Gov-Own5. GovRatio0 and GovRatio5 indicate that the magnitude of coefficients shrinks when the government ownership ratio goes up (but both are still positive). The declined coefficient of GovRatio5 supports the cost of government ownership because the possibility of government intervention in firm management enlarges conditional on the 5% rule. Also, square terms show the lessened negative magnitude of coefficients when the ratio increases, implying the diminishing marginal cost. Overall, empirical findings advocate the benefits of government ownership in the market, non-linearity, and diminishing marginal benefits and costs.

Tests for different marginal effects of coefficients in Panel B of Table 3.5 support that GovRatio0 and GovRatio5 are unequal in MTB and Tobins' Q (Adj Q), and squares are unequal in Returns and Tobins' Q (Adj Q). These results accept different curvatures of benefits and costs of government ownership conditional on the 5% rule. A further coefficients test based on the 5% rule support that government ownership ratio $< 5\%$ gives more advantage to firms' market-based value and performance because $\beta_1 = \beta_2$ is rejected (coefficient of GovRatio0 is larger than GovRatio5). Also, most of the benefits overcome the costs due to rejected sum of $\beta_{1(3)} + \beta_{2(4)} = 0$. These empirical findings support that even if there are disproportional marginal benefits and costs of government ownership due to the decreased its margin, firms enjoy more the benefits of government ownership.

Also, we propose one reason why the government as a large shareholder can reduce the quality of corporate governance by discouraging private active due to intervention in management (declined coefficients if the firm owned $\geqslant 5\%$).

Table 3.6: Univariate test for non-linearity.

	ROA	Returns	MTB	TobinQ	Adj Q
GovRatio0	-0.001	0.063**	0.211***	0.139***	0.171***
	(0.004)	(0.026)	(0.059)	(0.030)	(0.049)
GovRatio0sq	0.000	-0.011*	-0.024*	-0.015**	-0.022**
	(0.000)	(0.005)	(0.013)	(0.007)	(0.010)
GovRatio5-10	0.002	0.044**	0.152***	0.096***	0.115***
	(0.002)	(0.019)	(0.042)	(0.024)	(0.028)
GovRatio5-10sq	-0.000	-0.003	-0.011**	-0.007***	-0.008***
	(0.000)	(0.002)	(0.004)	(0.002)	(0.002)
GovRatio10	0.003	0.057***	0.118***	0.061***	0.061***
	(0.002)	(0.022)	(0.042)	(0.020)	(0.021)
GovRatio10sq	-0.000	-0.003**	-0.005	-0.002*	-0.002
	(0.000)	(0.001)	(0.003)	(0.001)	(0.001)
Observations	6,381	7,556	6,367	6,367	6,367
R-squared	0.011	0.099	0.042	0.064	0.009
F-test	5.085	61.11	25.04	35.65	7.493
$\beta_1 = \beta_3$	0.431	0.517	0.333	0.202	0.227
$\beta_1 = \beta_5$	0.290	0.842	0.175	0.022**	0.028**
$\beta_3 = \beta_5$	0.657	0.641	0.567	0.249	0.107
$\beta_2 = \beta_4$	0.441	0.227	0.298	0.244	0.196
$\beta_2 = \beta_6$	0.315	0.210	0.154	0.071*	0.064*
$\beta_4 = \beta_6$	0.531	0.973	0.343	0.147	0.066*
$\beta_1 + \beta_2 = 0$	0.915	0.012**	0.000***	0.000***	0.000***
$\beta_3 + \beta_4 = 0$	0.314	0.020**	0.000***	0.000***	0.000***
$\beta_5 + \beta_6 = 0$	0.135	0.008***	0.004***	0.001***	0.003***
$\beta_1 + \beta_2 = \beta_3 + \beta_4$	0.437	0.625	0.358	0.206	0.248
$\beta_1 + \beta_2 = \beta_5 + \beta_6$	0.298	0.962	0.195	0.020**	0.025**
$\beta_3 + \beta_4 = \beta_5 + \beta_6$	0.661	0.608	0.596	0.264	0.114
Firm & Year FE	Yes	Yes	Yes	Yes	Yes
Firm Characteristics	No	No	No	No	No

Notes: This table indicates results for the relationship between Government Ownership and a firm's value and performance. ROA is the returns of total assets, Returns are the stock returns, MTB is market to book value, Q (for Tobin's Q) measures market valuation, and Adj Q is industry-median adjusted Q. Ratio0, Ratio5-10, Ratio10, and squares are divided variable of ratio based on ranges (0% to 5%, 5% to 10%, and above 10%). All variables in levels are measured at the end of each year and are defined in Appendix A2.1. Leverage is winsorized at the 1% and 99% levels. Financial and utility firms are excluded. Firm and year-fixed effects are included., but firm characteristics are excluded. Constants and firm characteristics are not reported. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Table 3.6, using more separated ratios, also supports a positive association between government ownership and firms' market-based performance and values and the non-linearity. GovRatio0, 5-10 and 10 significantly positively affect Returns, MTB, and Tobin's Q (Adj Q). These results support that government ownership positively signals investors' perception of market-oriented performance and valuations rather than accounting measurement. The inverted-U relationship is less significant when the Government ownership ratio increases. Specifically, GovRatio0sq significantly decreases Returns, MTB, and Tobin's Q(Adj Q), and GovRatio5-10sq significantly decreases MTB and Tobin's Q(Adj Q). GovRatio10 significantly reduces Returns and Tobin's Q. Unlike Govratio variables; we

find that square terms affect market performance and valuations differently.

The prior test support that overall coefficients of GovRatio, Gov-Own, and square terms have not identical curvature and declined marginal effects when government ownership increased. But the coefficients test in Table 3.6 shows that most of the tests accept identical effects of GovRatio and squares regardless of their ranges. The different marginal effects of GovRatio0 and GovRatio10 and those squares are only significant in Tobins' Q partially. Even if the estimated coefficients of GovRatio and squares conditional on its ranges show declined tendency when government ownership increases, its impact is homogeneous, and its margins are not diminishing in response to the ownership ratio. Also, test $\beta_{1(3,5)} + \beta_{2(4,6)} = 0$ for the sum of costs and benefits shows the benefits are larger than the costs. Test for the heterogeneous effect of $\beta_{1(3)} + \beta_{2(4)} = \beta_{3(5)} + \beta_{4(6)}$ show an overall identical benefits effects of government ownership among the firms regardless of the range of government ownership ratios to government owned-firms.

To sum up, there is a non-linear (inverted-U) relationship between government ownership and firms' values and performances, and the overall impact of government ownership is significantly positive. The size of impacts declines conditional on the range of ratio. Maybe the 5% rule as one of the government policies raises the cost of government ownership. Even if the costs of government ownership (negative signs of square terms and reduced magnitude of ratios' coefficients) discourage market activities, the benefits overwhelm the costs.

In the next section, we investigate further by including firms' specific characteristics to confirm the findings of univariate tests and reduce omitted variables bias.

3.4.2 Effect of Government Ownership: The main result

Because prior results support the positive impact of government ownership, non-linearity, and different marginal effects, we include firms' specific characteristics in this section. Table 3.7 reports

the consistent results of dummies regardless of firm-specific characteristics. Specifically, in Table 3.7, Gov-Own0, Gov-Own5, and Gov-Own10 do not affect ROA but significantly increase Returns as market performance and MTB and Tobin's Q(Adj Q) as market valuations. This evidence supports the positive influence of the government as a shareholder. Results in Table 3.7 are paralleled with the previous findings, and we confirm the benefits of government ownership based on positive coefficients of dummies. Also, in Tables 3.7 we reject $\beta_{1(2)} = \beta_{2(3)}$ overall empirically. The coefficient test supports different marginal benefits of government ownership for market-oriented performance (Returns) and valuations (MTB, Tobin's Q, and Adj Q). As we noted, even if we find a positive effect of government ownership dummies and its different marginal effects among firms, those results can not capture the precise impacts of increased government ownership % on a firm's valuation and performance. Therefore, we explore further using ratio variables and square terms.

Table 3.7: Effect of Government Ownership : Main Result.

	ROA	Returns	MTB	TobinQ	Adj Q	ROA	Returns	MTB	TobinQ	Adj Q
GovOwn0	-0.001	0.017	0.226***	0.146***	0.095	-0.001	0.016	0.223***	0.145***	0.0949
	(0.002)	(0.026)	(0.053)	(0.026)	(0.072)	(0.003)	(0.026)	(0.053)	(0.026)	(0.072)
GovOwn5	-0.000	0.097**	0.438***	0.258***	0.235***					
	(0.004)	(0.041)	(0.092)	(0.044)	(0.084)					
GovOwn5-10						0.000	0.084**	0.411***	0.246***	0.223***
						(0.004)	(0.042)	(0.092)	(0.045)	(0.085)
GovOwn10						-0.006	0.161***	0.580***	0.325***	0.301***
						(0.005)	(0.054)	(0.112)	(0.051)	(0.089)
Conglomerate	-0.007	-0.051	-0.064	-0.068	-0.047	-0.007	-0.052	-0.066	-0.069	-0.048
	(0.007)	(0.064)	(0.110)	(0.049)	(0.048)	(0.007)	(0.064)	(0.110)	(0.049)	(0.048)
Salesgrowth	0.0003***	0.001***	0.002***	0.001***	0.000	0.0003***	0.001***	0.002***	0.001***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Size	0.053***	0.024	-0.571***	-0.414***	-0.307**	0.053***	0.024	-0.572***	-0.414***	-0.307**
	(0.009)	(0.044)	(0.131)	(0.064)	(0.129)	(0.009)	(0.044)	(0.131)	(0.064)	(0.129)
Tangibility	-0.037*	-0.245*	-1.210***	-0.675***	-0.909***	-0.037*	-0.247**	-1.213***	-0.676***	-0.910***
	(0.022)	(0.125)	(0.314)	(0.157)	(0.339)	(0.022)	(0.125)	(0.314)	(0.157)	(0.339)
Leverage	-0.001***	0.000	0.020***	0.003**	0.0141	-0.001***	0.000	0.020***	0.003**	0.014
	(0.000)	(0.001)	(0.004)	(0.001)	(0.008)	(0.000)	(0.001)	(0.004)	(0.001)	(0.008)
OCF	0.003***	0.004**	0.009	0.004	0.004	0.003***	0.004**	0.009	0.004	0.004
	(0.000)	(0.001)	(0.005)	(0.002)	(0.008)	(0.000)	(0.001)	(0.005)	(0.002)	(0.008)
Loss	-0.095***	-0.112***	0.113***	0.005	-0.026	-0.095***	-0.112***	0.113***	0.005	-0.025
	(0.003)	(0.019)	(0.042)	(0.021)	(0.041)	(0.003)	(0.019)	(0.042)	(0.021)	(0.041)
Observations	6,367	6,171	6,353	6,353	6,353	6,367	6,171	6,353	6,353	6,353
R-squared	0.335	0.132	0.070	0.100	0.017	0.335	0.132	0.071	0.100	0.017
F-test	112.7	49.72	20.93	30.23	7.019	104.1	45.92	19.54	28.02	6.916
P-value $\beta_1 = \beta_2$	0.815	0.024**	0.006***	0.002**	0.004***	0.615	0.058*	0.016**	0.007***	0.010**
P-value $\beta_1 = \beta_3$						0.333	0.004***	0.000***	0.000***	0.000***
P-value $\beta_2 = \beta_3$						0.095*	0.093*	0.021**	0.022**	0.038**
Firm FE & Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table indicates the relationship between Government Ownership and a firm's value and performance. ROA is the returns of total assets, Returns are the stock returns, MTB is market to book value, Q (for Tobin's Q) measures market valuation, and Adj Q is industry-median adjusted Q. Variables in levels are measured at the end of each year and are defined in appendix A2.1. Leverage is winsorized at the 1% and 99% levels. Financial and utility firms are excluded. Firm and year-fixed effects are included. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Table 3.8 indicates the results of GovRatio and square term and shows the benefits of government ownership and the inverted-U shape. We confirm significantly positive associations between

GovRatio and market base values (MTB and Tobins'Q (Adj Q)) and performance (Returns), but negatively associated with accounting performance (ROA) in Table 3.8. The curvilinearity (inverted-U) relationship is significant for market values (MTB, Tobin's Q, and Adj Q). We can argue that government ownership positively affects market-based evaluations, even if we detect a negative impact of the government ownership ratio on ROA. ROA relies relatively more on accounting and historical firms' performance rather than market expectations. On the other hand, Returns, MTB, and Tobin's Q reflect the recognition of investors in response to government ownership. Because market-oriented measurements contain the expectation of investors, results in Table 3.8 show investors' positive reactions in response to government ownership in the market. But, ROA would be negatively related to government ownership due to its different characteristics.

Table 3.8: Curvlinear Effect of Government Ownership : Main Result.

	ROA	Returns	MTB	Tobin's Q	Adj Q
GovRatio	-0.002*	0.020*	0.134***	0.088***	0.096***
	(0.001)	(0.012)	(0.024)	(0.015)	(0.019)
GovRatiosq	0.000	-0.000	-0.006***	-0.004***	-0.005***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Conglomerate	-0.007	-0.056	-0.099	-0.090*	-0.070
	(0.007)	(0.064)	(0.110)	(0.049)	(0.049)
Salesgrowth	0.0003***	0.001***	0.002***	0.001***	0.0008
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Size	0.054***	0.023	-0.580***	-0.421***	-0.316**
	(0.009)	(0.045)	(0.131)	(0.064)	(0.129)
Tangibility	-0.036	-0.246**	-1.222***	-0.687***	-0.914***
	(0.022)	(0.125)	(0.314)	(0.158)	(0.335)
Leverage	-0.001***	0.0004	0.020***	0.003**	0.0143*
	(0.000)	(0.001)	(0.004)	(0.001)	(0.008)
OCF	0.003***	0.004**	0.009	0.004	0.004
	(0.000)	(0.001)	(0.005)	(0.002)	(0.008)
Loss	-0.095***	-0.113***	0.119***	0.009	-0.0219
	(0.003)	(0.019)	(0.042)	(0.021)	(0.042)
Observations	6,362	6,167	6,348	6,348	6,348
R-squared	0.335	0.132	0.071	0.102	0.019
F-test	113.2	49.07	22.61	30.51	8.122
Firm & Year FE	Yes	Yes	Yes	Yes	Yes

Notes: This table indicates the relationship between Government Ownership and a firm's value and performance. ROA is the returns of total assets, Returns is the stock returns, MTB is market to book value, Q (for Tobin's Q) measures market valuation, and Adj Q is industry-median adjusted Q. GovRatio is the amount of firm(i)'s share owned the Government and GovRatiosq is the GovRatio's square term. All variables in levels are measured at the end of each year and are defined in Appendix A2.1. Leverage is winsorized at the 1% and 99% levels. Financial and utility firms are excluded. Firm and year-fixed effects are included. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

When we consider the 5% rule, previous results show the decrements in the magnitude of GovRatio5 compared to GovRatio0 when the government ownership ratio increases. Thus, we provide empirical evidence by including firms-specific variables and fixed effects in Table 3.9. When we

control firms specific characteristics such as Size, Tangibility, Leverage, CF, Loss, and Conglomerate, GovRatio0 has a significant negative impact on ROA in Column (1), but not GovRatio10 in Table 3.9. Table 3.9 shows the significant positive associations between government ownership ratios (GovRatio0 and GovRatio5) and Returns, MTB, and Tobin's Q(Adj Q). We confirm the negative influence on accounting performance and the positive influence on market base measurements. We also find the empirically declined size of coefficients of Ratios conditional on the 5 % rule. Specifically, GovRatio0 is 0.05 for Returns in Column (2) (0.20 for MTB in Column (3) and 0.14 for Tobin's Q in Column (4)), and GovRatio5 is 0.02 for Returns in Column (2) (0.11 for MTB in Column (3) 0.07 for Tobin's Q in Column (4)). The coefficients test ($\beta_1 = \beta_3(GovRatio0 = GvoRatio5)$) in Table 3.9 support more benefits for low government ownership based on the 5% in Returns, MTB, and Tobin's Q significant. These significant decrements in GovRatio5 support the disproportional positive impact of government ownership. In other words, the firms' cost of government ownership goes up due to increased government ownership. We find in Table 9 significantly negative coefficients of Ratiosq0 in Returns in Column (2), Tobin's Q in Column(4), Adj Q in Column(5), and Ratiosq5 in MTB in Column (3), and Tobin's Q in Column (4), Adj Q in Column (5) indicates that the government ownership has a curvilinearity on market-oriented firms' valuation and performance. The coefficients test ($\beta_2 = \beta_4(GovRatiosq0 = GvoRatiosq5)$) are almost accepted. In terms of burden, the marginal effect of squares is identical conditional on the 5%. Additionally, the costs and benefits analysis ($\beta_{1(3)} + \beta_{2(4)} \neq 0$) support that benefits is larger than costs ($\beta_{1(3)} + \beta_{2(4)} > 0$ is accepted), and more benefits for the firm owned $< 5\%$ ($\beta_1 + \beta_3 > \beta_2 + \beta_4$ is accepted). These findings empirically propose a positive market reaction of government ownership and diminishing marginal benefits if firms owned more than 5%.

Also, we detect similar patterns with more divided Ratio variables. GovRatio0,5-10 and 10 have

positive effects on market-oriented measurements(Returns, MTB, and Tobin's Q(Adj Q)), and their impacts decline when GovRatio increases. Thus, there are positive associations between government ownership and market-oriented firm valuations and performance, not accounting performance (ROA). Disproportional marginal the benefits ($\beta_{1(3)} = \beta_{3(5)}$) of government ownership are valid in Tobin's Q (Adj Q) but rejected overall in Table 3.9 with more divided Ratio variables. Square terms are significantly negative in market-based measurements (Returns, MTB, Tobin's Q, and Adj Q), and the show declined size conditional on ranges of government ownership. Coefficients for squares ($\beta_{2(4)} = \beta_{4(6)}$) show that we accept different marginal effect only for Tobin's Q ($\beta_{2(4)} = \beta_{4(6)}$ are almost rejected.). Therefore, we can confirm burden and fruits of government ownership in corporate governance has a proportional tendency with divided Ratio variables. But $\beta_{1(3,5)} + \beta_{2(4,6)} \neq 0$ support that benefits of government ownership overcome the costs even if benefits convert into burdens as government control is enhanced due to its nonlinearity. In addition, $\beta_{1(3)} + \beta_{2(4)} = \beta_{3(5)} + \beta_{4(6)}$ support overall effects of costs and benefits are identical.

Table 3.9: Separated Curvlinear Effect of Government Ownership : Main Result.

	ROA	Returns	MTB	TobinQ	Adj Q	ROA	Returns	MTB	TobinQ	Adj Q
GovRatio0	-0.007**	0.055*	0.206***	0.146***	0.167***	-0.008**	0.055*	0.209***	0.148***	0.169***
	(0.003)	(0.02)	(0.059)	(0.030)	(0.048)	(0.003)	(0.028)	(0.059)	(0.030)	(0.048)
GovRatiosq0	0.001	-0.011*	-0.021	-0.016**	-0.020*	0.001	-0.010*	-0.021	-0.016**	-0.020*
	(0.000)	(0.006)	(0.013)	(0.007)	(0.010)	(0.000)	(0.006)	(0.013)	(0.007)	(0.010)
GovRatio5	-0.001	0.023*	0.118***	0.074***	0.082***					
	(0.001)	(0.012)	(0.025)	(0.014)	(0.017)					
GovRatio5sq	0.000	-0.001	-0.005***	-0.003***	-0.003***					
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)					
GovRatio5_10						-0.003	0.035*	0.180***	0.111***	0.125***
						(0.002)	(0.020)	(0.041)	(0.024)	(0.027)
GovRatio5_10sq						0.000	-0.002	-0.013***	-0.008***	-0.009***
						(0.000)	(0.002)	(0.004)	(0.002)	(0.002)
GovRatio10						-0.001	0.050**	0.129***	0.066***	0.064***
						(0.002)	(0.021)	(0.043)	(0.020)	(0.021)
GovRatio10sq						-0.000	-0.003*	-0.005*	-0.002*	-0.002
						(0.000)	(0.001)	(0.003)	(0.001)	(0.001)
Observations	6,362	6,167	6,348	6,348	6,348	6,362	6,167	6,348	6,348	6,348
R-squared	0.335	0.133	0.072	0.104	0.020	0.335	0.133	0.073	0.105	0.020
F-test	97.19	42.84	19.55	26.58	7.430	85.10	37.66	17.30	23.57	6.929
$\beta_1 = \beta_3$	0.040**	0.265**	0.108	0.011**	0.056*	0.174	0.533	0.630	0.254	0.327
$\beta_1 = \beta_5$						0.070*	0.875	0.252	0.015**	0.034**
$\beta_3 = \beta_5$						0.383	0.601	0.394	0.141	0.066*
$\beta_2 = \beta_4$	0.104	0.121	0.198	0.059*	0.114	0.229	0.226	0.522	0.249	0.287
$\beta_2 = \beta_6$						0.110	0.224	0.237	0.052*	0.091*
$\beta_4 = \beta_6$						0.259	0.894	0.195	0.072*	0.037**
$\beta_1 + \beta_2 = 0$	0.021**	0.049**	0.000****	0.000***	0.000***	0.404	0.049**	0.000***	0.000***	0.000***
$\beta_3 + \beta_4 = 0$	0.34**	0.052*	0.000****	0.000***	0.000***	0.025**	0.077*	0.000***	0.000***	0.000***
$\beta_5 + \beta_6 = 0$						0.554	0.018**	0.002***	0.000***	0.002***
$\beta_1 + \beta_2 = \beta_3 + \beta_4$	0.031**	0.333**	0.096*	0.007***	0.048**	0.167	0.646	0.671	0.270	0.350
$\beta_1 + \beta_2 = \beta_5 + \beta_6$						0.068*	0.922	0.271	0.014**	0.028**
$\beta_3 + \beta_4 = \beta_5 + \beta_6$						0.401	0.572	0.423	0.153	0.071*
Year & Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table shows the relationship between Government Ownership Ratios and the firm's value and performance. ROA is the returns of total assets, Returns is the stock returns, MTB is market to book value, Q (for Tobin's Q) measures market valuation, and Adj Q is industry-median adjusted Q. GovRatio is the amount of firm(i)'s share owned the Government and GovRatiosq is the GovRatio's square term. All variables in levels are measured at the end of each year and are defined in Appendix A2.1. Leverage is winsorized at the 1% and 99% levels. Financial and utility firms are excluded. Firm and year-fixed effects are included. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Prior research proposes that corporate governance efficiency is related to a low level of government ownership. For example, the cost of equity increases in response to increased government ownership (Ben-Nasr et al., 2012 [11]). On the other hand, government ownership induces improved monitoring and governance (Borisova et al., 2012 [20]; Boubakri et al., 2018 [22]). Due to the costs and benefits of government ownership and its non-linearity, we investigate the impacts of government ownership and conduct the costs and benefits analysis. Overall our empirical evidence supports more the benefits of government ownership than the costs and the non-linearity relationship between government ownership and firm value and performance. Also, based on the financial rule in terms of the 5% rule and government ownership range, we suggest that government ownership's benefits and costs are disproportional. Especially, enhanced government ownership in corporate in terms of GovRatio reduces its benefits. This supports the non-linear impact of government ownership and implies that benefits convert into burdens as government control is enhanced. In other words, government ownership gives performance and value advantages to firms, but its benefits decline when GovRatio increases. Also, the costs of government ownership are reduced when the government increase. But these diminishing costs and benefits and disproportional effects are not robust with more divided ratios. Our empirical findings do not match corporate governance's traditional inefficiency theory of government ownership due to overall positive impacts.

3.4.3 Additional evidence

Boubakri et al. (2018) [22] introduce an alternative independent of compromising the effects of binary and continuous variables. Our research exploits GovOwn (dummy) and GovRatio (continuous) for the relationship between government ownership and firm value and performance. We make an alternative dependent variable for considering both variables in this research (GovCont0-5, GovCont5-10, and GovCont10). We utilize this idea to put together the effect of GovOwn and

GovRatio. The way to make the alternative is the following, GovCont0-5 is GovRatio if GovRatio $< 5\%$, and 5% if GovRatio $\geqslant 5\%$. GovCont5-10 is 0 if GovRatio$< 5\%$, GovRatio $- 5\%$ if $5\% \leqslant$ GovRatio $< 10\%$, and 10% if GovRatio $\geqslant 10\%$. GovCont10 is GovRatio $- 10\%$ if GovRatio $\geqslant 10\%$, and 0 if GovRatio is $<10\%$.

Table 3.10: Effect of Alternatiove Government Ownership.

	ROA	Returns	MTB	Tobin's Q	Adj Q
GovCont0-5	-0.002**	0.012	0.121***	0.078***	0.086***
	(0.001)	(0.009)	(0.020)	(0.013)	(0.016)
GovCont5-10	0.001	0.016	-0.008	-0.014	-0.015
	(0.001)	(0.012)	(0.024)	(0.013)	(0.015)
GovCont10	-0.003*	-0.002	0.042	0.027**	0.032**
	(0.001)	(0.016)	(0.029)	(0.013)	(0.015)
Observations	6,367	6,171	6,353	6,353	6,353
R-squared	0.336	0.132	0.072	0.103	0.019
F-test	113.8	49.06	22.06	30.36	8.322
$\beta_1 = \beta_2 = \beta_3$	0.050*	0.723	0.000***	0.000***	0.000***
$\beta_1 = \beta_2$	0.012**	0.880	0.000***	0.000***	0.000***
$\beta_1 = \beta_3$	0.925	0.466	0.024**	0.003**	0.011**
$\beta_2 = \beta_3$	0.043**	0.469	0.219	0.046**	0.056*
Year & Firm FE	Yes	Yes	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes	Yes	Yes

Notes: This table indicates regression results using the alternative Government Ownership Ratio. GovCont0-5 is GovRatio if GovRatio $< 5\%$, and 5 if GovRatio $\geqslant 5\%$. GovCont5-10 is 0 if GovRatio$< 5\%$, GovRatio $- 5\%$ if $5\% \leqslant$ GovRatio $< 10\%$, and 10% if GovRatio $\geqslant 10\%$. GovCont10 is GovRatio $- 10\%$ if GovRatio $\geqslant 10\%$, and 0 if GovRatio is $<10\%$. All variables in levels are measured at the end of each year and are defined in Appendix A2.1. Financial and utility firms are excluded. Firm characteristics and firm & year-fixed effects are included. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Table 3.10 reports the results for alternative government ownership. GovCont0-5 and GovCont10 are seemingly identical results to previous results. However, GovCon5-10 catches our eye because GovCon5-10 is not significant in all dependents. Specifically, our previous findings support GovOwn5-10 and GovRatio5-10 increase Returns, MTB, and Tobin's Q overall, but the GovCon5-10 does not affect firm values and performance. GovCont0-5 decrease ROA significantly at 5% level and increase MTB and Tobin's Q (Adj Q) at 1% levels. Also, GovCont10 negatively influences ROA at the 10% level and a positive on Tobin's Q(Adj Q) at the 5% level. The coefficients' tests accept different marginal impacts conditional on government ownership ranges in market valuations.

Our empirical findings support that GovCont0-5 and GovCon10 are positively associated with firms' market value but not performance. Also, the effects of government ownership are not proportional conditional on the range of government ownership because of the different marginal effects of GovCont. Therefore, those findings support our hypothesis about the benefits of government

ownership and its different marginal impacts.

3.4.4 Impact of government policy and government ownership

The Stewardship code

In this section, we explore whether the relationship between government ownership and firm value and performance hinges on the political issue introducing a new NPS policy called the Stewardship code. In 2018 Korea Government announced the active role of the national pension fund as the largest shareholder. Therefore, we conduct further tests on whether the government policy impacts government ownership differently on firm value and performance. We use this policy because there are two opposite views when the National Pension Service decided to introduce a stewardship code in Korea. One argument is that the stewardship code allows the National Pension Service as an active participator, as a result, the exercise of NPS's shareholder rights will enhance better corporate governance and improve shareholder value in the long run. As a result of better governance through NPS's active monitoring, the policy is able to improve firm value and performance (Kim et al., 2020 [78]; Kim et al., 2014 [79]). The contrasting argument is that the activism of the National Pension Service in management has dampened corporate management due to inappropriate intervention. Therefore, the NPS's activism leads to negative market reaction (Ko and Kim, 2020 [82]; Woidtke, 2020 [144]). These concerns take care of the possibility of pension socialism. Because of these two different views of the benefits and costs of the Stewardship code, the introduction of unique policy allow us to explore whether the relationship between government ownership and firm value and performance conditional on government policy. As Kim et al. (2021) [80] point out, policies related to the NPS in Korea are highly politicized. Therefore, this empirical design sheds light on the effect of political conditions on firm value and performance through government ownership.

We make the NPS dummy for capturing policy impact, where NPS is 1 if the year is 2018,

2019, and 2020. The interaction term with NPS and government ownership captures policy impact through government ownership. Because we consider GovOwn and GovRatio variables as treatment status for investigating the impacts of NPS's activism, the estimated interaction terms of the NPS and dummies are the same as the Difference-in-Difference estimation. The estimable model is as follows

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 GovOwn_{it} + \beta_3 GovOwn_{it} \times NPS_t + \beta_4 NPS_t + \tau_i + t_t + \epsilon_{it} \tag{3.2}$$

Panel A in Table 3.11 shows that GovOwn affects significantly positively Returns in Column (2), MTB in Column (3), and Tobin's Q in Column (4) at the 1% levels. These empirical results are consistent with the previous. The main finding is that policy dummy (NPS) changes the signs of GovOwn on firm value and performance in Panel A. MTB, Returns, and Tobin's Q are negatively associated with NPS×GovOwn significantly. The coefficient of DID terms captures the activism of the NPS and significantly reduces the firm's market-oriented performance and valuation. The findings of interactions support that active government intervention can give a negative signal to the capital market, and it can crowd out private investment activities. Also, we calculate total effect of government policy. GovOwn is 0.195, GovOwn×NPS is -0.230, and the sum of the two is -0.025. These results suggest that all benefits are absorbed by the costs of activism in Returns. For MTB and Tobin's Q, the benefits are still more prominent, even though activism has negative impacts.

Even if we detect the negative sign of the NPS's activism due to the 5%, the DID signs can be different conditional on the 5% Government ownership. We conduct tests based on the 5% rule by encompassing this effect in the DID model using GovOwn0 and GovOwn5 and interactions in Panel B. In Panel B, we find that split GovOwn dummies (GovOwn0 and GovOwn5) significantly increase Returns, MTB, and Tobin's Q at the 1% levels, and these results are consistent with previous find-

Table 3.11: Multivariate test for active shareholder.

Panel A	ROA	Returns	MTB	Tobin's Q	Adj Q
GovOwn	-0.000	0.195***	0.379***	0.201***	0.118
	(0.003)	(0.032)	(0.066)	(0.035)	(0.098)
GovOwn×NPS	-0.001	-0.230***	-0.186***	-0.065**	-0.021
	(0.003)	(0.026)	(0.057)	(0.030)	(0.058)
Observations	6,367	6,171	6,353	6,353	6,353
R-squared	0.335	0.143	0.071	0.099	0.017
F-test	115.5	58.17	23.94	31.36	6.503
$\beta_1 + \beta_2 = 0$	0.555	0.193	0.000***	0.000***	0.159
Panel B					
GovOwn0	0.000	0.166***	0.383***	0.214***	0.116
	(0.004)	(0.036)	(0.080)	(0.038)	(0.085)
GovOwn0×NPS	-0.002	-0.198***	-0.202***	-0.085**	-0.025
	(0.004)	(0.034)	(0.076)	(0.037)	(0.081)
GovOwn5	-0.000	0.298***	0.555***	0.283***	0.243**
	(0.005)	(0.052)	(0.117)	(0.056)	(0.124)
GovOwn5×NPS	0.000	-0.272***	-0.156*	-0.032	-0.010
	(0.003)	(0.039)	(0.088)	(0.046)	(0.093)
Observations	6,367	6,171	6,353	6,353	6,353
R-squared	0.335	0.145	0.072	0.101	0.017
F-test	99.61	53.37	25.16	36.55	5.756
$\beta_1 = \beta_3$	0.764	0.012**	0.138	0.214	0.303
$\beta 2 = \beta_4$	0.467	0.106	0.651	0.281	0.891
$\beta_1 + \beta_2 = 0$	0.513	0.211	0.001***	0.000***	0.119
$\beta_3 + \beta_4 = 0$	0.880	0.575	0.000***	0.000***	0.028**
$\beta_1 + \beta_2 = \beta_3 + \beta_4$	0.696	0.161	0.013**	0.004***	0.131

Notes: This table indicates results for policy effect through GovOwn on the firm's value and performance. All variables are defined in Appendix A2.1. Leverage is winsorized at the 1% and 99% levels. Financial and utility firms are excluded. Fixed effects and firm's characters are included. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

ings. Similarly, DID terms show negative signs. Specifically, GovOwn0×NPS significantly reduces Returns, MTB, and Tobin's Q. Also, in Panel B, GovOwn5×NPS significantly discourages Returns and MTB. These switched signs support the negativity of activism of public institutional investors. This crowding out private activities in the market in terms of performance and market value of firms is in line with Woidtke(2002) [144]. The marginal test of coefficients in Panel B accepts the identical impact of government ownership and policy overall.

However, even if the NPS's activism policy in 2018 has been negatively associated with market-oriented performance and valuation, the sum of DID terms and GovOwn dummies are positive ($\beta 1 + \beta_2 \neq 0$ and $\beta_3 + \beta_4 \neq 0$ are accepted) in market valuations (MTB and Tobins' Q). These results suggest that the negative impacts of policy in terms of the cost of government intervention in the private sector are covered by the benefits of government ownership in the market valuation. However, returns evidence indicates that the costs in the capital market absorb all the benefits. These two different impacts may support the stock market reaction is more sensitive than market

valuation to the NPS's activism. This evidence supports that the large benefits of government ownership in the market are maintained when public institutional investors are passive investors. Thus, this evidence empirically provides the conflict between public and private interests.

Table 3.12: Multivariate test for active shareholder.

	ROA	Returns	MTB	Tobin's Q	Adj Q
GovOwn0	0.000	0.165***	0.380***	0.212***	0.114
	(0.004)	(0.036)	(0.080)	(0.038)	(0.085)
GovOwn0×NPS	-0.002	-0.197***	-0.201***	-0.085**	-0.024
	(0.004)	(0.034)	(0.076)	(0.036)	(0.081)
GovOwn5-10	0.003	0.291***	0.535***	0.283***	0.247*
	(0.005)	(0.058)	(0.129)	(0.062)	(0.137)
GovOwn5-10×NPS	-0.004	-0.276***	-0.162	-0.047	-0.031
	(0.004)	(0.049)	(0.110)	(0.052)	(0.117)
GovOwn10	-0.011*	0.337***	0.669***	0.325***	0.279
	(0.006)	(0.074)	(0.167)	(0.080)	(0.177)
GovOwn10×NPS	0.006	-0.260***	-0.128	0.000	0.031
	(0.004)	(0.061)	(0.138)	(0.066)	(0.147)
Observations	6,367	6,171	6,353	6,353	6,353
R-squared	0.335	0.145	0.072	0.101	0.018
F-test	87.79	46.77	22.14	32.12	5.068
$\beta_1 = \beta_3$	0.486	0.030**	0.226	0.254	0.331
$\beta_1 = \beta_5$	0.058*	0.542	0.430	0.602	0.861
$\beta_3 = \beta_5$	0.006***	0.021**	0.083*	0.159	0.354
$\beta_2 = \beta_4$	0.667	0.152	0.751	0.518	0.960
$\beta_2 = \beta_6$	0.047**	0.337	0.617	0.229	0.718
$\beta_4 = \beta_6$	0.024**	0.838	0.838	0.566	0.729
$\beta_1 + \beta_2 = 0$	0.525	0.201	0.001***	0.000***	0.123
$\beta_3 + \beta_4 = 0$	0.889	0.740	0.000***	0.000***	0.046**
$\beta_5 + \beta_6 = 0$	0.456	0.229	0.000***	0.000***	0.040**
$\beta_1 + \beta_2 = \beta_3 + \beta_4$	0.706	0.255	0.032**	0.013**	0.191
$\beta_1 + \beta_2 = \beta_5 + \beta_6$	0.665	0.074*	0.007***	0.002**	0.127
$\beta_3 + \beta_4 = \beta_5 + \beta_6$	0.381	0.259	0.169	0.128	0.470
Firm & Year FE	Yes	Yes	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes	Yes	Yes

*Notes:*This table indicates results for the relationship between Government Ownership and a firm's value and performance. ROA is the returns of total assets, Returns are the stock returns, MTB is market to book value, Q (for Tobin's Q) measures market valuation, and Adj Q is industry-median adjusted Q. Ratio0, Ratio5-10, Ratio10, and squares are divided variable of ratio based on ranges (0% to 5%, 5% to 10%, and above 10%). NPS is 1 if the year is 2018, 2109, or 2020. All variables in levels are measured at the end of each year and are defined in Appendix A2.1. Leverage is winsorized at the 1% and 99% levels. Financial and utility firms are excluded. Firm and year-fixed effects are included. Constants and firm characteristics are not reported. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

We use more split GovOwn dummies in Table 3.12 due to the different marginal impacts of GovOwn and DID terms. Table 3.12 supports the significant positive effects of GovOwn0, 5-10 and 10 dummies and shows the benefits of government ownership. DID terms significantly decrease Returns, MTB, and Tobin's Q when Government ownership <5% mainly. On the other hand, GovOwn5-10 (GovOwn10)×NPS significantly only reduces Returns at 1% level. The DID terms in Returns support the active role of public institutions and give a negative signal to private investors in the stock market more than others. As a result, government ownership can dampen private investment. However, in the valuations aspect, the activism cost is not identified for firms owned

above 5%. Also, Table 3.12 supports identical benefits($\beta_{1(3)} = beta_{3(5)}$) and burdens($\beta_{2(4)} = \beta_{4(6)}$) of government ownership among the firms in the market and supports the benefits overwhelming the costs ($\beta_{1(3,5)} + \beta_{2(4,6)} \neq 0$).

Table 3.13: Multivariate test for active shareholder.

Panel A	ROA	Returns	MTB	Tobin's Q	Adj Q
GovRatio	-0.001*	0.029***	0.074***	0.039***	0.042***
	(0.000)	(0.005)	(0.012)	(0.006)	(0.008)
GovRatio×NPS	0.000	-0.026***	-0.017***	-0.003	-0.000
	(0.000)	(0.003)	(0.006)	(0.003)	(0.006)
Observations	6,367	6,171	6,353	6,353	6,353
R-squared	0.335	0.140	0.071	0.099	0.018
F-test	115.3	58.91	24.50	31.77	8.836
$\beta_1 + \beta_2 = 0$	0.102	0.534	0.000***	0.000***	0.000***
Panel B					
GovRatio0	-0.002*	0.054***	0.179***	0.098***	0.094***
	(0.001)	(0.014)	(0.031)	(0.018)	(0.028)
GovRatio0×NPS	-0.000	-0.063***	-0.100***	-0.038**	-0.020
	(0.001)	(0.012)	(0.029)	(0.016)	(0.031)
GovRatio5	-0.001*	0.028***	0.071***	0.038***	0.041***
	(0.000)	(0.005)	(0.011)	(0.006)	(0.008)
GovRatio5*NPS	0.000	-0.024***	-0.014**	-0.001	0.000
	(0.000)	(0.002)	(0.005)	(0.003)	(0.005)
Observations	6,367	6,171	6,353	6,353	6,353
R-squared	0.336	0.142	0.073	0.103	0.019
F-test	98.93	51.53	21.85	27.79	8.091
$\beta_1 = \beta_3$	0.177	0.037**	0.000***	0.000***	0.036**
$\beta 2 = \beta_4$	0.708	0.001***	0.002***	0.018**	0.371
$\beta_1 + \beta_2 = 0$	0.010	0.391	0.000***	0.000***	0.000***
$\beta_3 + \beta_4 = 0$	0.110	0.448	0.000***	0.000***	0.000***
$\beta_1 + \beta_2 = \beta_3 + \beta_4$	0.022**	0.134	0.266	0.027**	0.084*

Notes: This table indicates results for policy effect through GovRatio on a firm's value and performance. All variables are defined in appendix A2.1. Leverage is winsorized at the 1% and 99% levels. Financial and utility firms are excluded. Fixed effects and firm's characters are included. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Table 3.13 in Panel A provides empirical findings using GovRatio and policy effect. GovRatio significantly decreases ROA as the accounting measure at the 10% levels. Nevertheless, GovRatio is positively associated with market base firms' performances (Returns) and values (MTB, Tobin's Q, and Adj Q) at the 1% levels. Interactions (GovRatios×NPS) show a switch in the signs of GovRatio for Returns and MTB at the 1% levels. We find that the sum of benefits and costs of GovRatio and interactions ($\beta_1 + \beta_2 = 0$) is zero for ROA and Returns but positive in market valuations from the coefficient test in Panel A. Table 3.13 in Panel B using the 5% rule also shows identical results of GovRatio0 and GovRatio5 with Panel A. ROA (Returns MTB, Tobin's Q (Adj Q)) is negatively (positively) associated with GovRatio0 and GovRatio5 significantly. The negative impact of activism is identified owned <5% mainly. In detail, the NPS's activism significantly decreases Returns, MTB,

and Tobin's Q if firms owned <5%. If the firm owned ⩾5%, the NPS's activism significantly reduces Returns and MTB. The coefficient test in Panel B in Table 3.13 rejects identical marginal effects ($\beta_{1(3)} = \beta_{2(4)}$) of GovRatio0 and GovRatio5 and interactions for market-oriented measurements (Returns, MTB, Tobin's Q, and Adj Q) overall. Even if we accept disproportional benefits and costs of government ownership, the sum of benefits and cost ($\beta_{1(3)} + \beta_{2(4)} = 0$) of government ownership and NPS's activism shows a zero-sum game in performances (ROA and Returns). However, the benefits overwhelm the costs of activism ($\beta_{1(3)} + \beta_{2(4)} \neq 0$) in terms of market valuations (MTB, Tobin's Q, and Adj Q). Also, the overall effects based on costs and benefits ($\beta_1 + \beta_2 = \beta_3 + \beta 4$) conditional on the 5% show identical effects regardless of returns and MTB and diminished marginal effect in response to the increment of GovRatio on ROA and Tobin's Q (Adj Q).

Table 3.14: Multivariate test for active shareholder.

	ROA	Returns	MTB	Tobin's Q	Adj Q
GovRatio0	-0.002*	0.055***	0.182***	0.101***	0.097***
	(0.001)	(0.014)	(0.031)	(0.019)	(0.028)
GovRatio0×NPS	-0.000	-0.063***	-0.101***	-0.038**	-0.026
	(0.001)	(0.012)	(0.029)	(0.016)	(0.031)
GovRatio5-10	-0.000	0.036***	0.083***	0.046***	0.050***
	(0.000)	(0.006)	(0.014)	(0.008)	(0.011)
GovRatio5-10×NPS	-0.000	-0.034***	-0.024***	-0.007	-0.006
	(0.000)	(0.004)	(0.009)	(0.005)	(0.008)
GovRatio10	-0.001**	0.025***	0.067***	0.035***	0.037***
	(0.000)	(0.005)	(0.011)	(0.006)	(0.007)
GovRatio10×NPS	0.000	-0.019***	-0.008	0.001	0.003
	(0.000)	(0.003)	(0.006)	(0.003)	(0.004)
Observations	6,367	6,171	6,353	6,353	6,353
R-squared	0.336	0.143	0.073	0.103	0.019
F-test	88.31	45.90	19.21	24.42	7.147
$\beta_1 = \beta_3$	0.071*	0.141	0.000***	0.000***	0.064*
$\beta_1 = \beta_5$	0.394	0.023**	0.000***	0.000***	0.019**
$\beta_3 = \beta_5$	0.058*	0.032**	0.111	0.040**	0.048**
$\beta_2 = \beta_4$	0.908	0.014**	0.007**	0.051*	0.492
$\beta_2 = \beta_6$	0.507	0.000***	0.001**	0.011**	0.316
$\beta_4 = \beta_6$	0.051*	0.000***	0.108	0.110	0.141
$\beta_1 + \beta_2 = 0$	0.021**	0.415	0.000***	0.000***	0.000***
$\beta_3 + \beta_4 = 0$	0.230	0.725	0.000***	0.000***	0.000***
$\beta_5 + \beta_6 = 0$	0.115	0.252	0.000***	0.000***	0.000***
$\beta_1 + \beta_2 = \beta_3 + \beta_4$	0.027**	0.209	0.233	0.023**	0.077*
$\beta_1 + \beta_2 = \beta_5 + \beta_6$	0.056**	0.115	0.269	0.024**	0.066*
$\beta_3 + \beta_4 = \beta_5 + \beta_6$	0.888	0.416	0.991	0.544	0.442
Firm & Year FE	Yes	Yes	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes	Yes	Yes

*Notes:*This table indicates the relationship between Government Ownership and a firm's value and performance. ROA is the returns of total assets, Returns are the stock returns, MTB is market to book value, Q (for Tobin's Q) measures market valuation, and Adj Q is industry-median adjusted Q. Ratio0, Ratio5-10, Ratio10, and squares are divided variable of ratio based on ranges (0% to 5%, 5% to 10%, and above 10%). NPS is 1 if the year is 2018, 2109, or 2020. All variables in levels are measured at the end of each year and are defined in Appendix A2.1. Leverage is winsorized at the 1% and 99% levels. Financial and utility firms are excluded. Firm and year-fixed effects are included. Constants and firm characteristics are not reported. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Table 3.14 also supports the positive impact of GovRatio0, 5-10, and 10. Similarly, the negative

impact of the NPS's activism is conformed when the firm owned $< 5\%$ mainly. Identical findings are that the NPS's activism partially offsets the positive impact of government ownership ($\beta_{1(3,5)} + \beta_{2(4,6)} = 0$ is accepted in Returns). Specifically, the benefits are more than the costs ($\beta_{1(3,5)} + \beta_{2(4,6)} \neq 0$) in MTB and Tobins'Q, and the marginal effects are not identical(diminishing marginal benefits and costs of activism ($\beta_{1(2,3,4)} \neq \beta_{3(4,5,6)}$)) in Returns, MTB, and Tobin's Q. However, for returns, even if marginal benefits and cost of government ownership are disproportions, the benefits offset the costs perfectly. Those results are almost similar to Panel B in Table 3.13.

We find mixed evidence that supports both aspects of inefficient and efficient governance ownership. To put empirical results together, the activism of public institutional investors as a tool for government control negatively affects firms' market performances and values. Even if activism increases the costs of government ownership, we find more extensive benefits than costs in market valuations. To maximize the benefit of government ownership, we propose the passive role of government in the market because of the cost in response to activism.

Monitoring

The main debate on government control in corporate governance is monitoring. In this section, we test whether government ownership can improve corporate governance. We employ tax avoidance (Chen et al., 2020 [32]) as a proxy for the monitoring effects of government ownership. The measure of tax avoidance defines the difference between the nominal and the effective tax rates. We find the benefits and costs of government ownership in previous results. The literature supports that government ownership not only improves governance quality (Borisova et al., 2012) because of monitoring but also discourages corporate governance associated with moral hazard problems (Shleifer and Vishny, 1994 [133] and 1997 [134]; Megginson and Netter, 2001 [102]). We expect this section will contribute literature on the relationship between government ownership and the quality

Table 3.15: Monitoring effects.

	Taxavoidance	Taxavoidance	Taxavoidance	Taxavoidance	Taxavoidance
GovRatio	0.0000	-0.0001			
	(0.0001)	(0.0002)			
GovRatiosq		0.0000			
		(0.0000)			
GovRatio0			-0.0001		
			(0.0001)		
GovRatio5			0.0000		
			(0.0000)		
GovOwn				0.0000	
				(0.0004)	
GovOwn0					0.0000
					(0.0004)
GovOwn5					0.0004
					(0.0006)
Observations	5,945	5,940	5,945	5,945	5,945
R-squared	0.108	0.108	0.108	0.108	0.108
F-test	28.35	25.95	26.08	27.81	25.84
Year & Firm FE	Yes	Yes	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes	Yes	Yes

Notes: This table shows the regression results for Government Ownership Ratio and tax avoidance. Tax avoidance is average income tax - marginal tax. GovCont is the government ownership ratio, and GovConsq is the square of GovCon. GovCont0 is equal to GovCon if GovCont $<$ 5%, and GovCont5 is equal to GovCon if GovCont $\geqslant$ 5%. GovOwn is 1 if GovCont $>$ 0%, GovOwn0 is 1 if GovCon $<$ 5%, GovOwn5 is 1 if GovCon $\geqslant$ 5%, and 0 otherwise. All variables in levels are measured at the end of each year and are defined in Appendix A2.1. Financial and utility firms are excluded. Firm characteristics and firm & Year-fixed effects are included but not reported. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

of corporate governance in monitoring.

Tables 3.15 and 3.16 describe government monitoring's effect on tax avoidance. Table 3.15 shows that GovRatio, GovRatiosq, and GovOwn dummies are insignificant. We cannot find empirical results that government ownership and corporate governance quality are associated with inefficient and better monitoring. In other words, no effects of GovOwn and GovRatio suggest there is no empirical evidence related to inefficient and better corporate governance related to government ownership. Even if we consider the 5% rule, government ownership does not affect tax avoidance. We find that the policy (e.g., the Stewardship code) changes signs of the impact of government ownership. Thus, the effect of government ownership on monitoring might be conditional on policy. The main object of the Stewardship Code is to improve the quality of corporate governance, thus considering the NPS's activism and interactions (NPS $\times$ GovOwn and NPS $\times$ GovRatio) makes our research capture the effectiveness of the policy on monitoring through government ownership. Table 3.15 shows that interaction terms for GovRatio and Gov-Own increase tax avoidance in Columns (1), (2), and (4). These positive coefficients suggest that the NPS's activism as a watchdog can be the source of the moral hazard and inefficient governance issues associated with government control.

For more identification, we consider the 5% rule. Table 3.16 in Columns (3) and (5) shows that the introduced policy in 2018 for improving corporate governance by allowing activism of the public institutional investor led to increased tax avoidance when the firm owned $\geqslant$5%.

To sum up, empirical evidence supports that the activism of public institutions is the channel of the costs of government ownership, and the policy in 2018 induces the opposite effect with the original object. Our findings support the inefficient monitoring of government ownership as noted by Shleifer and Vishny(1994 [133], 1997 [134]); Woidtke, 2002 [144]. We suggest that excessive government intervention can ruin corporate governance quality. As a result, the costs of inefficient monitoring can reduce firms' market valuations and performances.

Table 3.16: Monitoring effects.

	Taxavoidance	Taxavoidance	Taxavoidance	Taxavoidance	Taxavoidance
GovRatio	-0.0001	-0.0003			
	(0.0000)	(0.0002)			
GovRatiosq		0.0000			
		(0.0000)			
GovRatio×NPS	0.0002***	0.0002***			
	(0.0000)	(0.0000)			
GovRatio0			-0.0004		
			(0.0002)		
GovRatio5			-0.0001		
			(0.0000)		
GovRatio0×NPS			0.0003		
			(0.0002)		
GovRatio5×NPS			0.0002***		
			(0.0000)		
GovOwn				-0.0008	
				(0.0005)	
GovOwn×NPS				0.0012**	
				(0.0005)	
GovOwn0					-0.0004
					(0.0006)
GovOwn5					-0.0009
					(0.0006)
GovOwn0×NPS					0.0007
					(0.0006)
GovOwn5×NPS					0.0020***
					(0.0005)
Observations	5,945	5,940	5,945	5,945	5,945
R-squared	0.109	0.109	0.109	0.109	0.109
F-test	27.25	25.14	23.51	25.59	23.15
Year & Firm FE	Yes	Yes	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes	Yes	Yes

Notes: This table shows the regression results for Government Ownership Ratio and tax avoidance. Tax avoidance is average income tax - marginal tax. GovCont is the government ownership ratio, and GovConsq is the square of GovCon. GovCont0 is equal to GovCon if GovCont $<$ 5%, and GovCont5 is equal to GovCon if GovCont $\geqslant$ 5%. GovOwn is 1 if GovCont $>$ 0%, GovOwn0 is 1 if GovCon $<$ 5%, GovOwn5 is 1 if GovCon $\geqslant$ 5%, and 0 otherwise. NPS is 1 if year $>$ 2017, and 0 otherwise. All variables in levels are measured at the end of each year and are defined in Appendix A2.1. Financial and utility firms are excluded. Firm characteristics and firm & Year-fixed effects are included but not reported. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

3.5 Robustness checks : Selected treatment

3.5.1 The Model

The primary concern of our empirical approach is whether government ownership is random. There is no reason why we do not believe that unobserved factors can affect government ownership in specific firms. Mainly, because of the endogenous selection issue (Heckman, 1977 [67]; Lewbel, 2006 [91]), our empirical results can be biased. Firms cannot decide whether they accept government investment in the capital market, thus, government ownership seems exogenous to the firm. We can argue that no selection bias from the firm side, however, we face a selection bias from the government side. When the NPS increases investment in the domestic capital market, the public agents may consider specific firms' characteristics and government policy. Therefore, we should consider unobserved factors associated with the investment decision of the government. Due to an ordinary IV approach do not allow binary variables in the first stage as an independent variable, we cannot use the standard IV method, and this problem is known as the "Forbidden regression". To resolve this problem, we use the Probit model with endogenous treatment and binary for instruments using the Maximum Likelihood Estimator (STATA command eregress (Cerulli, 2014 [29]) and ivtreatreg allows Heckman section model as well as others. The IV method for the binary variable is as follows,

$$
\begin{aligned}
Y_{it} &= \beta_1 D_{it} + \beta_2 X_{it} + \tau_i + t_t + \epsilon_{it} \\
D_{it} &= \pi_1 X_{it} + \pi_2 Z_{it} + v_{it} \\
D_{it} &= \begin{cases} 1 & \text{if } GovOwership_{it} > 0 \\ 0 & \text{otherwise} \end{cases}
\end{aligned}
\tag{3.3}
$$

where, D_{it} is dummy variables (e.g. Gov-Own), X_{it} is firm-specific variables (e.g. Size, Tangibility, SalesGrowth, CF, Conglomerate, and Loss), and Z_{it} is an instrument variable, τ_i is a firm fixed effect, t_t is a year fixed effect, and ϵ_{it} and v_{it} are error terms.

Our IV strategy follows Borisova et al.,(2015) [21], Boubakri et al.,(2018) [22], and Chen et al.,(2018) [31]. Prior research employs country-level firm data sets and investigates government and state ownership issues in corporate finance and governance. Borisova et al. (2015) [21], Boubakri et al. (2018) [22], and Chen et al. (2018) [31] exploit the IV regression and the Heckman model due to selection concerns. We use same IV methods using Borisova et al. 2015) [21], Boubakri et al. (2018) [22] for endogenous issue. More specifically, Borisova et al. (2015) [21] use total investment of country level, unemployment rate, and political systems (e.g., civil law and left-wing). Boubakri et al. (2018) [22] utilize country-industry average of government ownership and Chen et al.,(2018) [31] use Hofstede's (2001) [71] individualism index. Our data consists of Korean firm levels. Therefore, based on prior research, we consider the industry average government investment in the domestic capital market and the industry average of government ownership. Even if Gormley and Matsa (2014) [58] point out the cost of using group average as IV in corporate finance, for checking the consistency of empirical results, we use group-level instruments by taking into account selection bias.

3.5.2 Results

3.5.3 Heckman selection Model

Table 3.17 shows the results of the Heckman selection model based on Borisova et al.(2015) [21] and Boubakri et al. 2018 [22]. In Table 3.17, we can observe that the GovOwn has significantly negative effects on ROA but not significant on Returns, MTB, and Tobin's Q. Also, after considering selection bias, government ownership is inconsistent with the prior findings. The first-stage regression

in Column (5) in Table 3.17 indicates that IndustGovOwn variables are significantly associated with the GovOwn (We do not use Indust average total investment due to its insignificant in the first stage). The empirical finding in the first stage is consistent with Borisova et al.(2015) [21], but not in the second. For further investigation, we use an IV regression for GovRatio. Table 3.18 indicates that the effects of GovRatio are almost identical to the previous findings. Market valuations (MTB and Tobin's Q) are significantly positively related. The first-stage model in Column (5) shows industry average GovRatio is significantly positive at the 1% level, and the empirical result is consistent with Boubakri et al. 2018 [22].

Table 3.17: Heckman selection model.

	Second Stage				First Stage
	ROA	Returns	MTB	Tobin's Q	GovOwn
GovOwn	-0.303***	0.024	-1.082	-0.376	
	(0.0841)	(0.579)	(1.549)	(0.715)	
Conglomerate	-0.006	-0.049	-0.037	-0.057	0.198**
	(0.007)	(0.065)	(0.111)	(0.049)	(0.088)
Salesgrowth	0.0003***	0.001***	0.002***	0.001***	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Size	0.057***	0.008	-0.629***	-0.475***	0.874***
	(0.009)	(0.048)	(0.141)	(0.067)	(0.025)
Tangibility	-0.039*	-0.239*	-1.187***	-0.645***	-0.484***
	(0.022)	(0.128)	(0.323)	(0.162)	(0.129)
Leverage	-0.001***	0.000	0.020***	0.004**	-0.005**
	(0.000)	(0.001)	(0.004)	(0.001)	(0.002)
OCF	0.003***	0.003*	0.008	0.003	0.016***
	(0.000)	(0.001)	(0.006)	(0.003)	(0.003)
Loss	-0.097***	-0.103***	0.140***	0.032	-0.281***
	(0.003)	(0.020)	(0.046)	(0.023)	(0.048)
Mills	-0.521***	-0.218	-2.843	-1.461	
	(0.161)	(1.116)	(2.978)	(1.391)	
IndustGovOwn					4.043***
					(0.478)
Observations	6,322	6,127	6,308	6,308	6,322
R-squared	0.339	0.133	0.066	0.096	.
F-test	112.9	49.62	20.37	28.59	.
Pseudo R2	.	.	.	.	0.391
Firm & Year FE	Yes	Yes	Yes	Yes	Yes

Notes: This table presents the results of the Heckman selection model. The IndustGovOwn in the first stage in Column (5) as instruments are the industry average of GovOwn. Mills is the inverse of Mill's ratio. The dependent and independent variables are defined in appendix A2.1. Financial and utility firms are excluded. Firm & Year-fixed effects are included but not reported. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Additionally, we exploit linear regression models with endogenous treatment and binary for instruments using the Maximum Likelihood Estimator (STATA command eregress (Cerulli, 2014) [29]. Results of additional regression for endogenous problems are reported in Appendix A2.2, A2.3, and A2.4. IndustGovOwn is significantly related to GovOwn in the first stage in Table A2.2 (Endogenous binary) and A2.3 (Endogenous treatment). The second stage in A2.4 supports that GovOwn reduces

ROA significantly but increases firms' market value in terms of MTB and Tobin's Q. Table A2.3 also shows identical results with A2.2. GovOwn significantly reduces ROA and increases Returns, MTB, and Tobin's Q. For continuous government ownership, Table A2.2 indicates that GovRatio has a positive effect on MTB and Tobin's Q at the 10% levels. The results support that positive effect of governments ownership on the market-oriented valuations and negative effect on accounting measurement.

Table 3.18: IV model.

	Second Stage				First Stage
	ROA	Returns	MTB	Tobin's Q	GovRatio
GovRatio	-0.002	0.017	0.079**	0.047***	
	(0.002)	(0.019)	(0.040)	(0.018)	
Conglomerate	-0.006	-0.058	-0.099	-0.089*	0.390*
	(0.007)	(0.065)	(0.112)	(0.050)	(0.233)
Salesgrowth	0.0003***	0.001***	0.002***	0.001***	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Size	0.054***	0.022	-0.581***	-0.420***	0.265***
	(0.009)	(0.045)	(0.132)	(0.064)	(0.085)
Tangibility	-0.036	-0.246**	-1.231***	-0.689***	0.205
	(0.022)	(0.125)	(0.314)	(0.158)	(0.210)
Leverage	-0.001***	0.000	0.020***	0.003**	-0.002
	(0.000)	(0.001)	(0.004)	(0.001)	(0.002)
OCF	0.003***	0.003**	0.009	0.004	-0.004
	(0.000)	(0.001)	(0.005)	(0.002)	(0.003)
Loss	-0.095***	-0.112***	0.119***	0.009	-0.099**
	(0.003)	(0.019)	(0.042)	(0.021)	(0.044)
IndustGovRatio					0.979***
					(0.082)
Observations	6,367	6,171	6,353	6,353	6,367
R-squared	.	.	.	.	0.092
Chi2	1355	588.4	252.8	370.7	.
F-test	.	.	.	.	19.75
Firm & Year FE	Yes	Yes	Yes	Yes	Yes

Notes: This table indicates the results of the IV regression. The IndustGovRatio in the first stage in Column (5) as instruments are the industry average of GovRatio The dependent and independent variables are defined in Appendix A2.1. Financial and utility firms are excluded. Firm & Year-fixed effects are included, but not reported. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

3.6 Conclusion

The the role of government in the market has been continuously debated over four decades. With the recent economic downturn emerging as a major issue in the global economy, state capitalism has resurfaced around the world, the debate between reducing government control to encourage free markets and embracing the need for government ownership in the market. The central perspective of government's role is to minimize its control in the market, as politicians can exploit firms to pursue

personal political goals (promote employment or regional development) rather than maximize profits. Therefore, as long as the government's role is enlarged, the costs of government ownership increase, and investors' wealth decreases. However, the positive aspect of the government's role support that government ownership can, in some cases, reduce financial distress and provide better monitoring.

Based on the positive role of government in firms, as noted by Maskin (1996) [98], Kornai (1980) [83], and Borisova and Megginson (2011) [19], Chapter 3 provides empirical evidence for "Does government ownership in firms induce inefficient always?" and if not, "What condition maximizes the benefits of government and minimizes the cost." The results in Chapter 3 show that government affects firms' valuations and performance positively overall, but its effect is declined conditional on the size of government ownership and activism. Based on these findings, Chapter 3 sheds light on the benefits and costs of government in firms.

Specifically,in the Chapter 3, we employ the unique data of Korean listed firms over the period 2017 – 2020 to focus on the relationship between government ownership and market valuation and the performance of firms. The research in the Chapter 3 contributes to the literature about government controls on corporate. Korean Government uses public institutions, National Pension Service in our case, to invest domestic capital market and corporate governance. Recently, the NPS, the third largest pension agent in the world, increased its domestic assets portfolio, and the Korean Government reformed the Code to allow the active role of the NPS. These unique economic conditions can provide good implications for the government's role in corporate finance and governance.

The results of Chapter 3 support government ownership's value premium in the market due to investors' recognition of the advantages of government ownership. In addition, the non-linearity and diminishing marginal benefits of government ownership shows the burden of government ownership. This finding is consistent with evidence that government control can frustrate private activity due

to inefficiency and conflict of interests. Even if the benefits of government ownership in the market exceed the costs, the marginal benefits and costs are uneven conditional on the size of government ownership. Moreover, the study in the Chapter 3 shows that the activism of public institutional investors in the market leads to inefficient monitoring and affects firm outcomes negatively. Therefore, the result of Chapter 3 suggests that governments can be good public institutional investors in the market because of the premium valuations when the government seeks passiveness for encouraging private activity.

Chapter 4

Risk Management and Institutional Condition: Public Pension Funds' Asset Portfolios and Performances

4.1 Introduction

What makes different investment behaviors between public institutional investors? Financial literature provides empirical evidence that each institutional investor can have different investment decision-making processes due to different governance structures, sources of funds, and specific social factors. For example, Public Pension Fund (PPF), compared to other private institutions, might not have similar investment attitudes and strategies because PPF was established for social goals rather than private interest (Agarwal et al. (2015) [2]). In the contrast, in comparison to PPF, hedge funds encounter lower regulations and have more flexible investment strategies; therefore, Hedge funds can focus on their returns to maximize investors' benefits (Dai et al. (2022) [42]).

Especially, the main reason why PPF and other funds have different investor behaviors is that PPF should simultaneously consider social welfare and its returns to maintain funds between generations. In other words, compared to other private institutions (e.g., Commercial banks, Credit unions,

Hedge funds, Mutual Funds, Insurance, and REITs), PPF can have notably different investment and management practices because the government establishes PPFs to provide Social Protection and Insurance (Andonov et al. (2017 [5], 2018 [6]), Brooks (2017) [25], Dobra and Lubich (2013) [45], and Rivera-Rozo et al. (2018) [125]). Bolton et al. (2020) [15] also support different investment behaviors of PPFs with other institutional investors by providing empirical evidences that most pension funds is in favor of pro-social and pro-environment investment proposals, while the largest mutual funds are in favor of pursuing profits base investment. Also, the two main goals of PPF are intragenerational redistribution and smoothing of income over the life cycle..This is because PPF faces high levels of regulations within countries and has countries-specific rules than other institutions as Bagchi (2019) [9], Cravens and Oliver (2000) [39], and Rivera-Rozo et al. (2018) [125] noted.

Even if we set aside the distinctive characteristics of PPF compared to other investors, focusing on the role of PPF in the economy is also essential. Pension assets have grown faster than GDP during the last two decades, and pension funds are usually the country's largest and earliest institutional investors historically for a long time. As the OECD reported [118] in 2023, pension assets were evaluated to be USD 58.9 trillion in the OECD countries at the end of 2021 and USD 60.6 trillion when non-OECD countries include.. Also,the effect of PPFs might be enormous due to their funding size in the financial market. For example, Meng and Pfau (2010) [104] show that pension assets enhance market capitalization conditional on the financial development levels of countries, and Hu (2012) [73] reports that pension funds improve advanced countries' capital markets. Therefore, even if measuring the role of PPF in the capital market are relatively complex compared to other institutional funds due to cross-country differences in regulations, operating procedures, and government policies (OECD (2005) [116]), it is essential to study PPF's investment behaviors.

In addition, as Andonov et al. (2017) [5] and Mohan and Zhang (2014) [107] pointed out, research on the management of PPFs is an important in finance. For example, demands on PPFs have grown from the Baby Boom generation for their retirement plans, but the expected benefits have exceeded PPFs resources. This funding sustainability concern about PPF is a result of declined asset valuations and increasing pension promises and life expectancy. Also, the underfunding issue has been persistent in PPF operation with a time-inconsistency problem in terms of overlapped generation problems between funding providers and beneficiaries. The problem associated with finding sustainability support that why the PPF investment can be one of the critical issue in finance research to resolve underfunding and inter-generation funding problems (Andonov et al. (2017) [5], Brooks (2019) [25], and Lucas and Zeldes (2009) [95]). For dealing with PPF funding issues, recent studies (Andonov and Rauh (2022) [7], Broeders et al. (2016) [23], 2019 [24]), and Pennacchi and Rastad (2011) [120]) show that investment strategies and management practices of PPF started to maximize its resources based on its past performance and liabilities during the last decades.

However, even if the management team of PPF set the main goal of PPF asset allocation for the sustainability of funds focusing on PPF performance, as Aggarwal and Goodell (2013) [1] noted, due to the social characteristic of PPF, investigation of PPF investment strategies based on the modern portfolio theory might not be enough to explain PPF investment behaviors. Especially, Timmer(2018) [139] shows that financial institutions in Germany, particularly institutional investors, procyclically react to past asset returns. On the other hand, PPFs seek to be relatively stable in accounting values, and PPFs investments are relatively independent to economic fundamentals and financial conditions. Also, Timmer(2018) [139] finds that PPFs absorb losses on a short-term time periods and use a countercyclical investment approach. However, Andonov and Rauh(2022) [7] show that PPFs in the U.S. report higher expected returns like other institutional investors when PPF

has achieved higher past returns compared to other periods. Also, Andonov and Rauh(2022) [7] find that, based on high past returns, PPFs allocate its fund to risky assets to induce higher expected returns of PPFs. These two different investment behavior of PPF in the U.S. and Germany make this paper study that PPF investment management among countries, especially reallocating assets, conditional on past performance. In addition, we study what the other conditions, rather than past performances and funding deficits, can lead to different investment strategies of each countries PPF.

To investigate the other factors that make different investment patterns of PPFs among countries, we consider cultural factors as the country levels of institutional conditions. Because each country has different institutional conditions that affect investors' behaviors, we postulate possible factors associated with the different investment behavior of PPF between countries are cultural factors as the formal institutional conditions within country. La Porta et al. (1998 [86], 2000 [87]) show that institutional environments, such as investment protection, the rule of law, capitalization, and legal origins, lead to different levels of investments among countries. Also, North (1990) [115] noted that national cultural values outline appropriate societal decisions and behaviors, including corporate and individuals. Similarly, Aggarwal and Goodell (2013) [1] also argue that in social science the behavior of PPF is related to political interest conflicts based on social norms. Even if PPF can give more weigh on its performances like other private financial institutions pursuing risky asset allocation to resolve funding shortfalls, PPF can be highly associated with operating environment within countries, such as politics and social norms (Cravens and Oliver (2000) [39]) because PPF was established for improving countries welfare based on social policy. This is why we postulate the investment decision-making of PPF can depend on cultural factors as institutional conditions. Therefore, the cultural dimension as institutional conditions can be another factor that makes the different investment strategies of PPF between countries.

As we mentioned above, this paper considers institutional conditions using Hofstede's cultural factors to fill the gap in PPF investment strategies and management based on Andonov and Rauh(2022) [7] findings about relatively high dependency on past performance of PPFs in the U.S. The strong point of Hofstedes' measurement is that it provides the set of beliefs of individuals shared within countries; therefore, it can capture unexplained PPFs investment and management practices (Andonov and Rauh(2022) [7]) of financial variables (liabilities, past performance, etc.) using cultural aspects as shared beliefs or social values. Also, Rivera-Rozo et al. (2018) [125] and Cravens et al. (2000) [39]) show that PPF management depends on cultural dimensions when PPF determines PPF operating rules. The value of cultural dimensions can explain similarities or differences between institutional investors' financial behaviors conditional on past performance, as noted by Chui et al.(2016) [36], Dai et al.(2022) [42], and Li et al.(2013) [92]. This is why we believe that both financial and cultural dimensions should consider exploring the behavior of PPF. This approach might shed light on the under-explored financial behavior of PPF investment and management in terms of relatively high dependency on past performance suggested by Andonov and Rauh(2022) [7] using cultural factors as the set of shared beliefs.

As we noted, PPF has one distinctive characteristic due to its social goal when the government established PPF. Even if PPF has a social goal of improving welfare, PPF is one of the institutional investors in the capital market using contributions as funding resources. Therefore, PPF does not free from maximizing its returns to guarantee pension provisions. These dual objects of PPF can make different investment behaviors in comparison to other institutional investors. Based on the modern portfolio theory, the first goal of this paper is "Does a public pension fund's investment and its operation consistent with traditional portfolio theory?" Regardless of the consistency of PPF investment behaviors with portfolio theory, PPF has pro-social aspects because it is highly

related to public finance. The determinant of PPF policy and its operating rules are relatively highly associated with social values in the aspect of national culture and institutional conditions. The second research goal is "How cultural values as national institutional conditions affect PPF investment and its variations between countries. Based on these two research motivations related to portfolio and institutional condition, this paper provides empirical evidence of whether PPF investment is consistent with financial theory, and its variations depend on culture among countries.

The contributions of this paper are as followed. First, this study explore both financial and cultural dimensions, dissimilar to Andonov and Rauh(2022) [7] and Timmer(2018) [139] that only consider financial factors that affect PPF investment. Second, while Andonov and Rauh(2022) [7] exploit PPF in the U.S., and Timmer(2018) [139] use institutional investors in Germany, we employ the PPF data of several countries based on the OECD Pension reports. As a result, we can provide overall PPF investment behaviors conditional on financial factors and also explore cross countries-variations using institutional conditions. Third, we can provide empirical evidences to support the association between behavioral finance and modern portfolio theory using cultural dimension as the set of shared beliefs. Mohan and Zhang (2014) [107] consider social conflict factors, such as union, demographic, and political influence, using the U.S. pension data, but this paper cannot take the effect of culture as the set of belief into PPF investment behavior. In contrast, we can provide the possible impact of culture on the high dependency of investment decisions on past performance as the alternative using countries-level data. Lastly, we can provides how cultural dimensions are interacted with past performance to change risky asset allocation of public institutional investors. Dai et al. (2022) [42] provide the empirical evidence about interaction between cultural values and financial variables in private institutional investors. PPF investment can be differ because PPF has more socialistic characters and faces more regulations due to its goals compared to other private

funds. Therefore, this study can shed light on how PPF investment decision-making is related to social values in the view of the public institutional investor among counties, and its variations conditional on financial and cultural factors to literature.

4.2 Literature review and hypotheses

Academics and businesses have studied understanding institutional investors' behavior based on a financial perspective. The common opinion about public institutional investors is that public institutions have less efficient investment behavior than other private institutional investors (Shleifer and Vishny (1994) [133] and Woidtke (2002) [144]). Although previous related literature has examined public institutional investors extensively, a recent study conducted by Andonov and Rauh (2022) [7] shows that public investors have changed their investment behavior to increase efficiency and returns using an active portfolio investment strategy. Also, many researchers and the OECD have conducted studies focusing on investment management behavior, function, and practice of PPFs. All of the studies have stressed the demand for an effective portfolio management strategy to PPFs in order to sustain a satisfactory level of funds (Trianti(2015) [138] and Lucas and Zeldes (2009) [95]).

Rauh (2009) [123] focuses on the traditional financial approach and shows that the asset portfolios of pension fund is a function of funding status, liabilities in aspect of the risk management perspective. Rauh (2009) [123] finds that if firms have low-funded pension and bed credit ratings, then allocate pension fund assets to safe assets such as fixed assets and cash, while firms has well-funded pension and good credit ratings,then invest more in equity. Also, Mohan and Zhang (2014) [107] suggest that funding status of PPF is a source of transferring current pension costs to future generations in aspect of the risk transfer hypothesis. Especially, if the growth in PPF expense is over the growth in its contribution, the severely underfunded PPF would prefer to take on more risk. Based on the risk transfer hypothesis, Mohan and Zhang (2014) [107] provide the positive association be-

tween underfunding and risk-taking investment. Additionally, Mohan and Zhang (2014) [107] show public pension funds' investment decision depends on not only funding levels but also past returns. Especially, Mohan and Zhang (2014) [107] show PPF invests more in risky assets conditional on low past returns, and its results are paralleled with the risk transfer incentive hypothesis. These results support that PPF investments tried to allocate its asset optimally through the expected risk premiums in line with portfolio theory.

Similarly, Andonov and Rauh (2022) [7] focus on the association between expected returns and past performance. Andonov and Rauh (2022) [7] show that expected returns are not fully covered by investment skills, risk-taking, efforts to reduce cost, and incentives from underfundings, and emphasize the role of past returns. Especially, Andonov and Rauh (2022) [7] show pension funds highly depend on their past return to induce high expected returns because funds with higher expected risk premiums can invest in a targeted higher risky assets. This finding is the same as the findings in macroeconomics that past stock market performance is associated with the forward-looking expectations as noted by Vissing-Jorgensen (2003) [141], Malmendier and Nagel (2011) [100], and Greenwood and Shleifer (2014) [64]).

Based on empirical findings of the effect of past performance on expected returns, Andonov and Rauh (2022) [7] suggest the target asset portfolio set based on extrapolated expectations might reflect the institution's investment beliefs, and this finding is consistent with extrapolation belief bias in behavioral finance as Da et al. (2021) [41] pointed out. Da et al. (2021) [41] examine the extrapolation belief bias based on the asset pricing model using crowdsourcing platform data and show asymmetric extrapolation bias from negative and positive past returns. Especially, Da et al. (2021) find that investors give more weight to negative past returns, and this weight decreases more slowly for negative returns than positive. This finding also supports the extrapolation belief bias

associated with past performance in finance, as Andonov and Rauh (2022) [7] noted. Although the financial approach sheds light on PPF investment and optimal asset allocation, the extrapolation belief bias suggest that more studies are needed using other variables that absorb the effect of behavioral bias on investment of PPF conditional on financial performances.

As mentioned above, another line of research focuses on persistent components based on behavioral finance conditional on financial effects to fill the gap in the bias effect on investment behaviors. For example, the psychological and behavioral finance literature emphasizes that the role of institutional condition in terms of cultural values that allow the persistence of financial and economic shocks by amplifying its effect through various channels. Gorodnichenko and Roland (2017) [57] show how individualism as the institutional condition is positively associated with counties' economic development using the population genes similarity between countries as the set of instruments. This causal effect of individualism on economic performances supports that economic decision-making can be embodied in the shared group and individual beliefs based on culture. In the same line, Chui et al. (2002) [34] propose that the national culture can be the missing piece to the puzzle of the determinant of capital structure using firm and countries data and show conservatism (power distance) is significantly related to low debt ratio. Also, Li et al. (2013) [92] find that culture affects corporate risk-taking directly and indirectly through a managerial decision-making and through a country's formal institutions using 35 countries firm-level data. In details, Li et al. (2013) [92] provide empirical results that individualism positively affect risk-taking, but uncertainty avoidance and harmony are negatively associated with risk-taking. Also, Dai et al. (2022) [42] show that cultural factors can influence the risk management of hedge funds through the psychological process. Especially, Dai et al. (2022) [42] show that individualism culture induces high risk-taking, and its impact is amplified when individual incentive structure is legally guaranteed. These findings identify

a number of reasons for expecting differences in financial decision-making across national cultures via individual and institutional levels, as Hofstede (2001) [71] noted.

Most papers that consider cultural aspects, such as individualism, collectivism, and uncertainty avoidance, in finance pay less attention to whether cultural factors can amplify the effect of the financial effect on investment decisions conditional on past performance and liabilities in terms of the extrapolation belief bias as Andonov and Rauh (2022) [7] and Da et al. (2021) [41] noted. Dai et al. (2022) [42] provide how individualism can discourages the effect of underperformance on risk-taking. Dai et al. (2022) [42] use the Hazard ratio and Probit models to show that a more individualistic culture reduces the default risk of hedge funds using the interaction term of individualism and past performance. This finding indicate that the relationship between performance-failure and high individualistic countries are negative because of the risk-shifting behaviors. Due to the switched signs of interaction term of individualism and past performance, the finding of Dai et al. (2022) [42] support a possible link between individualism, overconfidence, and self-attribution bias in finance.

To sum up, based on the literature on traditional finance and behavioral finance, in this section, the prior suggestion is that financial conditions, such as past returns, funding deficits, and PPF characteristics, influence the investment behavior of PPF. Also, we postulate national culture can affect an institution's financial decision-making directly through management and indirectly through the institution- and country-level characteristics. Prior research has distinguished three levels at which culture has its effects: country levels, such as laws, regulations, and market development; institution levels, such as liabilities and past and future returns; and individual levels, such as managers' risk attitude and incentive. We do not have the individual level data,, our empirical approach focuses on the first two levels of conditions. In the next section, we develop hypotheses for countries and institutional levels.

4.2.1 Country level approach

Each country has different institutional conditions that affect corporate culture. La Porta et al. (1998 [86], 2000 [87]) show that institutional environments, such as investment protection, the rule of law, capitalization, and legal origins, lead to different levels of investments among countries. Also, North (1990) [115] points out that national cultural values outline appropriate societal decisions and behaviors, including corporate and individuals. We use the broadly exploited cultural variables of Hofstede (2001) [71] as the measures for formal institutional conditions based on empirical studies about the effect of culture as a formal institutional environment on finance (Aggarwal and Goodell (2013) [1], Griffin et al. (2021) [66], Li et al. (2013) [92], Licht et al. (2005) [93], and Kwok and Tadesse (2006) [85]). We especially postulate that national cultural values, such as individualism, uncertainty avoidance, masculinity, and power distance, can determine the formal institutional conditions.

Individualism emphasizes individual achievement by supporting individual freedom and self-interested. Markus and Kitayama (1991) [101] argue that an individualism fuels and encourages creativity with respect to own abilities. However, collectivism stresses groups' opinion rather than individual opinion and enhance informal tie and relationship within groups. Therefore, a collectivist society induces relatively low weight on individual proficiency (Hofstede (2001) [71]). Dai et al. (2022) [42] show that individualism significantly encourages performance in hedge fund management because hedge fund managers have greater autonomy in investment decisions. Cline et al. (2021) [37] also support that individualistic countries impose more strong regulations on insider trading using 92 countries' data and show that individualism with higher law enforcement significantly increases domestic financial market development. This literature supports the positive effect of individualism on financial performance.

H1a. Individualism is positively associated with PPF performance.

On the other hand, Ghuoul and Zheng (2016) [54] study how culture is associated with trade using 49 countries' 261,384 firm-year observations from 1993 – 2013. Guoul and Zheng (2016) [54] show that a higher level of collectivism (the opposite measure of individualism) is positively associated with trade credit provision, and collectivism can fuel transaction. This findings are the same as empirical evidence of Greif (1993) [65] that the Maghribis' institutional adoption (i.e., the coalition) related to collectivist beliefs in business. Also, Griffin et al. (2021) [66], using 43 countries' firm-level data from 2003–2015 period, use hierarchical linear model and find that individualism affect negatively ROA.

H1b. Individualism is negatively associated with PPF performance.

Another line of extent research has also noted a relationship between individualism and risk-taking. Li et al. (2013) [92]), and Markus and Kitayama(1991) [101] argue that an individualistic environment enforces investors' judgment to make decisions that weighty risky payoffs or underestimate the level of uncertainty by focusing corporate risk-taking. Li et al. (2013) [92] provide empirical evidence that firms in more individualistic cultures significantly increase R&D and the standard deviation of ROA. Chui et al. (2010) [35] also investigate how cultural dissimilarity influence the returns of momentum strategies using Hofstede (2001) [71] to control overconfidence and self-attribution bias, show positive effects of individualism on trading volume, volatility, and the magnitude of momentum profits. Shao et al. (2013) [131], using stock trading data in the U.S., explore the relationship between individualism and corporate investment and find that firms in in-

dividualistic countries invest more in risky assets than in safe assets. Dai et al. (2022) [42] also find that hedgefund management in individualistic countries significantly increases the standard deviation of monthly investment returns, market risk, and idiosyncratic risk.

H1c. Individualism is positively associated with PPF risk-taking.

However, Dai et al. (2022) [42] suggest that even if overall influences of individualism are positively associated with risk behavior, its direction is conditional on previous performance. Dai et al. (2022) [42] provide hedge funds that significantly reduce the default risk when past performance is low. This implies that individualism can have a negative effect on risk-taking. These findings suggest a negative association between high individualism and risk-taking. Griffin et al. (2021) [66] also find the paralleled result that firms with a high level of individualistic culture significantly reduce the cost of debts and cost of equity. Timmer (2018) [139] also provide that PPF prefers relatively more stable returns and responds countercyclically to investment.

H1d. Individualism is negatively associated with risk-taking.

Uncertainty avoidance evaluates the degree to which individuals feel either comfortable or uncomfortable in market-based financial systems characterized by uncertainty and ambiguity, as noted by Kwok and Tadesse (2006) [85], and Li et al. (2013) [92]). We focus on uncertainty avoidance because it is a proxy for hostility to ambiguity or Knightian Uncertainty (Knight, 1921 [81]). Hofstede (2001) [71] states that "Uncertainty Avoidance is not the same as risk avoidance; it deals with a society's tolerance for ambiguity." Since high uncertainty avoidance indicates a lower acceptance

for ambiguity and a higher distaste to adjustment, investors in countries with high uncertainty avoidance might be less reactive to fund performance due to its difficulty to distinct skilled managers from lucky grounded on past performance. Also, uncertainty avoidance is associated to fund managers' risk aversion to differing from the benchmark strategies. Countries with higher uncertainty avoidance show less tolerance to behavior that is novel, unknown, surprising, or different from usual. Based on these hypothesis, Keswani et al. (2020) [77] using 26,861 equity funds, show empirical relation between performance using four-factor alpha, and uncertainty avoidance are negative.

H2a. Uncertainty avoidance is negatively associated with PPF performance.

As Kwok and Tadesse (2006) [85] reported, high uncertainty avoidance makes countries use the banking system more than equity financing. For example, Germany, which has a high score in uncertainty avoidance, develops a banking system for the financial market. On the other hand, the U.S., with low uncertainty avoidance, uses an equity market financial system. Also, Li et al. (2013) [92] show that uncertainty avoidance negatively affects corporate risk-taking and R&D investment. These findings support the negative effect of uncertainty avoidance on financial institutions' asset portfolios. Ghoul and Zheng (2016) [54] also argue that a high uncertainty avoidance culture requires higher reliability by providing implicit guarantees that reduce opportunistic risk-taking of firms.

H2b. Uncertainty avoidance is negatively associated with risk-taking.

Additionally, behavioral economics and finance literature show that genders role in society as-

sociated with risk taking, and Hofstede (2001) [71] provides masculinity as a measurement of a preference in society for achievement and heroism. It can capture assertiveness and completeness as the institutional condition, and high masculinity society prefer to seek high economic achievements rather than quality of life by emphasizing more competitiveness among people than social relationship. Cline et al. (2021) [37] explore the effect of masculinity on the market outcome through regulation, but Cline et al. (2021) [37] cannot find the effect of masculinity on market performance and degree of regulation. Dai et al. (2022) [42] also find a similar result based on hedge fund data. Dai et al. (2022) [42] provide that masculinity is significantly associated with risk-taking and an incentive contract rather than fund performance. In addition, Chui et a. (2016) [36] show that a high level of masculinity increases the cost of debt, and its result supports firms in less feminine prefer high risk-taking. Ghoul and Zheng (2016) [54] postulate that borrowers in high masculinity society involve in high-risk taking and overinvestment, and they find that expected this problem, lenders in higher masculinity countries prefer to use shorter debt to alleviate borrower opportunism. Also, Ghoul and Zheng (2016) [54] show that trade credit is significantly positively associated with firm-level guaranteed credit with high masculinity countries.

H3a. Masculinity is positively associated with PPF risk-taking.

H3b. Masculinity is positively associated with PPF performance.

Power distance measures the degree to which society accepts that power is distributed unevenly and centralization which can be a proxy for anti-dictatorship measurements. Griffin et al. (2021) [66] use an anti-director rights index that measure allowing minority voters voice in firm rather than

power distance across countries, and show that a high score of the anti-direct index is associated with better firm performance in terms of Tobin'Q and ROA. This finding supports that the positive effect of equally distributed power or allowing minorities' voices have a positive effect on performance.

H4a. Power distance is negatively associated with PPF performance.

On the other hand, Chen et al. (2022) [33] test the effect of power distance in business using ownership structure. They show that the S-shape relationship between power distance and firms performance using the top 100 business groups in Taiwan. This finding provides the power distance can have positive effect on performance conditional on its level.

H4b. Power distance is positively associated with PPF performance.

Laeven and Levine (2009) [88] examine how risk-taking by banks is influenced by powerful owners and show consistent results with theories that shareholders have more substantial incentives to take high risk than non-shareholding managers and creditors. Ghoul and Zheng (2016) [54] also show that increased power distance significantly increase the credibility of a transaction due to high risk-taking incentive. This implies that power distance is positively associated with risk-taking.

H4c. Power distance is positively associated with risk-taking.

4.2.2 Financial institution approach

In the previous section, we provide the literature that countries encourage risk-taking and better performance conditional on high individualism, low uncertainty avoidance, high masculinity, and

high power distance. As Jensen and Meckling (1976) [75] noted, many corporations have compensation schemes to affiliate risk preferences. We also provide the literature that individualism highlights individual independence and self-interest, and it is consistent with performance base compensation (Li et al. (2013) [92] and Dai et al.(2022) [42]). Also, masculinity, power distance, and uncertainty avoidance are related to performance-base compensation schemes associated with risk preferences as country-level institutional condition. We do not directly observe channels of cultural variables' influence related risk preferences. Therefore, in this section, we provide literature about the direct effect of financial components related to PPF investment behaviors mainly. However, even if we can not capture the direct effect of risk preferences on PPF investment behaviors, we can explore whether the effect of financial factors are amplified or abated using cultural factors as the groups' beliefs related to preferences. For further investigation, we explore the literature on how the effect of financial factors is associated with cultural factors as basis mediators focusing on interaction terms.

Trianti (2015) [138] reports that public pension funds usually use conservative portfolios as investment strategies. Trianti (2015) [138] uses the OEDC countries data and shows PPFs are one of the main buyers of fixed-income securities or loans to public entities from 2001 to 2013. But, in the last decades, PPF started to invest in equities, and other asset classes, such as private equity, hedge funds, commodities, and other alternative assets facing higher risk and return than fixed assets as the OECD reported (OECD 2021 [117]). This change in the PPF portfolio makes us study what financial factors determine the change in asset allocation and how risks and returns are traded off from the change in asset allocation.

Based on the decreased fixed-income investment and the increased equity investment, Rauh (2009) [123], in a risk management aspect, propose that asset allocation decisions is associated with funding status, especially underfunding. Especially, Rauh (2009) [123] find that pension fund

asset allocation to a fixed income is positively associated with poorly funded pension plans and low credit score, on the other hand, investing more in equity is positively associated with well-funded pension plans and strong credit ratings using the U.S data from 1990 to 2003. Also, Mohan and Zhang (2014) [107], using the Public Plans Database, test whether a low-funding ratio leads to investing in more risky securities and find underfunded plans lead to investing in more risky assets This positive relationship is the risk transfer hypothesis. Similary, Lucas and Zeldes (2009) [95] support the effect of funding deficits on the risk-taking of PPF by providing empirical results of a positive correlation between risky assets (increased equity investment) and funding deficits as the role of stock as a hedge against funding deficits risk.

H5. Underfunding is positively associated with risk-taking.

Black (1989) [13] argues that if there is a positive long-term relationship between stock returns and pension, holding equities allows a partial hedge in opposition to liabilities. In the same vein, Lucas and Zeldes (2009) [95] show the relationship between stock returns and pension liabilities. However, Franzoni and Marin (2006) [53] argues that the market tend to overvalue firms that face severely under funding of pension plans and show pension companies with underfunding achieve lower investment returns than firms with better pension funding for at least five years using the three-factor model. These two different findings suggest the ambiguous effect of underfunded liabilities on PPF returns. The reason why the undetermined effect of underfunding is due to risk-taking. The previous literature provides that underfunding are positively associated with risk-taking; as a result, underfunding can give negative and positive returns through risky asset portfolios conditional on market fundamentals.

H6a. Underfunding is positively associated with PPF performance.

H6b. Underfunding is negatively associated with PPF performance.

Another research line is the effect of past returns on risk-taking. Pennacchi and Rastad (2011) [120] use a dynamic model for PPF portfolio risk based on the assets allocations and PPF characteristics using 125 state pension funds form 2000 to 2009. Pennacchi and Rastad (2011) [120] find that funds use high risk portfolio when pension funds experienced poor investment performance, and this evidence is in line with agency risk-taking behavior of public pension fund management. Mohan and Zheng (2014) [107] also exploit the last years' investment return to investigate the risk transfer incentive hypothesis. This hypothesis suppose that low returns in the past give the incentive to the management team to take more risk to cover past low performance. Based on this hypothesis, they show that PPFs experienced low returns in the previous years pursue increasing risk in the current year. Mohan and Zheng (2014) [107] show that the investment return coefficient is negative. On the other hand, Rauh (2009) [123] provides opposite results with risk transfer incentives. Rauh (2009) [123] show that higher investment return induces higher allocation to equity. The effect of the pension fund invested in safe assets decline when lagged investment returns are high. In line with Rauh (2009) [123], Boon et al. (2018) [17] show past investment return is positively associated with risk-taking, especially equity investment, using PPF in the U.S., Canada, and the Netherlands from 1992–2011.

H7a. Past returns is negatively associated with PPF risk-taking.

H7b. Past returns is positively associated with PPF risk-taking.

The other testable hypothesis is the positive relation between past returns and current. The positive relationship between past and current returns will be supported if there is long-term persistence in the investment practices and skills of PPF. For example, if a pension fund outperforms a given asset strategy in a given year, PPF might likely do so in the next years. Therefore, the outperformed PPFs in the past year could formulate investment skills in the asset strategy, thus, current performance would be the function of past performance. Andonov and Rauh (2022) [7] exploit the persistence of PPF performance using the lagged pension fund return from t–1, from t–3 to t–1, from t–5 to t–1, and from t–10 to t–1. Andonov and Rauh (2022) [7] show only positive persistence on a one-year lagged term. The results for the medium- and long- term persistence do not support the persistent effect of past performance on pension performance as the extrapolation bias. Based on Andonov and Rauh (2022) [7], we postulate the short-term positive persistence of PPF investment performance using the one year lagged return.

H8. Past(1yr) returns is positively associated with PPF performance.

The other research line is the effect of management fees in terms of incentives related to risk-taking. Dai et al. (2022) [42] show empirical evidence that performance is assessed to management fees and argue that incentives lead to better subsequent performance. In detail, Dai et al. (2022) [42] shed light on the effect of management fees on fund performance, and find that management fees significantly increase Hedge funds' performance. At the same time, incentive provisions can diminish the risk-shifting behavior subsequent inferior performance. Especially, Dai et al. (2021) [42] provide

empirical evidence that management fees are positively associated with total and idiosyncratic risks. Also, they provide the empirical result that the incentive related to performance reduces the default risk of hedge funds by stimulating risk-shifting conditional on poor performance.

H9a. Management fees is positively associated with risk-taking.

H9b. Management fees is negatively associated with risk-taking.

H9c. Management fees is positively associated with performance.

The last line of research is the interaction effect of cultural and financial variables. Even if cultural variables might have direct effects on PPF investment, they also can play a role as a mediator of risk attitude. Because culture is a factor that forms a belief of a group/individual, we postulate that cultural aspects can be a channel to enhance the effect of financial variables in terms of past performance. Andonov and Rauh (2022) [7] suggest target asset allocation set based on extrapolated expectations is the reflection of the institution's investment beliefs, and this finding is consistent with extrapolation belief bias in behavioral finance. Da et al. (2021) [41] find that investors give more weight to negative past returns, and this weighted effect decreases more slowly for negative returns than positive. This finding supports the extrapolation belief bias as the behavioral bias in PPF investment, as Andonov and Rauh (2022) [7] noted. Therefore, we use interaction terms to test the effect of past performance on investment behavior through cultural variables to capture overconfidence and self-attribution bias in terms of extrapolation belief bias based on past performance experiences in behavioral finance.

Primarily we focus on the effect of individualism through financial variables because Hofestede (2001) [71] noted that individualism is related to overconfidence and self-attribution bias. Also, Chui et al. (2010) [35] highlight the effect of overconfidence on risk-taking by focusing on the positive relationship between individualism and the momentum of profit. Dai et al. (2022) [42], as one paper, shows how individualism can change risks taking through past performance. Dai et al. (2022) [42] show the risk- shifting is driven by underperforming funds from high individualistic cultures. Especially, they find hedge funds in individualistic cultures is involved in more risk shifting reaction to inferior initial performance. Additionally, Dai et al. (2022) [42] show that the likelihood of fund failure increase with inferior past performance. But positive effect of the interactions of individualism and past performance support that the performance-failure relation is diminished in high individualistic countries. This findings suggest that more individualistic cultures grantees high discretion and individual judgment for leveraging based on managers ability. Therefore, individualism can change the risk attitude conditional on past performance as a mediator.

H10a. More individualistic culture is positively associated with risk-taking under poor past performance.

H10b. More individualistic culture is positively associated with performance under good past performance.

4.3 Variables and the Sample

The data in this paper covers mandatory public pensions based on OECD pension reports. OECD provides information for cross-country comparisons and shows a diversity of pension systems in OECD and non-OECD countries, and provided the pension model from the OECD and World

Bank consists of three pillars. The first pillar is the social security pension plan, introduced to benefit the elderly. Benefits under the first pillar almost be universal, and it is run by tax system. The second pillar is the supplement of the first pillar benefit using a funded system. It is financed through mandatory contributions on wages by the government of quasi-private agents. The third pillar is a fully private retirement savings and pension plan.

Based on the type of pension system, we focus mainly on the second pillar operated by the funding system and managed by government. We exclude if the second pillar pension system is not mandatory and is operated by the private agent. All OECD countries have three pillars of the pension system, on the other hand, most of non-OECD countries has the first and third pillars. Because this paper uses the mandatory funded second pillar type of PPF, our data set is made up of the OECD countries. Some countries, such as Russia, Arab Emirates, etc., have the second mandatory pension plan, but data is not accessible.

Table 1 describes the list of countries and PPFs in our sample. We cover 28 institutions in 19 OECD countries from $1998 - 2022$. We collect data from the annual reports of each countries PPF in Table 1. Because countries in Table 1 provide PPF financial statements or annual reports using their own website, we are able to collect data about PPF investment information and financial information.

Table 4.1: List of Countries

Country	Continent	Name
Austria	Europe	State Pension
Canada	North America	Canda Pension Plan (CCP)
Denmark	Europe	ATP
Finland	Europe	TyEL, VER, KEVA
France	Europe	French Public Pension (FRR)
Greece	Europe	National Social Security Fund
German	Europe	GRV, Pensionskassen
Hungary	Europe	Social Security funds
Iceland	Europe	Icelandic General Pension Fund (IGP)
Ireland	Europe	National Pensions Fund
Italy	Europe	National Institute for Social Security, Social Insurance
Japan	Asia	Government Pension Investment Fund
Korea	Asia	National Pensions Services
Latvia	Europe	Funded pension
Lithuania	Europe	Public Pension, Funded Pensions, Asset Preservation pension funds
Luxembourg	Europe	Caisse Nationale d'Assurance Pension (CNAP)
NewZeland	Asia	NZ Super Fund
Norway	Europe	Government Pension Fund Global, Government Pension Fund
Sweden	Europe	AP1, AP2, AP3, AP4, AP6

Notes: This table describes lists of public pension funds in the sample from 1998 to 2021.

4.3.1 Measures of risk-taking and performance

The first measure of pension risk is the percentage of total PPF assets invested in the equity market, as reported in annual reports from each country. For performance measures, we exploit the annual return of portfolios. Also, we cover other assets investment in aspect of portfolio theory, such as the amount of investment in international equity market, domestic equity market, fixed income, real estate (the amount of investment in land, infrastructure, and real commodities), and otherA (the amount of investment in private equity, credits, etc excluding real estate), and Alternative (sum of real estate and OtherA).

4.3.2 Cultural variables

We use four cultural values— individualism, uncertainty avoidance, masculinity, and power distance— constructed from the worldwide sample from Hofstede (1980, 2001). To save space, we provide the definitions of these variables in the Appendix A3.

Table 4.2: Sample Statistics

Variables	Obs	Mean	SD	Min	Max
Returns	327	6.53	9.942	-40.9	44.2
Fund deficits	357	-0.016	0.229	-3.151	0.998
Past(1yr) returns	309	6.806	9.471	-30.4	44.2
Past(1yr) deficits	336	-0.015	0.23	-3.151	0.998
Equity	356	44.44	17.42	0	78.97
DEquity	214	14.95	9.266	0	60.5
iEquity	214	28.33	16.07	0	67
Fixed income	356	38.24	18.57	0	93
Real Estate	331	6.16	6.825	0	28.31
OtherA	356	9.275	18.57	0	81.64
Alternative	356	13.289	16.07	0	82.9
Adcost	339	14.25	47.08	0.001	443.1
Investprofit	275	0.188	2.071	-0.3007	34.33
lnassets	394	5.413	2.958	0.302	13.764
Individualism	439	64.65	14.76	18	80
Masculinity	439	39.39	29.88	5	95
Powerdistance	439	37.63	13.25	11	68
Uncertaintyavoidance	439	58.7	13.25	23	112

Notes: This table presents sample statistics of our dependent variables and controls for PPF in sample, which consists of 28 institutions and 337 observations. Definition of these key variables are provided in Table A3.1.

4.3.3 Financial variables

We use Fund deficits(current) and Past(1yr) deficits as funding status to test the risk management hypothesis. Following the risk transfer hypothesis, underfunding is a method of transferring current pension costs to future taxpayers in the aspect of risk management. Especially, if the growth in pension expense exceeds the growth in contribution, the severely underfunded pension funds would take on more risk. Based on this hypothesis,the predicted sign for the funding deficits on risk-taking is negative. We also use the past investment return (Past (1yr) returns) to test the risk transfer incentive. Funds that experienced low returns in prior years may react by increasing risk in the current year; thus, the predicted sign for the investment return coefficient is negative. Also, we test the persistent performance hypothesis using Past (1yr) returns, suggested by Andonov and Rauh (2022) [7]. The short-term performance hypothesis is that if PPF experience outperforms in the past, then the management team will formulate this successful skill and keep using it to achieve high returns in the future. Therefore, past returns would positively affect PPF performance due to successful investment skills. Based on the risk transfer and performance hypothesis, we use Fund deficits, Past(1yr) deficits, and Past(1yr) returns mainly. Also, we use lnAssets , Investprofit, and Adcost to consider the effect of fund size and incentive on PPF performance and asset composition in the aspect of PPF operation. The Sample statistics are discussed above in Table 4.2.

4.3.4 Empirical Strategies

We use a reduced fixed effect framework for identification. Our research focuses on a PPF's performance and risk-taking using asset allocation in response to financial and cultural conditions. The main estimable model is as follows

$$Y_{it} = \beta_0 + \beta_1 Fundingstatus_{it} + \beta_2 Return_{it-1} + \beta_3 Cultures_{it} + \beta_4 X_{it} + \tau_i + \lambda_i + t_t + \epsilon_{it} \quad (4.1)$$

where Y_{it} is the return of assets and the percentage of Equity, Fixed income, Real estate, and OtherA investment; $Fundingstatus_{it}$ is Fund deficits (pension expense - pension contribution over total assets) and Past(1yr) deficits; $Returns_{it-1}$ is Past(1yr) returns; $Cultures_{it}$ is the Hofstede's cultural dimensions discussed above, X_{it} includes the PPF's financial characteristics, such as Size (ln(1+total assets)), Adcost (Administration Fees), Investincome (Investment income over total assets). τ_i and λ_i capture an unobserved fund- and country- specific fixed effects, and t_t is a year fixed effect, and the last term ϵ_{it} is the error term.

4.4 Results

4.4.1 The persistence of past performance and risk transfer Hypothesis : Fund deficits and past performance

We implement univariate tests first by excluding PPF characteristics, such as Fund Size (lnassets), Administration costs (Adcost), and Investment profit ratio (Investprofit), and then conduct the multivariate test with PPF characteristics. Panel A in Table 4.3 provides the univariate OLS estimation results of the impact of Fund deficits, Past(1yr) deficits, and Past(1yr) returns. Past (1yr) returns are significantly negatively associated with returns in all Columns in Table 4.3. On the other hand, Fund deficits and Past (1yr) deficits are not significant in all Columns in Panel A in Table 4.3.

Based on the results in Panel A of Table 4.3, we confirm that the short-term persistent hypothesis related to returns is rejected. This implies that in our case PPFs current outperform does not results of past outperform. In other words, the negative influence of Past (1yr) returns can be explained by the efficient market hypothesis. Because market is efficient, the past skills or information cannot make good performance today. This is opposite evidence with Andonov and Rauh (2022) [7].The other possible explanation for negative effect of Past (1yr) returns is that the risk transfer incentive

Table 4.3: Performance and PPF financial status

	Returns	Returns	Returns	Returns	Returns	Returns
Panel A						
Fund deficits	-1.377		-3.271	-1.377		-3.271
	(4.616)		(5.575)	(4.616)		(5.575)
Past(1yr) deficits		-3.255	-2.804		-3.255	-2.804
		(2.752)	(2.867)		(2.752)	(2.867)
Past(1yr) returns	-0.229***	-0.234***	-0.232***	-0.229***	-0.234***	-0.232***
	(0.066)	(0.066)	(0.066)	(0.066)	(0.066)	(0.066)
Shock(after 2008)				-23.00***	-22.56***	-22.57***
				(7.719)	(7.711)	(7.736)
Observations	289	288	287	289	288	287
R-squared	0.568	0.570	0.570	0.568	0.570	0.570
F-test	12.98	13.02	12.45	12.98	13.02	12.45
Other Controls	No	No	No	No	No	No
Panel B						
Fund deficits	-5.315		-4.345	-5.315		-4.345
	(5.224)		(5.288)	(5.224)		(5.288)
Past(1yr) deficits		-5.598	-5.016		-5.598	-5.016
		(4.341)	(4.402)		(4.341)	(4.402)
Past(1yr) returns	-0.267***	-0.279***	-0.277***	-0.267***	-0.279***	-0.277***
	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)
Adcost	0.022*	0.022*	0.022*	0.022*	0.022*	0.022*
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Investprofit	0.019	0.041	0.024	0.019	0.041	0.024
	(0.202)	(0.201)	(0.202)	(0.202)	(0.201)	(0.202)
lnAssets	2.720**	2.621**	2.807**	2.720**	2.621**	2.807**
	(1.208)	(1.187)	(1.209)	(1.208)	(1.187)	(1.209)
Shock(after 2008)				-27.90***	-27.12***	-27.80***
				(8.195)	(8.141)	(8.190)
Observations	239	239	239	239	239	239
R-squared	0.655	0.656	0.658	0.655	0.656	0.658
F-test	13.38	13.44	12.98	13.38	13.44	12.98
PPF & Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table shows the results for the relationship between PPF past performance and funding status and PPF performance. Fund deficits is the current funding status, Past (1yr) deficits is the last year funding status, and Past (1yr) returns is the last year PPF performance. All variables in levels are measured at the end of each year and are defined in appendix A3.1. Fixed effects are included. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

hypothesis suggests that funds that experienced low returns in prior years may pursue more risk-taking in the current year to achieve better performance in the next year. If the risk transfer incentive is valid, then Past (1yr) returns have a significant effect on PPF performance due to the changed in asset portfolios. Due to the negative effect of Past (1yr) returns, we can suggest the risk transfer incentive hypothesis is the valid channel in PPF investment. For investigating market efficient hypothesis and risk transfer incentive hypothesis through asset allocation, we need to further study on portfolios of PPF.

In addition, we confirm that the effect of the fund deficits on performance are rejected. Specifically, based on the risk transfer hypothesis, underfunding is a method of transferring current pension costs to future taxpayers. If the risk transfer hypothesis is valid, the expected sign for the Fund deficits would be a positive effect on risk-taking; as a result, due to risk-taking, fund deficits can

lead poor or good performance of PPF. But, we cannot detect any significant effect of Fund deficits and Past (1yr) deficits. We study how asset allocation is associated with funding status further in the next section.

For further investigating the results of Panel A in Table 4.3, we operate multivariate regressions with PPFs characteristic to test the short-term persistent hypothesis for returns and the risk transfer hypothesis for fund status. Results in Panel B of Table 4.3 are in line with the result in Panel A. Specifically, Fund deficits and Past (1yr) deficits are not significant in all Columns. Panel B in Table 4.3 indicates that Past (1yr) returns significantly decrease PPFs performance in all Columns, and the negative signs of Past (1yr) returns reject the short-term persistent hypothesis. As we mention above, the significantly negative effect of Past (1yr) returns might not be result of the risk transfer incentive hypothesis through risk-taking but the results of the efficient market hypothesis.

In addition, Panel B in Table 4.3 shows the effects of fund size and administration cost (management fees) on performance. lnassets in terms of PPF size significantly increase PPF investment returns, and Adcost in terms of the administration cost on also positively associated with PPF investment returns. These results support the size effect of PPF on returns, and the incentive effect related to management fees in terms of the administration costs on PPF returns.

4.4.2 Investment Strategies and performance

In the previous section, we operate empirical tests for the risk transfer hypothesis and performance persistence based on fund status and past performance. Even if fund deficits and past performance are important factors that affect PPF performance, PPF's performance results from investment strategies. Also, the significant effect of Past (1yr) returns on PPF investment returns can be biased because asset portfolios is the main determinant of investment returns. For example, if the last year's investment returns of PPF are low, then the management teams of PPF can

reallocate its assets to seek high returns or vice versa. Therefore, there is a direct effect of the Past (1yr) returns and the effect of the change in assets portfolio. This because PPF investment strategies should be considered. Specifically,fund status might be positively related with risky asset portfolios based on the risk transfer hypothesis, and the effect of fund status and past performance might be upwarded bias if we do not include asset allocations of PPF. Therefore, we will include asset composition for investigation of the effect of funding status and past performance on returns associated with the result of the risk transfer hypothesis.

For considering the effect of asset portfolios, we use three assets categories, such as Equity (iEquity and DEquity), Fixed income, and Alternative, and four assets categories, such as Equity (iEquity and DEquity), Fixed income, Real Estate, and OtherA. Based on asset portfolios, Panel A in Table 4.4 indicates the univariate effect of PPF portfolios on investment performance, and Panel B in Table 4.4 shows the effect of PPF portfolios with Past (1yr) returns on performance. In aspect of investment in risky assets in terms of equity, Panel A in Table 4.4 shows that Equity (PPF investment in public equity market) and DEquity (PPF investment in domestic public equity market) are not significant in Columns (1) and (2). On the other hand, the iEquity (PPF investment on international public equity market) is negatively associated with PPF returns in Column (3) at the 10% level. This implies that risk assets investment in terms of the international equity market reduces PPF investment returns.

In terms of safe assets investment, in Column (4), Fixed income is not significantly related to PPF performance. This implies that the investment in safe assets does not increase or decrease PPF performance. Furthermore, many institutional investors started to invest in alternative assets such as real estate, commodities, private equity, etc., since 2008. We test the effects of alternative assets investment of PPF using the amount of investment in Alternative assets, Real Estate, and

Table 4.4: Performance and portfolios: Univariate Tests

	Returns	Returns	Returns	Returns	Returns	Returns	Returns	Returns	Returns	Returns	Returns
Panel A											
Equity	0.004							-0.013			
	(0.035)							(0.044)			
DEquity		0.074							0.132	0.119	0.118
		(0.077)							(0.082)	(0.080)	(0.079)
iEquity			-0.134*						-0.205**	-0.170**	-0.240***
			(0.073)						(0.085)	(0.079)	(0.084)
Fixed income				0.001				0.001	0.001	0.001	0.001
				(0.001)				(0.001)	(0.001)	(0.001)	(0.001)
OtherA					-0.156						-0.317**
					(0.106)						(0.157)
Alternative						-0.115**		-0.118**	-0.153***		
						(0.053)		(0.054)	(0.057)		
Real Estate							-0.155*			-0.184**	
							(0.081)			(0.088)	
Observations	318	227	227	318	318	239	297	239	211	223	227
R-squared	0.555	0.604	0.609	0.556	0.558	0.548	0.578	0.549	0.631	0.624	0.622
F-test	13.72	11.52	11.76	13.76	13.91	9.747	13.98	8.962	10.44	10.78	10.94
Panel B											
Past(1yr) returns	-0.235***	-0.231***	-0.227***	-0.234***	-0.244***	-0.257***	-0.235***	-0.257***	-0.244***	-0.224***	-0.241***
	(0.059)	(0.070)	(0.070)	(0.059)	(0.059)	(0.069)	(0.061)	(0.069)	(0.073)	(0.071)	(0.070)
Equity	0.023							0.001			
	(0.035)							(0.044)			
DEquity		0.054							0.108	0.090	0.101
		(0.080)							(0.088)	(0.085)	(0.084)
iEquity			-0.090						-0.152*	-0.124	-0.205**
			(0.075)						(0.088)	(0.082)	(0.088)
Fixed income				0.001				0.001	0.00	0.00	0.001
				(0.001)				(0.001)	(0.001)	(0.001)	(0.001)
OtherA					-0.221**						-0.344**
					(0.105)						(0.158)
Alternative						-0.123**		-0.123**	-0.155***		
						(0.053)		(0.054)	(0.057)		
Real Estate							-0.147*			-0.174*	
							(0.081)			(0.088)	
Observations	301	217	217	301	301	227	282	227	201	213	217
R-squared	0.586	0.629	0.631	0.587	0.593	0.575	0.601	0.575	0.654	0.644	0.644
F-test	14.63	12.12	12.23	14.64	15.01	10.22	14.43	9.388	10.86	11.12	11.35
PPF FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls	No	No	No	No	No	No	No	No	No	No	No

Notes: This table shows the results for the relationship between PPF past performance and asset allocations and PPF performance. Past (1yr) returns is the last year PPF performance, Equity is the % of investment in equity market,DEquity is the % of investment in domestic equity market, iEquity is the % of investment in international equity market, Equity is the % of investment in equity market,Fixed income is the % of investment in bond market,OtherA is the % of investment in private equity market, Alternative is the % of investment in Real estate and private equity market, and Real estate is the % of investment in infrastructure and Real estate markets.All variables in levels are measured at the end of each year and are defined in appendix A3.1. Fixed effects are included. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

OtherA (private equity and others). The effect of Other.A are not significant in Column (5) of Panel A, however, Alternative and Real Estate significantly reduce returns at the 5% and 10% levels in Columns (6) and (7) in Panel A of Table 4.4. This implies that the negative effect of Alternative assets are from the investment of Real Estate rather than OtherA. The reason why real estate is negative is real estates such as infrastructure, plants, and buildings investment covers long-lived tangible assets, and those are not risk-return asset. In addition, real estate is a new asset class and has lower sensitivity to the business cycle, little correlation with equity markets, and long duration. The benefits of real estate investment deliver more stable and diversifying cash flows than other asset classes. Therefore, investment in real estate might be negatively related to low returns of PPF due to low risk. The other results in Columns (8), (9), (10), and (11) are consistent with negative effects of iEquity, Real estate, and OtherA in PPF return, even if we consider all PPF assets portfolios for inter-relationships assets.

Even if we detect the effect of investment strategies on PPF performance, Past (1yr) returns will

be important factors in PPF performance as the past investment skills. To consider this factor, Panel B in Table 4.4 provides results of assets composition and Past performance. We find the consistent negative effect of Past (1yr) returns on PPF performance in all Columns in Panel B of Table 4.4, regardless of asset portfolios. Also, the results of assets such as Alternative and Real Estate are consistent with the results in Panel A. The signs are native in Columns (6), (7),(8), (9), and (10). Also, the negative effect of iEquity on returns is significant in Columns (9), (10), and (11). These results support the riskt asset in terms of iEquity investment is negatively related to PPF performance. This implies that the risk-taking of PPF does not induce better performance. Also, investments in real estate as the long-term safe asset rather than equity markets reduce performance than equity investment. This finding support that risk-aversion can discourage PPF performance. The different findings compare to the previous result in Panel A are OtherA is significantly reduces performance. The OtherA mainly consists of private equity (PE), and it is a relatively more risky asset. This why the coefficients of OtherA is at least 1.5 times larger than the coefficients of equities.The negative effect of OtherA is in line with the results of the negative effect of iEquity, and the negative effect of risky assets (iEquity and OtherA) on performance is the results of bad performance of risk-king.

We conduct further tests of the effect of Fund status, past performance, asset allocation, and fund characteristics on PPF returns. Table 4.5 indicates that Fund status in terms of Fund deficits and Past (1yr) deficits are not significant in all Columns. These results are consistent with the previous findings and support that the risk transfer hypothesis (low fund level is related to performance through the change in portfolios)might not be supported. Also, we find the consistent result of Past (1yr) returns with the previous findings. Specifically, Past (1yr) returns have a negative effect on PPF performance in all Columns, and it implies that outperform in the past year induces poor

Table 4.5: Performance and portfolios

	Returns	Returns	Returns	Returns	Returns	Returns
Fund deficits	-3.970		-3.217	-17.25		-15.50
	(5.323)		(5.312)	(10.90)		(11.98)
Past (1yr) deficits		-6.771	-6.513		-7.279	-2.949
		(4.374)	(4.402)		(7.529)	(8.218)
Past (1yr) returns	-0.289***	-0.340***	-0.337***	-0.347***	-0.342***	-0.348***
	(0.067)	(0.070)	(0.070)	(0.083)	(0.084)	(0.084)
Equity	-0.031	-0.047	-0.048			
	(0.062)	(0.068)	(0.069)			
iEquity				-0.058	-0.048	-0.067
				(0.174)	(0.177)	(0.177)
DEquity				-0.025	-0.007	-0.028
				(0.138)	(0.139)	(0.139)
Fixed income	-0.044	-0.048	-0.053	-0.085	-0.045	-0.086
	(0.086)	(0.095)	(0.095)	(0.129)	(0.126)	(0.130)
OtherA	-0.249*	-0.287**	-0.274**	-0.335*	-0.348*	-0.344*
	(0.128)	(0.129)	(0.131)	(0.201)	(0.203)	(0.203)
Real Estate	-0.053	-0.031	-0.028	0.042	0.036	0.036
	(0.174)	(0.175)	(0.175)	(0.245)	(0.247)	(0.246)
Adcost	0.022*	0.184	0.193	0.195	0.153	0.190
	(0.013)	(0.179)	(0.180)	(0.195)	(0.194)	(0.196)
Profitinvest	-0.013	-0.052	-0.0722	-0.240	-0.119	-0.233
	(0.219)	(0.217)	(0.219)	(0.246)	(0.232)	(0.248)
lnassets	1.871	1.775	1.939	1.466	1.433	1.403
	(1.406)	(1.391)	(1.420)	(2.168)	(2.189)	(2.183)
Observations	234	227	227	157	157	157
R-squared	0.685	0.705	0.706	0.774	0.771	0.774
F-test	13.23	13.54	13.10	12.30	12.09	11.85
Year & PPF FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table shows the results for the relationship between PPF past performance, asset allocations, and PPF characteristics and PPF performance. Past (1yr) returns is the last year PPF performance, Equity is the % of investment in equity market,DEquity is the % of investment in domestic equity market, iEquity is the % of investment in international equity market, Equity is the % of investment in equity market,Fixed income is the % of investment in bond market,OtherA is the % of investment in private equity market, Alternative is the % of investment in Real estate and private equity market, and Real estate is the % of investment in infrastructure and Real estate markets.All variables in levels are measured at the end of each year and are defined in appendix A3.1. Fixed effects are included. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

current performance. This finding is opposite to the persistence hypothesis of past performance in terms of the extrapolation effect of past returns on current returns. This result provides evidence that even if PPF use formulated skills to keep achieving successful performance based on the past return, past management and investment skills do not improve today's performance.

Also, most of the coefficients of asset allocations are not significant. Specifically, Equity, iEquity, and DEquity as the variable for risky asset portfolios have no effect on PPF returns. Real Estate as the safe asset portfolio also has no effect on PPF performance. On the other hand, OtherA in terms of alternative assets excluding real Estate is negatively associated with performance in all Columns. This implies that partially risk asset investment can discourage PPF performance, but overall risky and safe assets investment are not associated with PPF returns.

In a nutshell, the past investment skills associated with past performance in the aspect of the short-term performance persistent is not reliable for inducing better performance. Also, the effect of

assets are limited. Especially, risky assets reduce PPF performance, and this implies the failure of PPF investment strategies and the inefficient of PPF management. Or it can be evidence to support the market efficient hypothesis.

4.4.3 Risk taking and investment strategies

In this section, we will explore how PPF investment strategies are determined based on funding status, past performance, and PPF characteristics. In the previews section, we show how PPF performances are related to funding status, past performance, PPF characteristics, and investment strategies. Because PPF performances are the results of investment strategies, in this section, we will provide the determinant of asset allocation. Because the asset allocations can reveal PPF risk-taking, we also explore the PPF risk-taking investment using the % of Equities and OtherA allocations particularly.

Table 4.6: Risk-takings

	Equity	Equity	Equity	Equity	Equity	Equity
Panel A						
Fund deficits	3.630			3.630		
	(3.788)			(3.788)		
Past(1yr) deficits		3.464			3.464	
		(3.924)			(3.924)	
Past(1yr) returns			0.080			0.080
			(0.104)			(0.104)
Shock(after financial crisis)				23.23*	13.48	9.524
				(12.26)	(12.26)	(12.17)
Observations	329	310	301	329	310	301
R-squared	0.137	0.118	0.124	0.137	0.118	0.124
F-test	1.725	1.415	1.531	1.725	1.415	1.531
Other Controls	No	No	No	No	No	No
Panel B						
Fund deficits	-7.705		-8.558	-7.705		-8.558
	(8.455)		(8.534)	(8.455)		(8.534)
Past(1yr) deficits		4.631	5.547		4.631	5.547
		(7.063)	(7.122)		(7.063)	(7.122)
Past(1yr) returns	0.026	0.034	0.037	0.026	0.034	0.037
	(0.109)	(0.109)	(0.110)	(0.109)	(0.109)	(0.110)
Adcost	-0.066***	-0.065***	-0.065***	-0.066***	-0.065***	-0.065***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Investprofit	0.147	0.180	0.144	0.147	0.180	0.144
	(0.320)	(0.318)	(0.320)	(0.320)	(0.318)	(0.320)
lnAssets	8.455***	7.834***	8.286***	8.455***	7.834***	8.286***
	(1.995)	(1.958)	(2.009)	(1.995)	(1.958)	(2.009)
shock(after 2008)				-17.13	-15.37	-16.99
				(13.13)	(13.04)	(13.14)
Observations	234	234	234	234	234	234
R-squared	0.259	0.257	0.261	0.259	0.257	0.261
F-test	2.395	2.376	2.329	2.395	2.376	2.329
PPF & Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table shows the results for the relationship between PPF funding status,past performance, and PPF characteristics and PPF risk-taking. Fund deficits is the current funding status, Past (1yr) deficits is the last year funding status, and Past (1yr) returns is the last year PPF performance. All variables in levels are measured at the end of each year and are defined in appendix A3.1. Fixed effects are included. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Panel A in Table 4.6 indicates the univariate results between equity investment and funding status and past performance, and we cannot find significant effects of Fund deficits, Past (1yr) deficits, and Past (1yr) returns in all Columns. This implies that the function of PPF investment is not associated with funding status. We do not include PPF-specific characteristics, as a results, it might be biased results. For precise estimation, Panel B in Table 4.6 provides results with PPF-specific characteristics. In all Columns, funding status and Past (1yr) returns are not significant. Based on these findings, we reject the risk transfer and risk transfer incentive hypothesis. This evidence support that even if we find the negative effect of past returns on performance, the results of insignificance of Fund deficits, Past (1yr) deficits, and Past (1yr) returns in Equity reject the possible effect of risk transfer through risky asset investment on performance. In addition, the incentive effect in terms of management fees significantly reduces investment in equity, and this implies that the incentive structure does not induce risk-taking investment of the management team of PPF. Also, we find the size effect of PPF investment on the equity market. This finding supports that when PPF size is increasing, PPF pursues risk-taking by allocating PPF assets to equity.

Even if we provide the empirical evidence in Table 4.6 for the effect of risk-management hypothesis on PPF performance in terms of risk transfer and risk incentive associated with funding status and past performance, the determinant of investment in risky assets in the aspect of the equity market is affected by the other assets allocation such as Fixed income, OtherA, and Real Estate. Because there is a substitute relationship between assets, we further explore the effects of fund status, past returns, and PPF characteristics on equity investment in the view of risk-taking by including other assets for taking into account the substitute effects in Table 4.7. Specifically, we find that Fund deficits and Past (1yr) deficits have no significant effect on risk-taking in all Columns, and this finding is consistent with the results in Table 4.6 and rejects the risk-transfer hypothesis. Past (1yr)

Table 4.7: Risk-takings and portfolios strategies

	Equity	Equity	Equity	Equity	Equity	Equity
Fund deficits	-1.984		-2.638	-1.984		-2.638
	(5.703)		(5.721)	(5.703)		(5.721)
Past (1yr) deficits		5.537	5.742		5.537	5.742
		(4.694)	(4.725)		(4.694)	(4.725)
Past (1yr) returns	0.096	0.106	0.108	0.096	0.106	0.108
	(0.074)	(0.075)	(0.075)	(0.074)	(0.075)	(0.075)
Fixed income	-0.869***	-0.857***	-0.860***	-0.869***	-0.857***	-0.860***
	(0.080)	(0.080)	(0.081)	(0.080)	(0.080)	(0.081)
OtherA	-0.831***	-0.856***	-0.845***	-0.831***	-0.856***	-0.845***
	(0.126)	(0.123)	(0.126)	(0.126)	(0.123)	(0.126)
Real estate	-1.049***	-1.065***	-1.062***	-1.049***	-1.065***	-1.062***
	(0.171)	(0.171)	(0.171)	(0.171)	(0.171)	(0.171)
Adcost	-0.0871	-0.106	-0.099	-0.087	-0.106	-0.099
	(0.194)	(0.193)	(0.194)	(0.194)	(0.193)	(0.194)
Investprofit	-0.523**	-0.496**	-0.512**	-0.523**	-0.496**	-0.512**
	(0.233)	(0.230)	(0.233)	(0.233)	(0.230)	(0.233)
lnAssets	-2.172	-2.457	-2.319	-2.172	-2.457	-2.319
	(1.517)	(1.487)	(1.520)	(1.517)	(1.487)	(1.520)
Shock				2.126	3.154	2.539
				(8.786)	(8.660)	(8.781)
Observations	227	227	227	227	227	227
R-squared	0.676	0.678	0.678	0.676	0.678	0.678
F-test	12.23	12.35	11.92	12.23	12.35	11.92
PPF & Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table describes the determinant of PPF risk-taking. Table 4.7 presents the effects of PPF paset performance, funding status, and asset allocation on investment in equity market. Equity is the % of investment in equity market,DEquity is the % of investment in domestic equity market, iEquity is the % of investment in international equity market, Equity is the % of investment in equity market,Fixed income is the % of investment in bond market,OtherA is the % of investment in private equity market, Alternative is the % of investment in Real estate and private equity market, and Real estate is the % of investment in infrastructure and Real estate markets.The dependent and independent variables are defined in Appendix A3.1. PPF & Year-fixed effects are included but not reported. For each model, standard errors are reported in parentheses and are robust and clustered by PPF. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

returns are not significant in all Columns, and this also rejects the risk incentive hypothesis. Based on the insignificant effects of funding status and past performance on risk-taking, we suggest that the hypothesis related to risk management might not be supported.

In addition, we cannot find the size effect of fund size and the incentive effect of administration fees on risk-taking. On the other hand, we find that risk-taking is negatively associated with Investprofit. This implies that if PPF achieves outperform in the last year, then PPF does pursue less risk or safe assets investment. To be specific, if PPFs experienced good performance, PPFs decide to reduce risky asset investment rather than pursue high rewarding investment approach. Due to the substitution effect between assets for managing risk, Fixed income, Real estate, and OtherA has a negative effect on Equity in all Columns in Table 4.7. The negative signs of Fixed and Real Estate are the results of risk-taking investment decisions. However, the negative signs of OtherA show risk hedging investment because OtherA is riskier than Equity. Therefore, the signs of assets in Table 4.7 show how PPF manage.

The reduced form regression in Table 4. 7 considers the simultaneity effect of asset allocation, but this might not be enough to explain simultaneity issues related to the inter-determinant of asset allocation. In the asset allocation problem, the single reduced forms for each asset might give the effect of funding status and past performance with substitute relationship, but it cannot resolve the error-terms relationship between regressions for each asset and the simultaneity problem. To consider these issues, we will use the SUR (Seemingly Unrelated Regression) to investigate the effect of funding status, past performance, and PPF characteristics on each asset investment decision in Table 4.8.

Table 4.8: Portfolio strategies: Seemingly unrelated regression

	4 Assets categories				5 Assets categories				
	Equity	Fixed income	OtherA	Real Estate	iEquity	DEquity	Fixed income	OtherA	Real Estate
Past(1yr) returns	0.096	-0.016	-0.082**	0.037	0.100	0.000	-0.115	-0.104**	0.045
	(0.098)	(0.097)	(0.040)	(0.055)	(0.066)	(0.059)	(0.124)	(0.045)	(0.074)
Fund deficits	-8.584	-6.799	7.915**	1.085	-11.09	-6.790	-36.30**	9.430	9.569
	(7.492)	(7.377)	(3.103)	(4.236)	(9.261)	(8.291)	(17.24)	(6.338)	(10.42)
Past(1yr) deficits	5.698	-5.946	2.543	3.494	-5.589	-0.658	7.357	-1.741	-1.659
	(6.237)	(6.142)	(2.584)	(3.526)	(6.587)	(5.897)	(12.26)	(4.508)	(7.409)
Adcost	-0.470*	0.482*	-0.006	-0.051	-0.375**	-0.184	0.640**	-0.043	-0.043
	(0.253)	(0.249)	(0.105)	(0.143)	(0.146)	(0.131)	(0.272)	(0.100)	(0.165)
Investprofit	0.143	-0.969***	0.074	0.152	-0.118	0.177	-1.165***	0.083	0.199
	(0.280)	(0.276)	(0.116)	(0.158)	(0.163)	(0.146)	(0.304)	(0.112)	(0.183)
lnAssets	7.537***	-7.486***	-2.206***	1.128	4.630***	2.716*	-4.471	-0.916	-1.215
	(1.830)	(1.802)	(0.758)	(1.035)	(1.578)	(1.413)	(2.936)	(1.080)	(1.775)
Observations	226	226	226	226	157	157	157	157	157
R-squared	0.577	0.720	0.449	0.756	0.915	0.776	0.729	0.476	0.766
Chi2	307.7	581.9	184.2	701.8	1685	545.1	422.1	142.8	514.6
PPF & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table describes the effects of PPF past performance, funding status, and asset allocation on risk-taking using the seemingly unrelated regression for asset allocation determinant. Fund deficits is the current funding status, Past (1yr) deficits is the last year funding status, and Past (1yr) returns is the last year PPF performance. Equity is the % of investment in equity market,DEquity is the % of investment in domestic equity market, iEquity is the % of investment in international equity market, Equity is the % of investment in equity market,Fixed income is the % of investment in bond market,OtherA is the % of investment in private equity market, Alternative is the % of investment in Real estate and private equity market, and Real estate is the % of investment in infrastructure and Real estate markets.The dependent and independent variables are defined in Appendix A3.1. PPF & Year-fixed effects are included but not reported. For each model, standard errors are reported in parentheses and are robust and clustered by PPF. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Column (1) in Table 4.8 is the same as the results in Table 4.6, and the results support no effect of funding status and past performance. Also, in the aspect of safe investment, Fixed assets in Column (2) and Real Estate in Column (4) are not affected by funding status and past performance. Based on results from investing in risky and safe assets, in our case, the risk transfer hypothesis is rejected in public equity investment. On the other hand, the other alternative assets in terms of OtherA (private equity) is reduced significantly at 5 % levels in Columns (3) when Past (1yr) returns and Fund deficits grow up. In other words, healthy funding status and good past returns shirks investment in OtherA (private equity). Private equity is a riskier asset than public equity because private equity consists of

new companies or start-ups that have significant growth potential. As a result, investing in private equity increases more liquidity risk in comparison to public equity.Therefore,we are able to confirm that healthy funding status and good past performance reduce risk-taking, and the risk transfer and risk incentive hypothesis are accepted.

We split equity investment into DEuqity and iEquity, and operate the same SUR. The funding status and past performance in iEquity in Column (5) and DEquity in Column (6) are not significant, and we reject the risk management hypothesis in equity investment. In the aspect of safety investment, funding status is negatively significant in Columns (7) at the 10% level. This implies that by reducing the safe asset due to unhealthy funding status, PPF can additional resources to invest other assets for better performance. This evidence can support the risk transfer hypothesis in the aspect of reallocated safe asset because of Fund deficits. Also, in Column (8) Past(1yr) returns significantly reduce investment in OtherA at 10% level, and this result support the risk incentive hypothesis.

Additionally, we find that the positive fund size effect on Equity in Column (1), iEquity in Column (5), and DEquity in Column (6). On the other hand, increasing fund size significantly reduces Other.A investment. This ambiguous effect suggest that fund size on risky assets might depend on asset classes and the relative riskiness between two assets. In the aspect of safety assets, lnasset in terms of fund size has a significant negative effect on Fixed income at 1% level in Column (2). This opposite effect with equity investment (Equity, DEquity, and iEquity) supports that funding size can be positively related to risk-taking. Also, we find a similar result in incentive effect in terms of administration cost. We find significant negative effects of Adcost on Equity in Column (1) at 10% level and on iEquity in Column (5)at 5% level and positive effect of Adcost on Fixed income in Columns (2) at 10% level and (7) at 5% level. This result implies that we reject that

incentive structure leads to risk-taking investment. In other words, the investment incentive system in PPFs makes invest more in safe assets.

4.4.4 Institutional conditions on PPF investment and asset management

Institutional conditions on PPF performance

In the previous section, we explore the effect of funding status, past performance, and PPF characteristics on PPF performance and ris-taking using the Fixed Effect and SUR model. However, each country has different institutional conditions that affect corporate culture. Even if we use institutional fixed effect to control institutional condition, behavioral finance literature emphasizes that the role of institutional condition in terms of cultural values that allow the persistence of the financial variables by amplifying its effect through various channels. Andonov and Rauh (2022) [7] show the persistent of past returns in the short-term, and show that it is related to extrapolated expectation of past experience.

Table 4.9: Institutional condition: National culture

	Returns	Returns	Returns	Returns	Returns	Returns	Returns	Returns
Individualism	0.369				0.367			
	(0.239)				(0.243)			
Power distance		-0.418***				-0.421***		
		(0.110)				(0.111)		
Masculinity			0.146				0.150	
			(0.147)				(0.148)	
Uncertainty avoidance				-0.332***				-0.334***
				(0.086)				(0.088)
Fund deficits					-3.688	-3.688	-3.688	-3.688
					(5.275)	(5.275)	(5.275)	(5.275)
Past (1yr) deficits	-6.258	-6.258	-6.258	-6.258				
	(4.326)	(4.326)	(4.326)	(4.326)				
Past (1yr) returns	-0.334***	-0.334***	-0.334***	-0.334***	-0.319***	-0.319***	-0.319***	-0.319***
	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)
Equity	-0.044	-0.044	-0.044	-0.044	-0.051	-0.051	-0.051	-0.051
	(0.061)	(0.061)	(0.061)	(0.061)	(0.062)	(0.062)	(0.062)	(0.062)
Fixed income	-0.073	-0.073	-0.073	-0.073	-0.072	-0.0720	-0.072	-0.072
	(0.087)	(0.087)	(0.087)	(0.087)	(0.088)	(0.088)	(0.088)	(0.088)
Real Estate	-0.186**	-0.186**	-0.186**	-0.186**	-0.191**	-0.191**	-0.191**	-0.191**
	(0.082)	(0.082)	(0.082)	(0.082)	(0.082)	(0.082)	(0.082)	(0.082)
OtherA	-0.292**	-0.292**	-0.292**	-0.292**	-0.300**	-0.300**	-0.300**	-0.300**
	(0.126)	(0.126)	(0.126)	(0.126)	(0.128)	(0.128)	(0.128)	(0.128)
Observations	226	226	226	226	226	226	226	226
R-squared	0.734	0.734	0.734	0.734	0.732	0.732	0.732	0.732
F-test	11.06	11.06	11.06	11.06	10.93	10.93	10.93	10.93
PPF & Country & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PPF characteristic	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table describes the effect of institutional conditions on PPF performance using individualism, power distance, masculinity, and uncertainty avoidance. Equity is the % of investment in equity market, DEquity is the % of investment in domestic equity market, iEquity is the % of investment in international equity market, Equity is the % of investment in equity market,Fixed income is the % of investment in bond market, OtherA is the % of investment in private equity market, Alternative is the % of investment in Real estate and private equity market, and Real estate is the % of investment in infrastructure and Real estate markets.The dependent and independent variables are defined in Appendix A3.1. PPF & Year-fixed effects are included but not reported. For each model, standard errors are reported in parentheses and are robust and clustered by PPF. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

We also find the dominantly significant effect of past returns on PPF performance, but it is not

positive. Because of opposite signs of past returns, we postulate that there is the other factors that make the opposite effect. We suggest that the cultural values as the formal institutional condition can be realted with Past (1yr) returns in PPF. Dai et al. (2022) [42] provide that the signs of interaction term between individualism and past performance can be changed, and this finding of Dai et al. (2022) [42] show how cultural values can be the link for overconfidence and self-attribution bias that affect investment performance and risk behaviors in finance. Due to the effect of cultural variables in financial decision-making, we will explore the direct effect of institutional conditions on PPF operation using Hofstede's cultural variables (2001) [71]. Specifically, we provide whether cultural values affect PPF returns and asset portfolios using the Fixed effect model and the SUR., and then we investigate the interaction effect between past returns and cultural variables to capture whether institutional conditions change the effect of past performance.

Table 4.9 shows the effect of four cultural values within countries, such as individualism, Power distance, Masculinity, and Uncertainty avoidance, on PPF performance. Individualism as the measurement for encouraging individual abilities has no significant positive effect on PPF performance in Columns (1) and (5). The insignificant influence of individualism support that PPFs in more individualistic countries do not lead to better performance than the other PPFs in countries with a low level of individualism. The power distance indicates the strength of a society's social hierarchy and authority, and its effect is negatively associated with returns significantly at the 1% level in Columns (2) and (6). The negative signs of power distance imply that countries allow minorities' voices and pursue equally distributed power, making PPF perform better. The uncertainty avoidance as the measurement for tolerance for ambiguity negatively affects PPF performance significantly at the 1% level in Columns (4) and (8) of Table 4.9. Because higher uncertainty avoidance is associated to PPF management teams' aversion to deviating from ambiguity and usual situations, higher uncer-

tainty can lead to taking low risk-taking. Therefore, our finding support that uncertainty avoidance can discourage PPF performance, and this finding is associated with preference about risk aversion. Masculinity captures assertiveness and completeness within countries, and its effect is not significant in Columns (3) and (6) of Table 4.9.

Table 4.9 shows that the effect of funding status on PPF performance is insignificant in all Columns; however, Past (1yr) returns significantly reduce PPF performance in all Columns. These results align with the previous findings, and the significant negative influence of past performance also rejects performance persistence, as suggested by Andonov and Rauh (2022) [7]. We include PPF characteristics, such as lnAssets, Adcost, and Investprofit, which are insignificant in all Columns. In addition, Equity and Fixed income are also insignificant in all Columns, and these results are consistent. On the other hand, Real Estate and OtherA harm PPF performance in all columns at the 5% level. The negative influence of Real Estate suggests that investing in safe assets as long-term investment strategies deteriorates PPF performance. In addition, this finding supports the low risk and low returns. The negative impact of Other.A support that investment in riskier assets than public equity does not guarantee positive returns of PPF. This finding provide empirical evidence for the negative results of high risk-taking in the aspect of asset management.

The institutional condition in terms of cultural values can have the persistence of the financial variables by amplifying its effect through various channels. Also, based on empirical findings of the effect of past performance on returns, Andonov and Rauh (2022) [7] suggest portfolios strategies is affected by the investors beliefs, and argue that extrapolation belief bias can be the factor to make the persistent effect of past performance through the changes in asset allocation in behavioral finance. Moreover, Dai et al. (2022) [42] find that the overconfidence and self-attribution bias are related to cultural values using interaction term of individualism and past performance. Therefore,

we also use the interaction effect between cultural variables and Fund deficits and past performance for the investigation of the behavioral finance aspect related to cultural values.

Table 4.10: The interactions between institutional condition and variables.

	Returns	Returns	Returns	Returns
Fund deficits	77.95	-0.776	2.666	18.56
	(48.47)	(29.64)	(31.31)	(26.43)
Past(1yr) returns	-2.009***	-0.150	-0.451***	-0.271**
	(0.556)	(0.145)	(0.091)	(0.134)
Individualism	-0.802			
	(0.505)			
Individualism×	-1.135*			
Fund deficits	(0.660)			
Individualism×	0.023***			
Past(1yr) returns	(0.007)			
Powerdistance		2.941		
		(2.377)		
Powerdistance×		-0.148		
Fund deficits		(1.017)		
Powerdistance×		-0.004		
Past(1yr) returns		(0.004)		
Masculinity			0.146	
			(0.206)	
Masculinity×			-0.127	
Fund deficits			(0.491)	
Masculinity×			0.005***	
Past(1yr) returns			(0.001)	
Uncertainty avoidance				0.229
				(0.152)
Uncertainty avoidance×				-0.596
Fund deficits				(0.644)
Uncertainty avoidance×				-0.000
Past(1yr) returns				(0.002)
Observations	239	239	239	239
R-squared	0.703	0.684	0.696	0.684
F-test	10.75	9.801	10.38	9.8025
PPF & Country & Year FE	Yes	Yes	Yes	Yes
Other Controls	Include	Include	Include	Include

Notes: This table describes the effect of financial variables and institutional conditions on PPF performance using interaction terms between financial variables, such as past 1(yr) returns and fund deficits, and cultural values, such as individualism, power distance, masculinity, and uncertainty avoidance, on PPF performance. The dependent and independent variables are defined in Appendix A3.1. PPF & Year-fixed effects are included but not reported. For each model, standard errors are reported in parentheses and are robust and clustered by PPF. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Table 4.10 provides empirical results of Fund deficit, Past (1yr) returns, cultural values, and interaction terms. Specifically, Fund deficits have no effect on PPF performance in all Columns. Past (1yr) returns are negatively associated with PPF performance overall, and we confirm the opposite effect of past returns on PPF performance, suggested by Andonov and Rauh (2022) [7] in terms of performance persistence.

In Table 4.9, individualism and masculinity are not significant, and power distance and uncertainty avoidance are negatively significant with PPF performance. However, in Table 10, the direct effect of all cultural variables is not significant. The interaction between individualism and Fund deficits has a significantly negative effect on PPF performance at the 10% level in Column (1).

This negative effect implies that healthy funding status makes the management team achieve better performance if institutions condition is high individualistic. Also, the interaction terms between individualism and Past(1yr) return are significantly positively associated with PPF performance in Column (1), and this result supports that PPF performance will be better when the management team experiences good past performance if PPFs are in more individualistic countries. Those results suggest the effect of individualism associated with overconfidence and self-attribution bias. Also, we find that the positive effect of interaction between masculinity and Past(1yr) return in Column (3). This positive influence suggest if PPF in countries with high assertiveness and completeness, then experience of good past performance will be persistent. Also, the effect of interaction between masculinity and Past(1yr) return support that the existence of overconfidence bias.

To sum up, we cannot find the positive effect of past returns on PPF performance, as noted by Andonov and Rauh (2022) [7] in terms of short-term performance persistence even if we consider interaction terms. However, the short-term persistence of past performance is conditionally accepted when cultural values, such as individualism and masculinity, play a role as a mediator or amplifying factor. In addition, the significant effect of interaction terms provides evidence of the link between individualism, masculinity, overconfidence, and self-attribution bias in PPF investment. Thus, the conditional effect of performance persistence suggests the important role of cultural values in PPF operation.

Institutional conditions on PPF asset portfolios

In Tables 4.9 and 4.10, we provide empirical evidence about the effect of cultural values and financial variables on PPF performance. We show the direct negative effect of power distance and uncertainty avoidance on PPF performance. Also, we find the positive interaction effect of individualism and masculinity, as the evidence for overconfidence and self-attribution bias. Even if

we provide empirical evidence of the effect of cultural values on PPF performance, we need to explore whether cultural variables change the asset allocation of PPF because the PPF performance is the result of the asset allocation. Also, the portfolio strategies of PPF might be associated with cultural factors because cultural factors can influence risky behavior, as noted by Dai et al. (2022) [42] and Mohan and Zhang (2014) [107]. Therefore, in this section, we explore whether cultural variables affect PPF asset portfolios using the SUR regression in Table 4.11.

Table 4.11: Portfolios and national culture: Seemingly unrelated regression

	4 Assets categories				5 Assets categories				
Panel A	Equity	Fixed income	OtherA	Real Estate	iEquity	D.Equity	Fixed income	OtherA	Real Estate
Fund deficit	-8.529	-4.096	8.112***	1.073	-8.545	-5.039	-27.39***	10.19*	9.559
	(7.491)	(4.842)	(3.052)	(4.235)	(8.365)	(7.675)	(8.976)	(6.164)	(10.41)
Past(1yr) deficits	5.797	-5.671	2.526	3.463	-6.157	-0.972	4.245	-2.060	-1.727
	(6.236)	(4.031)	(2.540)	(3.526)	(5.949)	(5.459)	(6.384)	(4.384)	(7.401)
Past(1yr) returns	0.097	0.031	-0.074*	0.037	0.088	0.009	-0.062	-0.094**	0.045
	(0.098)	(0.063)	(0.040)	(0.055)	(0.060)	(0.055)	(0.064)	(0.044)	(0.074)
Panel B									
Individualism	-2.442***	1.246*	1.252***	0.164	5.087***	-0.029	-2.157*	-0.736	-0.885
	(0.746)	(0.735)	(0.309)	(0.422)	(0.661)	(0.592)	(1.231)	(0.453)	(0.744)
Masculinity	0.930***	-0.475*	-0.477***	-0.062	0.768***	-0.004	-0.326*	-0.111	-0.134
	(0.284)	(0.280)	(0.118)	(0.161)	(0.099)	(0.089)	(0.186)	(0.104)	(0.112)
Powerdistance	9.768***	-4.983*	-5.007***	-0.655	-4.522***	0.026	1.917*	0.654	0.787
	(2.985)	(2.939)	(1.236)	(1.688)	(0.588)	(0.526)	(1.094)	(0.402)	(0.661)
Uncertainty avoidance	0.651***	-0.332*	-0.334***	-0.043	2.035***	-0.011	-0.863*	-0.294	-0.354
	(0.199)	(0.196)	(0.082)	(0.113)	(0.265)	(0.237)	(0.492)	(0.181)	(0.298)
Observations	226	226	226	226	157	157	157	157	157
R-squared	0.577	0.720	0.449	0.756	0.915	0.776	0.729	0.476	0.766
Chi2	307.7	581.9	184.2	701.8	1685	545.1	422.1	142.8	514.6
PPF & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PPF characteristics	Include	Include	Include	Include	Include	Include	Include	Include	Include

Notes: This table describes the relationship portfolio allocation and institutional conditions using seemingly unrelated regression for asset allocation determinant. Equity is the % of investment in equity market,DEquity is the % of investment in domestic equity market, iEquity is the % of investment in international equity market, Equity is the % of investment in equity market,Fixed income is the % of investment in bond market,OtherA is the % of investment in private equity market, Alternative is the % of investment in Real estate and private equity market, and Real estate is the % of investment in infrastructure and Real estate markets. Fund deficits is the current funding status, Past (1yr) deficits is the last year funding status, and Past (1yr) returns is the last year PPF performance. The dependent and independent variables are defined in Appendix A3.1. PPF & Year-fixed effects are included but not reported. For each model, standard errors are reported in parentheses and are robust and clustered by PPF. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Table 4.11 provides four SUR regressions for the effect of each cultural variable on asset portfolios. Panel A in Table 4.11 shows that Fund deficits significantly increase investment in OtherA in Column (3) at the 1% level and (8) at the 10% level. The positive influence of Fund deficits in OtherA (investment in private equity) supports the risk transfer hypothesis. Also, the significantly negative effect of Fund deficits on Fixed income in Columns (8) at the 1% level suggests the opposite version of the risk transfer hypothesis in safe asset investment. These results are consistent with the finding in Table 8, and we are able to accept the risk transfer hypothesis in PPF risk-taking. Moreover, the negative effect of Past (1yr) performance on OtherA is significant in Column (3) at the 10% level and in Column (8) at the 5% level. This evidence support that the risk transfer incentive hypothesis. In other words, if PPF's past investment performance is poor, then PPF invests more in the risky

asset, in our case OtherA to achieve a high return in the future.

We expect individualism is positively associated with risk-taking in terms of equity investment based on Dai et al. (2022) [42] and Mohan and Zhang (2014) [107]. However, individualism significantly reduces equity investment at the 1% level in Column (1). This implies that we reject risk-taking related to individualistic institutional conditions. To further investigate the relationship between risk-taking and individualism, we split equity investment into iEquity and DEquity. Individualism has a positive effect on iEquity at the 1% level in Column (5) but not DEquity. There are several reasons why iEquity is more significantly related to individualism compared to DEquity. One possible reason is that because international equity market is more thick market than domestic equity market, investing in iEquity market is riskier than DEquity. Therefore, individualism can be positively related to investment in iEquity because more individualistic countries encourage to use individual abilities to overcome risk aversion. Also, PPF can have more advantages in achieving market information in the domestic market than international market. This implies that the domestic market is a relatively safe investment. In other word, information advantages related to home bias of public institutional make them to invest domestic equity rather than international market. Therefore, the positive effect of individualism on iEquity supports individualism in PPF can increase risk-taking. Also, individualism has a positive effect on OtherA (private equity), and this effect provides additional evidence to support the positive association between individualism and risk-taking. However, individualism significantly increases Fixed income in Column (2) and decreases in Column (7). These findings support an ambiguous effect of individualism on risk-hedging. Overall, we find risk-taking is positively associated with individualism, but its relationship depends on asset categories.

Masculinity positively affects Equity in Column (1) and iEquity in Column (5) of Table 4.11,

and this evidence suggests that high competence in society makes PPF pursue more risk. Also, in the aspect of risk aversion (opposite side of risk-taking), masculinity significantly decreases safe investment, and these additional findings support masculinity is positively (negatively) associated with risk-taking (risk aversion). However, the negative effect of masculinity on OtherA (private equity) in Column (3) suggests that risk-taking depends on asset types. OtherA mainly is made up of private equity, and private equity is riskier assets than public equity. Because OtherA gives more risk to PPF, reduced investment of OtherA provides risk-taking of PPF will be changed conditionally on the degree of risk between risky assets.

Power distance is positively associated with Equity investment in Column (1), and this finding support centralized power lead risk-taking. But, the significantly opposite effect of power distance for OtherA in Column (3) and iEquity in Column (5) rejects the hypothesis about the positive association between risk-taking and power distance. Also, we find that Fixed income in Columns (2) and (7) show different signs. Based on the switched signs of Fixed income and equity investment, we suggest that the effect of power distance might be different conditional on asset types because of the degree of risk among assets. Overall, effect of power distance is ambiguous.

Uncertainty avoidance significantly increases Equity in Column (1) and iEquity in Column (5) and decreases OtherA in Column (3). These results partially accept the hypothesis that uncertainty avoidance is positively associated with risk-taking. But, the negative sign of OtherA supports that risk-taking associated with uncertainty avoidance depends on the degree of risk between assets. This means that the relative degree of risk between risky assets can be the factor in making the decision on the asset allocation of PPF. Also, the negative effect of uncertainty avoidance on Fixed income supports the positive influence of uncertainty avoidance risk-taking of PPF in the aspect of safe asset investment.

4.4.5 Robustness check

The major concern of results for PPF performance is autocorrelations. We use 1yr lagged returns to test the short-term performance persistence; therefore, our dynamic panel regression should take care of the effect of the autocorrelation. In addition, even if we use institution-, country-, and years- fixed effects to control the heterogeneity of PPF, the test for heteroskedasticity of error terms show we cannot reject heteroskedasticity. Based on test results, we have autocorrelation and heteroskedasticity issues in our empirical strategies. Therefore, we need to conduct an additional econometrics approach to resolve two issues.

To deal with autocorrelation and heteroskedasticity, we use the GLS, GMM, Random effect, and Weighed fixed effect models. Specifically, GLS is used for dealing with heteroskedasticity and panel-specific (overall) autocorrelation issues in the error terms. GMM is mainly used for the dynamic model broadly due to autocorrelation. Also, because we find that the fund size makes heteroskedasticity, we use fund size as a weight to reduce the heteroskedasticity (The heteroskedasticity of error is rejected in the Weighted FE). Lastly, we use the Random effect model to consider unobservable PPF-specific effects uncorrelated with the independents. Those models can reduce the error term issues related to the heteroskedasticity and autocorrelation, and the result using four models are in Tables 4.12 and 4.13.

Table 4.12 indicates the effects of funding status, past returns, asset portfolios, and PPF characteristics. Specifically, using past dependent, as independent called the dynamic panel model, leads autocorrelation problem. To reduce this issue, we use GMM models in Table 4.12 in Columns (3) and (4), and find that Past (1yr) returns and Fixed income are negatively associated with PPF returns. The results of Past (1yr) returns reject the short-term performance persistence related to the successful past investment skills of management teams and are consistent with the previous findings.

Table 4.12: Robustness: Heteroskedasticity and Autocorrelation

	GLS(ht & par) Returns	GLS(ht & ar) Returns	GMM Returns	GMM Returns	Random Returns	Weight FE Returns
Past(1yr) returns	-0.233***	-0.233***	-0.253***	-0.268***	-0.298*	-0.261***
	(0.066)	(0.067)	(0.097)	(0.066)	(0.070)	(0.067)
Fund deficit	-0.724	0.251	-46.89	-4.420	-3.278	-3.753
	(4.864)	(4.998)	(53.24)	(5.509)	(5.343)	(6.283)
Past(1yr) deficits	-4.185	-3.065	-7.929	-8.943*	-5.557	-7.782
	(4.378)	(4.533)	(26.64)	(4.856)	(4.402)	(5.241)
Equity	-0.042	-0.034	0.310	0.051	-0.027	-0.019
	(0.039)	(0.041)	(0.216)	(0.074)	(0.062)	(0.044)
Fixed income	-0.044	-0.053	-0.406***	-0.115**	-0.049	-0.096**
	(0.042)	(0.044)	(0.150)	(0.054)	(0.086)	(0.043)
OtherA	-0.192**	-0.204***	-0.647	-0.176	-0.231*	-0.217*
	(0.079)	(0.076)	(0.612)	(0.212)	(0.128)	(0.131)
Adcost	0.026**	0.025**	0.091	0.017	0.027*	0.027***
	(0.010)	(0.010)	(0.361)	(0.018)	(0.013)	(0.009)
Investprofit	-0.068	-0.074	0.059	-0.096	-0.017	0.018
	(0.090)	(0.095)	(0.983)	(0.252)	(0.218)	(0.225)
lnassets	2.101*	1.820	3.020	1.624	2.015	1.742
	(1.110)	(1.158)	(2.733)	(1.038)	(1.408)	(1.260)
Observations	234	234	234	234	234	234
R-squared	.	.	.	.	.	0.728
Chi2-test	1978	1773	240.8	648.6	460	.
F-test	.	.	.	.	.	11.20
AR (1) (P-value)	.	.	0.007	0.026	.	.
AR (2) (P-value)	.	.	0.176	0.112	.	.
Over-identification	.	.	No	Yes	.	.
Heterskedasticity (P-value)	.	.	.	.	.	0.173
PPF FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	Yes	Yes	Yes

Notes: This table describes robustness tests to hetroskedasticity and autocorrelation using GLS, GMM, Random effect, and Weighted regression. Fund deficits is the current funding status, Past (1yr) deficits is the last year funding status, and Past (1yr) returns is the last year PPF performance. Equity is the % of investment in equity market,DEquity is the % of investment in domestic equity market, iEquity is the % of investment in international equity market, Equity is the % of investment in equity market,Fixed income is the % of investment in bond market,OtherA is the % of investment in private equity market, Alternative is the % of investment in Real estate and private equity market, and Real estate is the % of investment in infrastructure and Real estate markets. The dependent and independent variables are defined in Appendix A3. PPF & Year-fixed effects are included but not reported. For each model, standard errors are reported in parentheses and are robust and clustered by PPF. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

The results of Fixed income support low risk and low returns. Mainly GMM estimations in Columns (3) and (4) focus on autocorrelation, and we use 2 and 3 years lagged variables as instruments. If we have AR(2) and AR(3) issues, then GMM estimations are not valid. However, AR(2) and AR(3) are rejected in Columns (3) and (4). Even if GMM in Column (4) has the over-identification issue due to the year-fixed effect, results in Column (3) are similar to Column (4). Therefore, we suggest that the overall GMM estimation is valid.

Also, we detect heteroskedasticity issues in our models. To take care of this issue, we use weighted fixed effects in Column (6) of Table 4.12. We find that the fund size leads to heteroskedasticity of the error term; therefore, we use fund size as a weighted factor. The estimated error terms distribution from the weighted fixed effect rejects heteroskedasticity. The weighted regressions support the negative effect of Past (1yr) returns, Fixed Income, and OtherA. We reject short-term performance persistence and accept low risk and low returns. In addition, the negative effect of OtherA indicates

high risk-taking can lead to low performance due to risk. Also, the positive effect of Adcost on PPF returns supports the incentive effect on the operation of PPF.

Based on two issues about the error terms, we operate GLS to deal with heteroskedasticity and autocorrelation both in Columns (1) and (2). The GLS in Column (1) takes care of panel-specific AR, and GLS in Column (2) is for overall AR. The results show the negative effect of Past (1yr) returns, and results consistently reject the positive short-term performance persistence related to the successful investment skills of management teams. The negative effect of OtherA on returns is negative effect of risk-taking in Column (1). In addition, GLS results in Columns (1) show that incentive for the management team (positive effect of Adcost) increases PPF performance.

The random effect model show the similar results with others in Table 4.12. Specifically, Column (5) show that negative effect of Past (1yr) returns and OtherA on PPF performance and positive effect of Ad costs in terms of incentive effect.

Table 4.13: Robustness: Heteroskedasticity and Autocorrelation

	GLS(ht & par) Returns	GLS(ht & ar) Returns	GMM Returns	GMM Returns	Random Returns	Weight FE Returns
Panel A						
Individualism	-0.431	-0.323	-0.069	0.727***	0.228***	0.341*
	(0.399)	(0.434)	(1.711)	(0.199)	(0.055)	(0.190)
Past(1yr) returns	-0.233***	-0.233***	-0.205	-0.318***	-0.170**	-0.261***
	(0.066)	(0.067)	(0.221)	(0.066)	(0.068)	(0.066)
Observations	234	234	234	234	234	234
R-squared	.	.	.	.	.	0.728
Chi2-test	1980	1775	1950	687.1	365.1	
F-test	.	.	.	.	.	11.20
AR (1) (P-value)	.	.	0.212	0.046	.	.
AR (2) (P-value)	.	.	0.503	0.108	.	.
Over-identification	.	.	10.46	127.6	.	.
Heterskedasticity (P-value) .	.	.	.	.	.	0.173
Panel B						
Power distance	1.724	1.292	1.846	-0.553***	-0.211***	-0.0563
	(1.595)	(1.736)	(3.682)	(0.165)	(0.050)	(0.091)
Past(1yr) returns	-0.233***	-0.233***	-0.283*	-0.279***	-0.171**	-0.261***
	(0.066)	(0.067)	(0.159)	(0.065)	(0.068)	(0.066)
Observations	234	234	234	234	234	234
R-squared	.	.	.	.	.	0.728
Chi2-test	1980	1775	315.3	673.3	366.2	.
F-test	.	.	.	.	.	11.20
AR (1) (P-value)	.	.	0.104	0.038	.	.
AR (2) (P-value)	.	.	0.083	0.090	.	.
AR (3) (P-value)	.	.	0.691	0.442	.	.
Over-identification	.	.	No	Yes	.	.
Heterskedasticity (P-value) .	.	.	.	.	.	0.173
PPF & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls	Include	Include	Include	Include	Include	Include

Notes: This table describes robustness tests to hetroskedasticity and autocorrelation using GLS, GMM, Random effect, and Weighted regression for the effect of institutional conditions, such as individualism and power distance, on PPF performance. Fund deficits is the current funding status, Past (1yr) deficits is the last year funding status, and Past (1yr) returns is the last year PPF performance. The dependent and independent variables are defined in Appendix A3.1. PPF & Year-fixed effects are included but not reported. For each model, standard errors are reported in parentheses and are robust and clustered by PPF. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Our research focuses on the effect of financial variables as well as institutional conditions using cultural values. We show that in the previous section, the positive effects of individualism and masculinity on PPF performance and the negative effect of power distance and uncertainty avoidance are in Tables 4.9 and 4.10. The results in Tables 4.9 and 4.10 also have heteroskedasticity and autocorrelation issues; thus, we use the same advanced econometric approaches using cultural values. We include the results for individualism and power distance because masculinity and uncertainty avoidance are not significant in all regression. Over, Past (1yr) returns are negatively associated with PPF performance, and these results are consistent. The effect of individualism (power distance) is positive (negative) in Columns (4), (5), and (6) in Table 4.13. The GMM in Column (4) has over-identification issues, and the effect of individualism (power distance) might not be robust even if we have no autocorrelation issue. Random and weighted effects support the validity of the positive (negative) effects of individualism (Power distance). However, the GLS results reject the effect of individualism and power distance on PPF returns. Based on the results in Table 4.13, we suggest that overall individualistic (high authority) institutional conditions encourage (discourage) PPF financial performance.

To sum up, the overall effect of individualism on returns is positive, and power distance is negative. Also, we provide the opposite evidence for short-term performance persistence based on past successful investment management skills. Because we do not find the effect of Past (1yr) returns on risk-taking, the negative influence of Past (1yr) returns supports the efficient market hypothesis rather than the risk transfer incentive hypothesis. Additionally, the significant effect of cultural values on returns and asset allocation sheds light on the effect of shared beliefs as institutional conditions in financial decision-making.

4.5 Conclusion

In the Chapter 4, we explore the factors that make different investment behaviors between public institutional investors using Public Pension Fund (PPF). Even if financial literature provides that different governance structures, sources of funds, and specific social factors, each institutional investor can have different investment decision-making processes, PPF can have notably different investment behaviors because PPF should simultaneously consider social welfare and its returns to maintain funds between generations. In addition, the government establishes PPFs to provide Social Protection and Insurance; therefore, PPFs face high levels of regulations within countries and more depends on countries-specific rules than other institutions. Because of the distinctive goal of PPF compared to other institutional funds, we investigate whether PPF's investment decision will be affected by not only funding status and past performance but also institutional conditions in terms of cultural values. Based on characteristics of PPF, we set two research questions for Chapter 4. The first question is "Does a public pension fund's investment and its operation consistent with traditional portfolio theory?"And the second question is "How cultural values as national institutional conditions affect PPF investment and its variations between countries" These two questions is the main motivation of Chapter 4, we find different investment behaviors of PPF with the portfolios theory and the effect of cultural values as national institutional conditions.

Specifically, to investigate two questions, based on the previous empirical evidences that most pension funds are in favor of pro-social and pro-environment investment proposals, while the largest mutual funds are in favor of pursuing profits base investment, we use the Hofested cultural dimension that related to shared belief within countries as the institutional condition, and explore the effect of financial, cultural variables, and interaction terms of financial and cultural variables on PPF operations in aspects of performance and asset allocation.

Main finding in the Chapter 4 is that the short-term performance persistence is negative, and this evidence shows that the past successful management operation skills do not induce better performance. The rejection the performance persistent hypothesis supports the efficient market hypothesis. Also, we overall reject the risk transfer hypothesis associated with underfunding because we do not find significant effects of fund deficits on risk-taking. in public equity market. However, fund deficits reduces investment in fixed income and increases investment in OtherA, and this finding supports the risk transfer hypothesis depends on assets class. Also, the validity of the risk transfer hypothesis in fixed income and private equity indicates that the risk transfer hypothesis is not only related to funding status but also the degree of risk between assets. Additionally, we find that past performance reduces risk investment, and we reject the risk transfer incentive hypothesis.

We also find that cultural values as institutional conditions are related to performance and asset allocation. Individualism and masculinity are positively related to PPF performance, but power distance and uncertainty avoidance are negatively associated. Even if individualism and masculinity encourage risky asset investment, the effect of the other cultural values on asset allocation in the aspect of risk-taking and risk aversion is ambiguous. The changed coefficient signs of cultural values in asset allocation might be related to the degree of asset classes. We suggest that the results of cultural values and portfolio strategies provide additional evidence that the degree of risk for each asset might be related to the investment decision-making of PPF more than the specific cultural values. However, the cultural factor can play a role in changing asset allocation because of the valid interaction effect with past performance in terms of overconfidence and self-attribution bias in behavioral finance.

To sum up, the Chapter 4 provides empirical evidence for the relationship between funding status and past performance and PPF operation in asset allocation and performance aspects. Also, the

Chapter 4 sheds light on how institutional conditions within countries are associated with PPF financial decision-making in risk management. Firstly, we in Chapter 4 find the partial risk transfer hypothesis and the effect of institutional conditions on PPF operations. Second, there is no short-term performance persistent as a formulated management practice, and we accept the efficient market hypothesis in performance. Lastly, we find the significant effect of cultural values on performance and its relationship between cultural values and the degree of risk between assets regarding risk management in asset allocation.

Chapter 5

Conclusion

This dissertation provides an empirical analysis of private and public corporations' financial decision-making. Financial literature finds that not only governance structures but also financial components do matter in finance. Financial factors among firms may have a similar or symmetric effect on a firm's decision-making process, such as tax avoidance, capital structure, investment, etc. But each corporation faces many valid constraints, such as regions, culture, and laws. Even if financial components impact the corporate' decision homogeneously, those factors can lead to a heterogeneous effect because of specific social and governance components of countries.

For exploring the interaction effect of countries-specific institutional conditions and financial factors on corporations' economic and financial decision-making, this dissertation provides three empirical findings of private and public corporations' financial decision-making conditional on countries-specific corporate structures, institutional environments, and the role of the public agent using firm and public institutional investors data.

Chapter 2 focuses on the relationship between capital structure and corporate tax. We postulate that even if the corporate tax affects mainly the cost of debt financing, firms' responses to tax changes may differ conditional on country-specific corporate structure. Using difference-in-difference and difference-in-difference-in-difference, we find that tax cut response supports the trade-off theory, but

tax rise response does not. This heterogeneous response to tax conditional on corporate structure supports that country-specific corporate structure matters in debt financing.

At Chapter 3, I study how government ownership is associated with firms' valuations and performances. I find that government ownership is associated with higher market-oriented values to owned-firms compared to non-owned firms, but the effect has non-linearity. Also, because the activism of public agents does not provide better monitoring and valuation on firms, even if the benefit of government ownership over the cost, the activism of public agents crowds out the private activity. The results of Chapter 3 suggest the passive role of government in the market as a watchdog rather than an active agent to minimize costs or maximize benefits of government ownership.

In Chapter 4, I investigate what makes different investment behaviors between public institutional investors based on the Public Pension Funds data of OECD countries. I show the partial acceptance of the risk transfer hypothesis and the effect of institutional conditions on PPF operations. I find no short-term performance persistent as a formulated management practice and accept the efficient market hypothesis in performance. Lastly, I provide the effect of cultural values on performance and its relationship between cultural values and the degree of risk between assets regarding risk management in asset allocation empirically.

Based on three research, I confirm that countries-specific institutional conditions, such as culture, law, and regulation, and corporate structure play important roles in economic decision-making. Especially, I show that even if financial conditions are the basis of economic decision-making, their effect will vary across countries because of countries' characteristics in terms of institutional environments. I suggest that studying institutional conditions and organizational structure in each country is essential to understand why corporations have heterogeneity among countries based on the results of this dissertation.

The provided empirical results face some limitations. Chapters 2 and 3 use the Korean firm's data. This country's specific case study can have internal validity because of the detailed data set, specific policies, and homogeneous institutional conditions. However, the results of Chapters 2 and 3 have limits for external validity because each country has different economic fundamentals, rules and laws, and governance structures. Because these limitations are rooted in data, further study is needed to extend the empirical findings of Chapters 2 and 3.

Public pension research in Chapter 4 uses the OECD country's data. The results of Chapter 4 may have an external validity contribution, but this research also cannot cover all PPF data in the world. Even if we use all PPF data for comparison studies between private and public institutional investors, we also need to include private institutional investors' data. Therefore, the study of Chapter 4 also has some limitations for external validity.

However, there are contributions and implications of three research to the related literature. The first study sheds light on the importance of corporate structure in determining capital structure in repose to tax policy and its heterogeneity. The second study provides the bright side of government ownership in the firm. Even if most of the related studies provide the inefficient of government intervention, the second study provides how the benefits are maximized and the cost are minimized based on the cost and benefits analysis. The last study also contributes to financial research by focusing on public pension fund investment and asset portfolios. Due to the limitation of data, most of the research of PPF considers one country case. However, the third research tried to cover many countries' PPFs and show the determinants of the factor that make countries' variations of PPF investment and asset allocation conditional on financial variables.

Therefore, even if the research in this dissertation has external validity issues, all studies have the potential to further study. The first study can be applied to similar countries in Asia and other

emerging countries which have a strong conglomerate corporate structure. The second study also easily extends to exploring the effect of government ownership in other countries. By adding more countries' PPF data, the third study can contribute related research further and resolve external validity issue. Especially the third study can be extended to public economics and public finance study by focusing on the social welfare aspect. This is why this thesis can have contributions and implications to empirically applied economics and finance studies.

Appendix A1

Chapter 2

Table A1.1: Definition of variables.

Variables	Formula
Long term book leverage	Long term debt over total assets
Long term market leverage	Long term debt over total assets and market value in fiscal year
Real long term debt	ln(1+Long term debt deflated to 2010 wons using the GDP deflator)
Size	ln(1+Assets)
Tangibility	Tangible assets over total assets
MTB (Market to book ratio)	Market value over book value
Conglomerate	1 if firm is in a large business group, and 0 if otherwise
OCF	Operating Cash flow over total assets$\times$100
Zero effective tax B	Estimated paid tax before deduction over taxable income Zero effective tax B is 0,if taxable income is negative
Marginal statutory tax	Highest statutory tax rate based on taxable income
Increase marginal statutory tax	1 if marginal statutory tax rate increases at t, and 0 if otherwise
Decrease marginal statutory tax	1 if marginal statutory tax rate decreases at t, and 0 if otherwise
Increase effective tax B	1 if effective tax rate increases at t, and 0 if otherwise
Decrease effective tax B	1 if Effective tax rate decreases at t, and 0 if otherwise

Appendix A2

Chapter 3

Table A2.1: Definition of variables

Variables	Formula
ROA	Net income over total assets
MTB (Market to book ratio)	Market value over book value
Returns	Annual returns of Stock
Tobin's Q	Market value of equity and book value of liability over book value of asset
Tax avoidance	Marginal tax - Effective tax
GovOwn	1 if Government owns firm(i)'s share at t 0 if Otherwise
GovOwn0	1 if 0<Government owns firm(i)'s share<5% at t 0 if Otherwise
GovOwn5	1 if Government owns firm(i)'s share$\geqslant$5% at t 0 if Otherwise
GovOwn5-10	1 if 5%$\leqslant$Government owns firm(i)'s share<10% at t 0 if Otherwise
GovOwn10	1 if Government owns firm(i)'s share$\geqslant$10% at t 0 if Otherwise
GovRatio	Government ownership ratio
GovRatio0	GovRatio if GovRatio<5% 0 if Otherwise
GovRatio5	GovRatio if GovRatio$\geqslant$5% 0 if Otherwise
GovRatio5-10	GovRatio if 5%$\leqslant$GovRatio<10% 0 if Otherwise
GovRatio10	GovRatio if GovRatio$\geqslant$5% 0 if Otherwise
GovRatiosq	Square of Government ownership ratio
GovRatio0sq	Square of GovRatio0
GovRatio5sq	Square of GovRatio5
GovRatio5-10sq	Square of GovRatio5-10
GovRatio10sq	Square of GovRatio10
NPS	1 if Year is 2018, 2019, and 2020 0 if Otherwise
Salesgrowth	ln(Sales(t))-ln(Sales(t-1))
Size	ln(1+Assets)
Lev	Long-term debt over total assets
Tangibility	Tangible assets over total assets
CF	Operating Cash flow over total assets$\times$100
Loss	1 if Net income is negative at t 0 if Otherwise

Table A2.2: Endogenous Binary regression.

	Second ROA	First GovOwn	Second Returns	First GovOwn	Second MTB	First GovOwn	Second Tobin's Q	First GovOwn
GovOwn	-0.157***		0.024		0.244*		0.373***	
	(0.005)		(0.055)		(0.130)		(0.091)	
IndustGovOwn		2.727***		4.476***		4.511***		4.568***
		(0.298)		(0.362)		(0.355)		(0.358)
Conglomerate	-0.032***	0.035	0.002	0.241**	0.549***	0.253***	0.446***	0.233**
	(0.007)	(0.084)	(0.022)	(0.095)	(0.080)	(0.093)	(0.076)	(0.094)
Salesgrowth	0.0004***	0.001***	0.001***	0.000	0.004***	0.000	0.002***	0.000
	(0.000)	(0.000)	(0.000)	(0.0006)	(0.000)	(0.000)	(0.000)	(0.000)
Size	0.039***	0.745***	-0.004	0.906***	-0.368***	0.912***	-0.248***	0.912***
	(0.002)	(0.025)	(0.012)	(0.028)	(0.032)	(0.027)	(0.026)	(0.027)
Tangibility	-0.041***	-0.463***	-0.028	-0.582***	-0.795***	-0.559***		
	(0.013)	(0.126)	(0.037)	(0.141)	(0.131)	(0.137)	(0.124)	(0.138)
Leverage	-0.000	-0.004*	0.001*	-0.007***	0.018***	-0.008***	0.005**	-0.008***
	(0.000)	(0.002)	(0.000)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
OCF	0.009***	0.026***	0.004***	0.018***	-0.024***	0.014***	-0.023***	0.016***
	(0.000)	(0.002)	(0.000)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
Loss	-0.121***	-0.219***	-0.116***	-0.284***	0.329***	-0.277***	0.120**	-0.269***
	(0.004)	(0.046)	(0.014)	(0.051)	(0.050)	(0.050)	(0.047)	(0.050)
Corr(e.GovOwn,e.Dept)		0.687***		0.040		0.226***		0.114***
		(0.014)		(0.083)		(0.050)		(0.034)
Observations	6,367	6,367	6,171	6,171	6,353	6,353	6,353	6,353

Notes: This table indicates robustness tests to endogeneity. Table A2.2 presents the results of endogenous binary regression. The IndustGovOwn in the first stage as instruments are the industry average of GovOwn. The dependent and independent variables are defined in Appendix A2.1. Financial and utility firms are excluded. Firm & Year-fixed effects are included but not reported. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Table A2.3: Endogenous Treatment regression.

	Second ROA	First GovOwn	Second Returns	First GovOwn	Second MTB	First GovOwn	Second Tobin's Q	First GovOwn
GovOwn	-0.167***		0.024***		0.244***		0.199***	
	(0.005)		(0.055)		(0.130)		(0.068)	
IndustGovOwn		2.727***		4.476***		4.511***		4.540***
		(0.298)		(0.362)		(0.355)		(0.356)
Conglomerate	-0.032***	0.035	0.002	0.241**	0.549***	0.253***	0.373***	0.254***
	(0.007)	(0.084)	(0.022)	(0.095)	(0.080)	(0.093)	(0.043)	(0.093)
Salesgrwoth	0.000***	0.001***	0.001***	0.000	0.004***	0.000	0.002***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Size	0.039***	0.745***	-0.004	0.906***	-0.368***	0.912***	-0.210***	0.915***
	(0.002)	(0.025)	(0.012)	(0.028)	(0.032)	(0.027)	(0.017)	(0.027)
Tangibility	-0.041***	-0.463***	-0.028	-0.582***	-0.795***	-0.559***	-0.502***	-0.561***
	(0.012)	(0.126)	(0.037)	(0.141)	(0.131)	(0.137)	(0.070)	(0.137)
Leverage	-0.000	-0.004*	0.001*	-0.007***	0.017***	-0.008***	0.002**	-0.008***
	(0.000)	(0.002)	(0.000)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
OCF	0.009***	0.026***	0.004***	0.0181***	-0.024***	0.014***	-0.008***	0.014***
	(0.000)	(0.002)	(0.000)	(0.003)	(0.002)	(0.003)	(0.001)	(0.003)
Loss	-0.121***	-0.219***	-0.116***	-0.284***	0.329***	-0.277***	0.117***	-0.277***
	(0.004)	(0.046)	(0.014)	(0.051)	(0.050)	(0.050)	(0.026)	(0.050)
Corr(e.GovOwn,e.roa)		0.687***		0.687***		0.687***		0.687***
		-0.014		-0.014		-0.014		-0.014
Observations	6,367	6,367	6,171	6,171	6,353	6,353	6,353	6,353

Notes: This table indicates robustness tests to endogeneity. Table A2.3 presents the results of the endogenous treatment regression model. The IndustGovOwn in the first stage in column as instruments are the industry average of GovOwn. The dependent and independent variables are defined in Appendix A2.1. Financial and utility firms are excluded. Firm & Year-fixed effects are included but not reported. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Table A2.4: Endogenous continuous regression.

	Second ROA	First GovRatio	Second Returns	First GovRatio	Second MTB	First GovRatio	Second Tobin's Q	First GovRatio
Ratio	-0.002		0.017		0.117*		0.073*	
	(0.003)		(0.020)		(0.070)		(0.038)	
IndustGovRatio		0.959***		0.945***		0.960***		0.960***
		(0.100)		(0.102)		(0.100)		(0.100)
Conglomerate	-0.0158**	1.805***	-0.030	1.862***	0.330**	1.797***	0.234***	1.797***
	(0.007)	(0.119)	(0.043)	(0.121)	(0.151)	(0.119)	(0.0813)	(0.119)
SalesGrowth	0.000***	-0.000	0.001***	-0.000	0.004***	-0.000	0.002***	-0.000
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Size	0.0125***	1.231***	-0.021	1.233***	-0.464***	1.232***	-0.262***	1.232***
	(0.004)	(0.029)	(0.025)	(0.030)	(0.089)	(0.030)	(0.048)	(0.030)
Tangibility	-0.022***	-0.604***	-0.019	-0.695***	-0.751***	-0.628***	-0.480***	-0.628***
	(0.006)	(0.192)	(0.039)	(0.198)	(0.137)	(0.192)	(0.073)	(0.192)
Leverage	-0.000**	0.003	0.001	0.002	0.0171***	0.003	0.002	0.003
	(0.000)	(0.003)	(0.000)	(0.003)	(0.002)	(0.003)	(0.001)	(0.003)
OCF	0.005***	-0.010**	0.004***	-0.010**	-0.022***	-0.010**	-0.007***	-0.010**
	(0.000)	(0.004)	(0.000)	(0.004)	(0.003)	(0.0042	(0.001)	(0.004)
Loss	-0.115***	-0.512***	-0.109***	-0.533***	0.369***	-0.510***	0.138***	-0.510***
	(0.002)	(0.072)	(0.017)	(0.074)	(0.060)	(0.072)	(0.032)	(0.072)
var(e.GovOwn,e.Dept)		0.044		-0.078		-0.036		-0.060
		(0.105)		(0.108)		(0.105)		(0.105)
Observations	6,367	6,367	6,171	6,171	6,353	6,353	6,353	6,353

Notes: This table indicates robustness tests to endogeneity. Table A2.4 presents the results of endogenous continuous regression. The IndustGovRatio in the first stage as instruments are the industry average of GovRatio The dependent and independent variables are defined in Appendix A2.1 Financial and utility firms are excluded. Firm & Year-fixed effects are included but not reported. For each model, standard errors are reported in parentheses and are robust and clustered by firms. ***,**, and * indicate significance at the 1%, 5%, and 10% level (two-sided), respectively.

Appendix A3

Chapter 4

Table A3.1: Definition of variables.

Variables	Definition	Source
Equity	% of the equity market investment	Annual reports
iEquity	% of the international equity market investment	Annual reports
DEquity	% of the domestic equity market investment	Annual reports
Fixed income	% of the bond market investment	Annual reports
Real estate	% of the Real estate and Infrastructure investment	Annual reports
Alternative	% of the Alternative investment (Incl. Real estate and Infrastructure)	Annual reports
OthersA	% of the Alternative investment (Excl. Real estate and Infrastructure)	Annual reports
Returns	Return of assets	Annual reports
Total assets	The sum of Assets	Annual reports
Investment income	Total amount of income from investment activities over Total assets	Annual reports
Liabilities	Total amount of pension entitlements	Annual reports
Pension Expenses	Total amount of transferred benefits to pensioners	Annual reports
Contribution	Total amount of contribution from employers and employees	Annual reports
Fund deficits	Pension expenses -Contribution over Total assets	Annual reports
AdCost	Administration fees, transaction costs, wages, etc.	Annual reports
Individualism		Hofstede's national cultures
Power distance		Hofstede's national cultures
Mascularity		Hofstede's cultures
Uncertainty avoidance		Hofstede's national cultures

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