

**Participant Investment Behaviour and Investment Performance in Defined
Contribution Plans: Evidence from Small Firms in Korea**

Abstract

Using panel data associated with 420,839 participants in 47,442 workplace pension schemes for small firms operated by a public institution, we seek insight into the participant behaviors and investment performance of DC plans. First, we find that participants of sample firms exhibit extreme risk avoidance in their pension management, leading to lower investment returns. We also find that most participants choose a small number of investment products and initiate no trades. The results suggest that employees aren't better off with a public pension provider established with the aim to facilitate small firms' participation in corporate pension plans.

Keywords: Korean Defined Contribution Plan, Investment Behaviour, Return Rates

I . Introduction

Korea is aging the fastest among Organization for Economic Cooperation and Development (OECD) countries. Its old-age dependency ratio¹ is projected to increase from 20% in 2015 to 72% in 2050 according to the OECD report (Preventing Ageing Unequally, 2017). Further, Korea stands out as having a highest old-age (aged 65 and over) poverty rate. This is largely attributable to weakened filial norms that children should be responsible for the care of their aging parents and the extension of lifespan. Although national pension schemes (NPS) represent the mainstay of the country's old age income security system in Korea, it does not cover many older people due to its relatively short history (set up in 1988). The expected replacement rate after 40 years of contributions is currently 45% and being reduced by 0.5% every year from 2008 until reaching 40% in 2028. Moreover, the NPS fund is expected to be completely depleted by 2060. Accordingly, NPS benefit alone doesn't seem to suffice ensuring a stable post-retirement life. As such, strengthening the role of corporate pension schemes is unavoidable.

In Korea, there are two corporate pension schemes that exist alongside one another. Until recently, the severance pay system has been the main pension scheme mandatory for firms with five or more employees. The corporate pension system was introduced in 2005 based on the Employee Retirement Security Act and is voluntary. As of June 2017, the participation rate of corporate pension plans is 26.9% based on workplace. This varies considerably depending on the size of firms, according to the National Statistics. While 88.1% of large companies with 300 and more employees have introduced corporate pension plans in lieu of the severance pay system, only 23.5% of small firms with less than 30 employees have established corporate pension plans. This is mainly due to the fact that small business owners have difficulty in setting up corporate pension plans and managing them due to time and cost. Under contract-based governance, corporate pension plans are set by contracts between employers and service providers (financial institutions), and so small-scale firms are not of interest to pension providers. This leaves them with market failure.

As a part of the effort to increase participation of corporate pension plans for employees

¹ The old-age dependency ratio is the ratio of the number of elderly people (aged 65 and over) to the number of working-age population (aged 15 to 64).

in small firms, the Department of Employment and Labor legislated in 2010 that Korea Workers' Compensation & Welfare Service (KCOMWEL) needed to enter the Defined Contribution (DC) market as a pension service provider along with private financial institutions². Since 2010, KCOMWEL has offered management and administration related services to small firms, and entrusts asset management related services to two private financial institutions. KCOMWEL charges a relatively low management fee of 10 basis points (bps) compared to other pension service providers (charging 30 bps), reducing costs incurred from the adoption of corporate pension plans. The market share of KCOMWEL in DC plans is 18.1% by the end of 2017.

In this paper, we seek insight into the behavior of participants and investment performance of DC plans in small firms with less than 30 employees. To do so, we analyze a unique data set that consists of participants' corporate pension accounts managed by KCOMWEL over a five year period from 2012 to 2017. The data is an unbalanced panel associated with 420,839 participants in 47,442 firms and includes both firm (sponsor-level) characteristics and employee (participant-level) characteristics. As previously mentioned, KCOMWEL only provides management and administration service on corporate pension, and therefore employers need to choose one of two asset management service providers. Since both providers offer the same investment options for all employers operated by KCOMWEL, the same investment menu is offered to firms choosing the same service provider.

Several interesting patterns emerge from the analysis of descriptive statistics. First, participants of sample firms with relatively low-income and low wealth exhibit extreme risk avoidance in their pension management. Surprisingly, more than 99% of assets are invested in products that guarantee principals and interests, such as deposits and guaranteed income contracts.³ Given that the proportion of the total corporate pension reserve invested in principal guaranteed products is 88.9% by the end of 2017, the sample participants have greater tendency to avoid investment risk. This is consistent with evidence that income and

² KCOMWEL is an affiliated public organization of Ministry of Employment and Labor and is in charge of various services, such as registration of Workers' Compensation Insurance and Employment Insurance, workers' compensation and rehabilitation service, medical service, employee assistance service, etc.

³ The director of investment service for Korea at Towers Watson said "This conservative allocation is largely influenced by corporate sponsors' cash-reserving mentality which is rooted in legacy severance schemes and the fierce competition among service providers offering attractive or inflated rates for new clients. As a result there is also an inappropriate focus on capital preservation rather than on income or return generation which would be more suitable given allocations should be focused on the ability to pay pensions in the longer term."

wealth are negatively related to risk aversion (Riley and Chow, 1992). The greater conservatism in corporate pension investment for low-income employees results in lower income replacement. The geometric mean of annual rate of return on these products is only 1.22%. Unfortunately, principal non-guaranteed products also generate 1.36% of annual return (only 0.14% higher than principal guaranteed products). This is because most participants with principal non-guaranteed vehicles choose bond type funds (the ratio of equity is under 40%). Another pattern that appears is that the average number of investment options (of which there are 8~14) chosen by participants in small firms is two. This is consistent with Huberman and Jiang (2006) showing that the majority of 401(k) participants tend to choose a small number of investment options. The last pattern we find is that over the 97.5% of participants initiate no trades, exhibiting a high level of inertia. Along these lines, Agnew, Balduzzi, and Sunden (2002) and Mitchell, Mottola, Utkus, and Yamaguchi (2006) also document the profound inertia of 401(k) participants.

Ordinary Least Square (OLS) regression tests examine factors that determine investment performance of participants. Participants belonging to sponsors who select asset management service provider A have higher returns than those selecting asset management service provider B. Regarding participants' characteristics, female employees earn higher returns than male employees, and there is a U-shape relationship between age and investment performance. Employment period and corporate pension subscription period are positively associated with investment performance. Lastly, the number of trades and the proportion of principal non-guaranteed products is positively related to investment performance.

Using Tobit regression, we also examine the factors that determine the proportion of principal non-guaranteed investment products. Participants in firms that select asset management services from provider A and participants in firms that establish Corporate IRP in lieu of DC plans tend to be more aggressive in their asset allocation. At the employee-level, the period for which participants have joined the plans are positively associated with the level of non-guaranteed funds. Finally, there is a positive relationship between the change of trade and the proportion of investing in risky assets.

The evidence of our regression analyses is consistent with previous research regarding the effect of demographics and investors' characteristics on investment behaviors. Using individual accounts held by a Dutch online broker from 2000 to 2006, Bauer, Cosemans, and Eicholtz (2007) document that females are more likely to achieve higher investment

performance. Regarding participant trading behaviors in DC plans, Mitchell, Mottola, Utkus, and Yamaguchi (2006) document that 80% of participants in 401(k) do not change their investment options, and an additional 11% make only a single trade over two years.

Our findings contribute to a growing area of research on DC plans. Even though it is evident that participants should be more responsible for their own retirement income security, a large body of literature on behavioral economics provides evidence that plan participants have difficulty in making optimal investment choices. This is due to choice and information overload (Benartzi and Thaler, 2001; Iyengar, Huberman, and Jiang, 2004; Iyengar and Kamencia, 2006), undefined preferences and investment menu design (Benartzi and Thaler, 2001, 2002; Mitchell and Utkus, 2002; Elton, Gruber, and Blake, 2006), and procrastination and inertia (Benartzi and Thaler, 2002; Choi, Madrian, and Metrick, 2002).

This paper also contributes to corporate pension research by providing unique features of Korean DC plans in small-scale firms. The fact that that 99% of corporate pension assets in the sample are allocated to capital preservation products is completely deviated from the diversification rule in finance. Extremely conservative allocations can be partially explained by the negative relation between risky assets and income documented by Riley and Chow (1992). The authors argue that this is not because individuals with low income are risk averse, but because they have little flexibility in their budget. However, inappropriate focus on principal guaranteed vehicles are mainly influenced by special features of the corporate pension market in Korea - such as the cash-conserve mentality of sponsor firms and fierce competition among service providers [even] taking reverse margins.

The paper is organized as follows: Section II reviews the corporate pension system in Korea; Section III describes the sample data and descriptive statistics; Section IV shows the empirical results; and Section V concludes the paper.

II. Corporate Pension System in Korea

2.1. Three pillar system and development of corporate pension

Korea pursues a three-pillar income security system incorporating the national pension service introduced in 1988, the corporate pension scheme started from 2005, and individual

pensions introduced in 1994. Due to a fast aging population coupled with low birthrate and slow economic growth, strengthening Korea's current pension system is one of the most urgent policy issues that we are facing. The NPS is a partially funded, mandatory defined benefit system. Employers and employees each contribute 4.5% of an individual's wages. The benefit formula consists of basic and earnings-related portions. The system's progressive benefits are paid mainly in the form of an annuity, which is indexed to prices, with the full pension available at age 60 (the retirement age will rise to 65 by 2033). Unfortunately, the future of Korea's national pension service is bleak due to an imbalance between low contributions and high benefits. Hence, the role of corporate pension plans is significantly important.

Under the Korean Labor Law, all workers with more than one continuous year of service are entitled to receive, upon retirement, a mandatory lump sum payment of retirement allowance. This is commonly known as the severance payment scheme, and in which payments are equivalent to one month of the base salary for each year of service. The severance payment scheme, which started in 1961, has been considered postpaid wages and employers have legal obligations to pay employees regardless of the reason for termination of employment. However, employers have difficulty predicting the actual retirement liability, leading to increases in their cost burden and threats to employees' entitlements. Further, employees use this lump sum payment for living expenses rather than saving for income after retirement. To compensate for these shortcomings, the corporate pension scheme based on "Employee Retirement Benefit Security Act (ERBSA)" has been adopted since 2005. Under this act, labor and management can choose a retirement pension system instead of the severance payment scheme. Despite the efforts of Korea government (changing regulations under which employers and employees converting to corporate pensions receive more benefits in terms of tax), the rate of participation is still low, with regard to small firms.

A unique feature of corporate pension in Korea is governance structure. Pension plans are set by contract between employers and financial institutions such as banks, insurance companies, or security companies without legal personality and capacity.⁴ Under ERBSA, a firm establishing a corporate pension plan makes a contract related to management and

⁴ Pension fund in most European countries has an independent entity with legal personality and capacity and hence it has its own internal governing board. Pension plan in countries with an Anglo-Saxon has the trustees who legally own the pension fund assets and they must act in the best interest of the plan participants.

administration work (providing investment options and related information, designing of pension plans, and recordkeeping) and separate contract related to asset management work (account setup and management, storage and management of contributions, and payments of retirement income). Although it was intended that pension service providers for management and administration work oversee pension service providers for asset management, most pension plans make a contract with single service providers to do both.

There are four types of corporate pension plans in Korea - defined benefit plans (DB), defined contribution plans (DC), individual retirement pension plans (Personal IRP), and corporate individual retirement pension Plans (Corporate IRP). Under DB plans, the amount of pension benefits that an employee receives upon retirement is predetermined, which is years of service times average of the final three month's salary. An employer makes a full decision on how the contributions are invested, and so has responsibility for the investment outcomes. DB plans are similar to the severance payment scheme except that an employee as a plan participant can receive the benefits in the form of annuity. Under DC plans, an employer contributes predetermined amount of money (1/12 of the annual total wage of a worker) to the individual accounts of workers at the pension service. An employee makes a full decision on how the contributions are invested, and so has responsibility for investment outcomes. Both DB and DC plan participants can open personal IRP accounts for individual savings. With this they are investing their lump-sum retirement benefits with tax deferrals - creating tax saving effects. Lastly, a firm with less than 10 employees is recognized as having established corporate pension plans if all workers consent to subscribe to an individual IRP. Corporate IRPs operate in a similar way to DC plans, but are not subject to ERBSA regulation.

2.2. The corporate pension scheme

As of December 31, 2016, the corporate pension plan scheme is covering 5.83 million workers (61.2 % of the total 11.57million) with more than one continuous year of service, while it is covering 340 thousand corporations (15.3% of the total 1.8 million).⁵ The lower rate of coverage [of firms that participate in corporate pension plans] is mainly driven by the

⁵ The data is obtained from Korea Financial Supervisory Service.

fact that only 17.3% of small firms with less than 30 employees provide corporate pension plans. The total contributions to corporate pension plans as of end-December 2017 totaled KRW 169.4 trillion, up KRW 21.4 trillion from KRW 147.0 trillion at end-December 2016. Looking at the assets by type of pension schemes, the distribution of assets invested in DB, DC and IRP is 65.8%, 25.1%, and 9.1% respectively. The proportion of DB plans seems to have decreased, as most large companies have completed the shift from lump-sum severance payment scheme to DB plans and medium/small firms remain in the severance payment scheme. Further, those medium/small would be more likely to choose DC plans. Pension service providers in Korea are banks, insurance companies, and brokerage houses with a corporate pension plan license. Due to nationwide branch operations, sales forces, banks take up half of the corporate pension market in Korea. Contributions to plans of banks totaled KRW 84.3 trillion, followed by life insurers (KRW 39.6 trillion), brokerage houses (KRW 32.1 trillion), property & casualty insurers (KRW 10.8 trillion), and KCOMWEL (KRW 1.7 trillion) as of end-December 2017.

One of the peculiarities of the Korean corporate pension market is that 88.9% of the corporate pension reserve is invested in financial products that guarantee principals and interests. Looking at the assets by type of pension schemes, the proportions of assets invested in financial products that guarantee principal and interest in DB, DC and IRP are 94.6%, 78.7%, and 66.3% respectively. Investments in non-principal protected products with floating return are expected to increase, as DC and IRP are allowed to invest in stock funds and hybrid funds within 70% of contributions per participant according to Article 9 of the Enforcement Decree to the ERBSA. In addition to regulatory restriction, there are other main drivers to a disproportionately high concentration of investment in non-principal protected products. Those drivers are the cash-conserve mentality of sponsor firms and lack of experience in corporate pension asset management. The provision of a high fixed interest rate with the negative margin for securing market share of pension service providers in the early stage of introducing corporate pension plans also contributes to extremely conservative allocation (Kang 2011). In addition, the concerns about large-scale investment losses due to the financial crisis of 2008, poor financial literacy, and participants' indifference lead to this phenomenon.

The investment return on corporate pension plan assets falls far short of what we expect for life after retirement. The annual average return on Korea's corporate pension after deducting

total fees and expenses comes to 2.39% for the past 5 years from 2012 to 2017 (3.29% from 2008 to 2017); products that guarantee principal and interest generate 2.36% (3.18% from 2008 to 2017) while non-principal protected products generate 2.93% (4.74% from 2008 to 2017). Further, the average return on principal-guaranteed vehicles in 2017 is 1.49% and 6.58% on non-principal guaranteed vehicles in 2017.⁶ Given that the interest rate of the Central Bank of Korea is 1.50% and the inflation rate using consumer price index was 1.5% as of December 2017, a high concentration on principal guaranteed products in occupational pension assets in Korea doesn't seem to be rational investment behavior.⁷ Unfortunately, the investment performance in non-principal protected vehicles in corporate pension assets is relatively low once we consider the fact that the Korea Stock Exchange Composite (KOSPI) increase 21.76% to 2,467.49 at the end of 2017 from 2,026.46 at the end of 2016. This is because more than 50% of non-principal guaranteed vehicles in corporate pension assets are hybrid-bond funds, and maximum proportion of equity is less than 40% of total assets.

⁶ The data is obtained from Korea Financial Supervisory Service.

⁷ The data is obtained from the Central Bank of Korea and the National Statistics

III. Data and Descriptive Statistics

3.1. Plan administrator data sample

We use a unique data set collected at the individual level from the COMWEL which is a non-profit government institute and started retirement pension service as of December 2010. The COMWEL provided records on participants in DC type plans (DC and corporate IRP) for 6 years between 2012 and 2017, who were employed in workplace under 30 employees. The data consists of two levels, i.e., sponsors and participants. For each plan (sponsor), we obtained the records such as the number of employees, industry, the location of main office, the numbers of offered products as of the year ending points. For the participant level, our data set provides relevant socio-economic information such as employee status, gender, age, plan entry dates, contribution amount, gross investment income, and account balance, etc., and investment behaviour such as choice of offered products, change the products.

Due to the various reasons, we exclude some data from the analysis. First of all, executive members are deleted because the payment method of the wages and retirement benefits of executives are different from general employees. In addition, we eliminate some participants who have accounts with a value less than 1 million Won or more than 100 million Won because they are identified as outliers. According to the Korean Workers Retirement Benefit Act, the employees with more than one year of service are entitled to retirement benefits, so we exclude the participants who have been in service under one year. Finally, considering that the legal retirement age is 60 years old within a workplace with 30 or less employees, we exclude above 65 years old workers.

Table 1 summarises characteristics the sample of defined contribution plans. We display year-end statistics regarding the number of plans, participants, and total assets under management in the sample, as well as available plan options offered by the sponsors. Plan sponsors, participants, and assets are dramatically increased during the sample period. As of the end of 2017, the KCOMWEL hold 9,898 sponsors, 135,053 participants and total assets of 10,655 billion Won. The average number of participants per workplace increased from 2 to 14. Sponsors offered investment products from 8 to 14 depending on the investment managers. Average number of products per workplace increased steadily from 9.2 to 11.7, however, actually chosen products by participants decreased from 2.7 to 1.8 during the

sample period.

3.2. Participant Investment behaviour

As the investment managing service providers, KCOMWEL selected two different types of financial institutes. In this study, we named the two financial organizations ‘Asset manager A’ and ‘Asset manager B’, respectively. Korean Financial Supervisory Service, the regulator of financial industry, classifies investment options by two broad categories. Safe type products are stable-value products, such as deposit and guaranteed income contract (GICs). Risky type products have the possibility of loss such as equity funds, bond funds, and balanced funds, etc.

Table 2 shows the investment options are grouped by safe and risky products and the number of products offered to sponsors by service providers. The ‘Asset manager A’ provided 6 safe products such as bank deposits with a maturity of 1 year, 2 years, and 3 years and 8 risky products such as government, balanced, and equity funds. On the other hand, the ‘Asset manager B’ provided 5 safe products such as interest rate linked insurance, guaranteed income contracts with a maturity of 1 year and 2 years and 3 risky products such as balanced funds. The number of safe products is similar level, while the risky products of the ‘Asset manager B’ are 5 less than the ‘Asset manager A’. A further important consideration is that the ‘Asset manager B’ did not provide equity funds. On this aspect, we primarily focus on how the asset managers, i.e., line-up investment options effect participants’ investment performance and asset allocation behaviour. The previous papers document that overall portfolio choice is affected by the menu of options (Benartzi and Thaler, 2001; Brown et al., 2007).

Figure 1 shows the distribution of investment returns for offered two kind of products by ‘Asset manager A’ and ‘Asset manager B’. The estimated investment rates of safe products are calculated by using the monthly unit price return of the deposit for 3-year periods (2015-2017). In the case of risky products, the geometric means are obtained for 3-year periods and divided by investment period. Average annual returns for safe products (1, 2, 3) were only 1.7% (1 and 2-year maturity)-1.8% (3-year maturity) during 2015-2017. Reflecting stronger equity markets in the 2017, estimated returns for equity funds (4, 5) were 5.8%-6.7%, which are the highest level among offered product types by the two asset managers. In comparison, estimated returns for government balanced funds (6, 7) were 2.8%-3.1%, and bond balanced

funds (8-14) were 1.4-4.9%.

Turning to investment behaviour of participants, Figure 2 shows the distribution of chosen investment options by participants. Although sponsors offered 8-14 products, approximately 99.6% of the participants used under 4 products; 51.8% held the 1 product and 16.2% held the 4 products between 2012 and 2017. Participants on average chose 2.1 products. Overall, the only 0.4% of all participants held 5 or more products. This is similar to the results of prior research Huberman and Jiang (2006). They report that 401(k) participants tend to use a small number of funds; the number of participants using a given number of funds peaks at 3 funds and declines after more than 3 funds.

As shown in Figure 3, more than 99% of assets were invested in risk-free products, i.e., deposit and GICs. Participants with risky assets had remained steady at about under 0.5%-1% for the full 6-year period. The proportion of participants holding risky products decreased from 0.91% in 2012 to 0.41% in 2017. It appears that the participants never responded to the bull market of 2015-2017; in Figure 1, the investment returns of equity funds (product 4 and 5) are 5.8%-6.7%. Despite the increase in returns of the equity funds, the participants have reduced risky assets from 0.52% to 0.41%. Therefore, our sample provides an indirect indication that participants do not try to time the market, and make trading decisions with the asset returns. (Agnew et al., 2003).

Figure 4 displays geometric investment return rates for extreme asset allocation (totally safe vs. totally risky) accounts. For this, we compare the participants' returns during 3 years reflecting time-weighted investment performance holding zero (0%) risky asset allocations and all (100%) risky asset allocation. Unlike our expectation, when looking at returns from safe and risky assets allocation, there is a slight difference within the sample data. Participants with 100% in risky products (1.36%) were merely 0.14% points higher than those who did not invest in risky assets at all (1.22%). We could infer that there are two reasons for poor investment performance of the participants with 100% risky products. Firstly, the policyholders with the 'Asset manager B' could not select for an equity fund because equity-type funds were not included in their sponsor's line-up menu. Secondly, although some sponsors belonging to 'Asset manager A' suggested the 2 equity funds (annual return rates 6.7%, 5.8%), participants did not choose them. Reflecting the low level of standard deviation (0.89%), most participants with 100% risky assets seem to have opted for bond-type funds. Generally in the DC system, the investment returns of participants are driven by

the investment options offered by sponsors, as well as by particular individual styles and product selections. Despite experiencing strong equity markets during the period under review, the return rates of the participants were very poor.

To access the trading behaviour of participants, Figure 5 measures trading activity by the number of times a participant changes products. The left-hand and right-hand side display the distribution for per year and whole period (average 2.4 years), respectively. In reality, there are two types of product changes: asset rebalancing and new money from sponsor's contributions, i.e., allocation of contributions. Our data has no information about the specific type of product changes, so we could not distinguish between them. Therefore, due to the data limitation, both the asset balancing and the change of contribution allocation are considered as the same trade activities.

We find strong evidence of inertia in product changes, like earlier studies (Agnew et al., 2003; Mitchell et al., 2006; Dahlquist et al., 2014). Almost all (97.5%) of the participants in our sample made no product changes over a year; annual change number is zero. Only 2.5% of the participants are of at least one trade per year. Overall, approximately 43% of total change numbers are zero over the plan participated period. These prior studies report about 10% of 401(k) accounts had at least one trade over a year. Compared with prior research (Agnew et al., 2003; Mitchell et al., 2006; Yamaguchi et al., 2006), our sample statistics indicate very limited trading activity. This 'extremely high inertia' phenomenon is attributed to our limited sample characteristics; small-size businesses under 30 employees with high degree of risk aversion, and investment choices focused on guaranteed income such as bank deposit.

3.3. Variables

To examine the investment performance of individual participants, we should measure investment return rates on an annual basis. Our measurement of investment returns to account balance has to consider for raw data limitations. We only observe snapshots of participants' assets at the end of each year, and we don't know the exact timing about the flow of investment income and the contribution of sponsors. Accounting the limitation of the data, therefore, we decide to use Hardy's formula for the yield on an individual account balance. We calculate participants' investment returns as follows

$$R_{i,t} = \frac{2 \times I_{i,t}}{V_{i,t-1} + V_{i,t} - I_{i,t}} \times 100 \quad (1)$$

where $R_{i,t}$ is the net return on the account of participant i in year t , $V_{i,t-1}$ is the account value of participant i at the end of year $t - 1$, $V_{i,t}$ is the account value of participant i at the end of year t , and $I_{i,t}$ is the investment income of participant i during the year t . By deriving returns from beginning ($t - 1$) and end of the year (t) account values, we implicitly calculate value-weighted returns (Bauer et al., 2007).

In this paper, we analyze factors affecting individual participants' investment returns, focusing on the type of asset manager, asset allocation choices and trading activity. Also, we consider demographic and earnings characteristics. Table 4 lists and describes the variables. We use explanatory variables such as sponsor-level and participant-level characteristics. In sponsor-level, we firstly consider the service provider institutes which are designing the investment options. Within DC type plan, the role of sponsors and service providers such as administration and asset management is very important. Brown and Harlow (2012) report that 401(k) plan investment options produce annualized risk-adjusted returns exceeding those of non-plan investment options by as much as 120 basis points. This performance advantage is largely due to activity managed plan options. The researchers conclude that plan sponsors do appear to possess superior selection skills when designing the set of investment options offered to plan participations. Considering this point, we also consider the service provider variable; equal to 1 if the asset manager offering more rich options including equity funds ('Asset manager A'), 0 otherwise ('Asset manager B'). Plan type introduced is also indicator variable, and equals to 1 if the plan is corporate IRP, 0 DC. Industry means the business area of workplace; code manufacturing as 0 and service as 1. Size is total employee number of workplace at the end of year. Location is the located place of workplace: 1 if the metropolitan and 0 otherwise.

In participant-level, the personal characteristics variables are limited to gender, age, workplace tenure, DC type plan tenure, contribution (wage), account balance, and trading activity. Because we got our sample data from the recordkeeping institute (KCOMWEL), we could not have information some critical factors that might affect investment decision such as marital status, total household assets size, composition of asset classes (financial vs. real estate), three-tier pension asset (public-corporate-individual pension) holding, total household

income size, education years, etc. Demographic variable gender takes the form of a dummy; 0 for males and 1 for females. Age, tenure, and plan tenure are continuous variables, measured as year unit. We estimate wage variable using the sponsor's yearly contribution because the sponsor should have to contribute at least one month of the annual wage under the law. Wage size is a proxy variable for total income, transformed to logarithmic scale. The investment performance would be positively related with wealth, so we use the logarithm of account balances ($\ln(\text{Asset})$) for the proxy of total wealth and financial literacy of the participants. Many previous studies (Fagereng et al., 2016) have found that the returns of individuals are positively correlated with their wealth. In addition, participants holding larger assets are more likely to choose risky options with financial literacy and investment experience. Finally, we control for economic conditions using year dummy variables, setting 2012 as reference group.

3.4. Hypotheses

In this paper, we do focus on analysis the relation between participant investment return rates and asset managing service provider, asset allocation for risky assets and turnover activity under the control of characteristics of sponsor and participant. We establish three hypotheses as following. Firstly, we examine whether and how the different asset managers influence the investment performance of participants. Within DC plan, investment menus offered by plan sponsors are given to participants. Also, plan sponsors select the products offered by the asset manager. Therefore, not all participants are provided the same investment opportunity because of different line-up products between asset managers. We hypothesise that participants belonging to the 'Asset manager B' (code 0) would be more likely to earn lower return rates than 'Asset manager A' (code 1) due to the low possibility of risky products such as equity funds.

Secondly, we examine the effect of risky asset allocation on investment returns. On the basis of the finance theory, we expect that participants with the higher percentage of risky assets are more likely to have higher return rates. When investing pension assets, risky asset classes such as equities and bonds are used to achieve higher expected returns (Alestalo and Puttonen, 2006). As a whole, during the analysis period from 2012 to 2017, the returns of risky products were higher than those of safe products as shown in the Figure 1 (safe

products : 1.7%-1.8% vs. risky products: 1.4%-6.7%).

Thirdly, the investment rates of the active trading participants are higher than those of inactive trading participants due to the continued declining of deposit rates and increasing stock prices during the sample period. In addition, in our sample, it is difficult to apply the ‘overconfidence theory’. Barber and Odean (2000) report that active traders realize substantially lower returns than do non-traders within self-directed brokerage accounts in U.S. due to excessive transaction costs. In Korea, however, excessive trading behaviour is unlikely to lower returns because a participant’s direct investment in stocks is prohibited and retirement pension funds do not bear the redemption fee. Moreover, capital gains on stocks are non-taxable income in Korea.

IV. Empirical Results

4.1. Descriptive analysis

Table 3 provides descriptive statistics for the sample of accounts we use in the empirical analysis. For each variable, the mean, standard deviation, minimum and maximum values are reported. Panel A reports sponsor-level descriptive statistics. Regarding the service provider variable, about 46.7% of sponsors selected ‘Asset manager B’ (code 1), and the remaining 53.3% of sponsors chose ‘Asset manager A’ (code 0). Almost all sponsors provide DC type; only 0.3% sponsors provide corporate IRP type. Nearly 85% of business sector are belong to service industry, especially social welfare service industry; 15% of business areas are manufacturing field. The average number of employee is 8.2: minimum 1 and maximum 29. More than 50% of all businesses are located in the metropolitan area. In summary, our sample data are concentrated in a small-sized social welfare workplace.

Panel B shows participant-level descriptive statistics. The average annual return of participant is 1.64%: standard deviation 0.716%, minimum -12.3%, and maximum 27.5%. Over 60% of the participants in the samples are females, as the result of concentrated in small-sized social welfare employees. The age of participants ranges from 18 to 65 (due to the exclusion of above 65) and is on average equal to 42.5 years old. The average years since joined the workplace are 4.8, and the plan participated years are 2.4 years. Mean account value is 4.9 million Won and distributes from 1 million Won (due to exclusion of under 1

million Won) and 99.9 million Won (due to exclusion of above 100 million Won).

The average share of risky assets is 0.472%, with a minimum of 0 and a maximum of 100%. Overall, the mean number of product changes per year is 0.033, and the 99th percentile number is also zero. This extreme inactive behaviour implies that it takes 30 years to change a product once

4.2. Regression models

Our raw data have the characteristics of the unbalanced panel; 207,836 participants (i) for an average of 2.02 years (T-bar), so total observations are 420,839 (N). We set two versions of model for individual's investment performance. In the first model, dependent variable is annual investment rates. We assume the participant's investment return model as follow,

$$R_{i,t} = \alpha + \beta X_{i,t} + \gamma Y_{i,t} + \gamma Z_{i,t} + u_i + \varepsilon_{i,t} \quad (2)$$

where i and t denote a panel entity and an observation time point, respectively. X is the vector of variables to the sponsor-level characteristics such as selected asset manager and plan type, business industry, employee size, and location area. Y is the vector of the participant-level characteristics such as gender, age, tenure, time participated plan, wage and account balance. Z is the vector of investment behaviour such as asset allocation and trading. u_i is an panel-specific effect and $\varepsilon_{i,t}$ is an idiosyncratic error term.

In the second model, to estimate the asset allocation equation, we put the share of risky assets as a dependent variable. Since risky asset allocations are restricted to be between 0 and 1, we use a tobit (censored regression) model as follow,

$$\text{RiskyAsset}_{i,t} = \alpha + \beta X_{i,t} + \gamma Y_{i,t} + \gamma Z_{i,t} + u_i + \varepsilon_{i,t} \quad (3)$$

where X and Y are the same vector with equation (2); in the case of Z, the asset allocation variable becomes the dependent variable. Error terms, u_i and $\varepsilon_{i,t}$, represent an participant - specific effect and random-error term, respectively.

To estimate model (2) and (3), we use ordinary least squares (OLS) regression; the pooled OLS estimator ignores the panel structure of our sample data, i.e., large number of panel

entities ($i=207,836$) and very few years ($t=2.02$). We test for independence using Breusch-Pagan Lagrangian Multiplier; the null hypothesis is that residuals across participants are not correlated. We fail to reject the null hypothesis, so use a pooled OLS with corrected standard errors. The robust standard errors are clustered on each participant in order to account for correlation across time for a given participant.

4.3. Regression results

First, we examine equation (2), and report on the results of analysis of investment performance as a function of asset allocation and trading behaviour, controlling both sponsor and participant-level characteristics. The sponsor-side factors such as asset manager, industry, size, and location have strong relationship to participants' investment returns. The most significant factor is asset managers (Provider). Participants belonging to sponsors who select 'Asset manager A' (code 1) have higher returns than those of participants with 'Asset manager B' (code 0). This finding is interesting in light of decision architecture within DC type plans. As a result of the selection of 'Asset manager B', some participants' returns employed at the workplace were lower than the others, i.e., not because of individual-level decision but sponsor-level choice. This result implies that the importance of sponsor's responsibility selecting a service provider.

The other participant-side factors also are strongly associated with the investment returns. For example, the returns of female are higher than those of male. In our sample, we find gender differences; female is better than male. The relationship between investment performance and gender varies depending on empirical analysis results. Our result supports the Bauer et al. (2007); confirm that females are more likely to be higher returns than males. On the other hand, Gan et al. (2015) do not find gender differences within superannuation products in Australia. Also, we find evidence of a U-shaped relationship between age and investment return. Regarding the tenure variables, the time of the participated plan has a greater effect on the rate of return than the service years in workplace. The wage, a proxy variable of income level, has a negative relationship with the rate of return. Contrary to the age variable, account balance size has an inverse U-shaped relationship with rate of return. The coefficients of year dummies show a downward trend in investment returns and they are all statistically significant at the 1% level. Here discuss the impact of asset allocation and

trading activities on investment performance. As expected, the percentage of risky asset has a positive effect on investment return. In addition, the magnitude of influence of risky assets was a greater than any other factor. Based on our analysis, the participants who were traders are likely to be higher returns than the individuals no trading.

In order to measure the effect of risky asset allocation, we regress the share of risky assets on the explanatory variables using equation (3). Table 5 presents the results of the regressions. The model shows a low pseudo- R^2 of 11.19%, but the joint significance of the explanatory variables is high (p -value=0.0000). Most of the observations are censored to the left ($n=418,839$), and the number of uncensored ($n=1,160$) and right-censored ($n=1,376$) observations are very small.

In the sponsor-level, the coefficient of service provider variable is significant at the significance level of 1%. Participants with ‘Asset manager B’ (code 0) offered less risky products (3 balanced funds and 0 equity fund) allocate less risky assets than participants belong to ‘Asset manager A’ (code 10 offered more rich risky assets (2 government funds, 4 balanced funds, and 2 equity funds). Our result is consistent with the previous study. Brown et al. (2007) report that the share of investment options in a particular asset class (i.e., company stock, equities, fixed income, and balanced funds) has a significant effect on aggregate participant portfolio allocation across these asset classes. Corporate IRP participants invest more in risky assets than their DC participants, and service industry employees' allocation in risky assets is higher than the manufacturing employees. Unexpectedly, participants employed with the larger workplace allocate less in risky assets. The participants working in the metropolitan area hold more risky assets than those of non-capital regions.

In the participant-level, females are more conservative than males like previous studies (Agnew et al., 2003; Hinz et al., 1997), but not statistically significant. Age and age square have positive and negative effect on the risky assets allocation, respectively. In our sample, there is an inverse U-relationship between age and risky asset holdings, but not statistically significant. The longer service (Tenure) and the longer participated (PlanTenure), the higher the proportion of risky assets, however, only the participated time is statistically significant. Contrary to the age variable, we find a U-shaped relationship between the account balance and the risky assets allocation, however, only a nonlinear relation is significant. The change of product (Trade), our interest variable, has a positive effect on the holding in risky assets.

This result implies that active investors tend to prefer risky assets. The coefficients of year dummies show a downward trend in risky asset allocation and they are all statistically significant at the 1% level. Despite the increasing years of plan participated, the preference for participants' risky assets has decreased.

5. Conclusions

In this paper, we examine participant investment behavior and investment performance of DC plans in small firms operated by KCOMWEL. We find that that participants of sample firms with relatively low-income and low wealth exhibit extreme risk avoidance in their pension management. This conservative asset allocation leads to lower investment returns; the annual rate of return on principal guaranteed products, on average, is only 1.22%. The case for investment performance on non-principal guaranteed products is not that different; as the annual rate of return for those are 1.36%, (only 0.14% higher than capital preservation products). In addition, we find that the average number of investment options is two from the investment menu with 8~14 option (of which there are 8~14) chosen by participants in small firms is two. Lastly, over the 97.5% of participants initiate no trades, exhibiting the high level of inertia.

KCOMWEL, a public institution, has started providing corporate pension services with the aim to facilitate small firms' participation in corporate pension plans. Relatively lower fees for management and administration work compared to other private pension providers make sponsor firms choose KCOMWEL for setting up their pension plans. However, it seems unlikely that workers better off with KCOMWEL, considering that the rate of investment returns of pension plans operated by KCOMWEL is similar to that of other pension providers and that there are no benefits (such as subsidies) to workers. To improve workplace pension scheme for employees in small firms, the Department of Employment and Labor has submitted government legislation with regard to establishing trust-based workplace pension schemes set by KCOMWEL, and this now pending in National Assembly. The main purpose of this is to achieve economy of scale, and improve efficiency and investment performance

by pooling assets and resources.

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