

SOCIAL SECURITY AND HOUSEHOLD SAVING IN KOREA: EVIDENCE FROM THE HOUSEHOLD INCOME AND EXPENDITURE SURVEY

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Using a quasi-experimental approach, the paper examines how the introduction of a social security system in Korea affects household saving. The relatively short history of social security in Korea provides an exogenous source of variations both in time-series and cross-section. For time-series variation, periods 1983 to 1987 and 1989 to 1991 are used in various combinations. For cross-sectional variation, government employees with special pension plan are used as control group. The paper finds that a social security system crowds out household saving. Estimates show that the effect of Korea's national pension on household saving ranges from -0.9 to -1.8 percentage points, and -1.4 percentage points on average. When the group-specific time trend is considered, the crowding-out effect is estimated as -3.4 percentage points to -9.3 percentage points, and -5.9 percentage points on average. The crowding-out effect might get larger as a social security system matures.

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I. INTRODUCTION

Korea has a relatively short history of social security system. The

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national pension system for the general public was introduced in 1988. Regarding the efficiency cost of the social security system, the effect of national pension on private saving, the degree to which the social security system crowded out private saving, theoretical models have generated ambiguous predictions. A substitution effect would reduce private saving while an induced retirement effect would increase private saving.

A simple two-period life-cycle model with no income in the second period predicts that an actuarially fair social security program crowds out private saving, but the magnitude of crowding-out is not dollar for dollar when there are borrowing constraints and negative net transfers (Feldstein and Liebman, 2001). When second-period income exists and labor supply is endogenous, the induced retirement effect offsets the crowding-out effect, making the effect on private saving ambiguous (Feldstein, 1974). The implications would be further complicated if precautionary motives and bequest motives for saving are considered. For instance, provision of old-age pensions would not affect precautionary savings to any great extent, but a social security system with survivor and disability components would reduce precautionary saving.

The ambiguous prediction of theoretical models has fueled a significant amount of empirical literature. Most of such empirical studies support the evidence for crowding-out effects, with various magnitudes. However, the estimates of various studies are not directly comparable due to the nature of the data and the specification of empirical models. Empirical studies on social security and private saving are often classified by methodological issues and the nature of the data as to whether it is time-series, cross-section, or cross-countries. Cross-sectional studies of social security and private saving have examined the relationship of private wealth to social security wealth, controlling for other factors such as income, age, education, and family structures (Feldstein and Pellechio: 1979, Gale: 1997).¹ Time-series studies have often examined the relationship of consumption to social security wealth (Feldstein: 1996, Munnell: 1974).

The calculation of social security wealth, however, often causes problems in estimation, since it is calculated based on predicted future

¹ The estimates of cross-sectional studies are from 0.38 to -1.67 and the estimates from time-series are very sensitive to empirical specification.

earnings which rely on information on educational attainment and age. Future benefits are calculated based on future earnings, using benefit formulas which have been frequently changed. Different discount rates used in calculation also cause quite different results and, hence, different implications for the impact of social security on private saving. For example, Leimer & Lesnoy (1982) found that time-series estimates depend on the calculation method of social security wealth. Another problem in identification with time-series data is that the estimates are quite sensitive to the chosen time period and to chosen of explanatory variables. On the other hand, cross-sectional specifications have the omitted variables issue that unobserved individual heterogeneity in saving behavior cannot be accounted for. The issue of unobserved individual heterogeneity may be crucial, since it is likely that individuals may have different dispositions toward savings.

Compared to the criticism for time-series and cross-sectional analysis, the relative strength of using quasi-experimental approach is that variations induced from the treatment are not correlated with individual-specific fixed effects. This approach can provide better identification of the estimates, especially when omitted variables or selection issues are present. In this sense, a quasi-experimental approach may provide better identification for the effect of social security on household savings. This paper uses quasi-experimental approach with repeated cross-section data in order to identify crowding-out effect of social security system. This paper consists of six sections. The second section presents previous literature on the crowding-out effect of a social security. The third section provides overviews on Korean social security system and saving rates. The fourth section starts with data description and discusses the identification strategy. The fifth section discusses the estimation results and the sixth section concludes.

II. PREVIOUS LITERATURE

Empirical studies show various results of the crowding-out effect of a social security system. Although most previous studies show that a social security system crowds out private saving, some researches (Barro, 1978; Leimer and Lesnoy, 1982; David and Menchick, 1985; Gullason et al,

1993) find no such evidence. Studies showing a negative impact on private saving vary in the magnitude of the crowding-out effect. The interpretation of the magnitude of such effect is not directly comparable in most cases, because it varies across different empirical model specification, background theoretical model, and methods of social security wealth estimation.

Most of cross-sectional studies analyze the impact of social security wealth on private wealth, while most of time-series researches analyze the impact of social security wealth on consumption. The interpretation of the estimated results of cross-sectional studies, hence, may differ from those of time-series studies. Also, different measures of social security wealth make results incomparable to each other. For example, Kotlikoff (1979) constructed social security wealth by subtracting present value of future payroll taxes and past payroll taxes, and included the present value of social security contributions paid in the past. The cross-sectional estimation using 1966 National Longitudinal Study was from an equation that combined the impact of social security benefits in excess of social security taxes paid. Kotlikoff (1979) showed that the overall crowding-out effect of social security is -13.2 percentage points, substantially different from estimates of other studies. The survey of Congressional Budget Office (1998) on 30 studies concludes that the best estimates from 14 cross-sectional studies imply the crowding-out effect between zero and -50 percentage points.

Feldstein (1974) predicted a crowding-out effect of -30 percentage points to -50 percentage points, based on a life cycle model with induced retirement effect. With aggregate U.S. data between 1929 and 1971, the paper analyzed the effect of social security wealth on aggregate consumption. Diamond and Hausman (1984) estimated that the social security wealth affected private wealth by -25 percentage points to -40 percentage points, using National Longitudinal Survey between 1966 and 1976. The estimation used the projected social security benefits instead of social security wealth calculation. Bernheim (1987) found that the social security wealth reduced private wealth by -77 percentage points to -137 percentage points, using the 1969 wave of the Longitudinal Retirement History Survey. He suggested that simple present value of future social

security benefit was often good enough to estimate the effect of social security on saving behavior. According to his study, actuarial valuation of social security benefit was not only inconsistent with pure life cycle theory, but also might understate the crowding-out effect of social security.

Leimer and Lesnoy (1982) replicated the research of Feldstein (1974), because of an earlier error in the calculation of social security wealth. They found no crowding-out effect with their corrected calculation, and a positive effect on saving with an alternative calculation of social security wealth. David and Menchik (1985) also found a positive effect on saving of 13 percentage points. They used probate inheritance records to analyze the crowding-out effect on wealth at time of death.

The few previous studies of a the social security system in Korea mostly show evidence of crowding-out. Using Daewoo Panel from 1993 to 1998, Lim and Moon (2003) estimated the effect of social security wealth on household asset ratio and consumption. They found that crowding-out effect was 61.8 percentage points for the household with special pension scheme and generally larger than the household under national pension scheme. The crowding-out effect of national pension was significant only for consumption equation. The magnitude of such effect was considerably small, but was significantly larger when severance pay was included in the social security wealth calculation.

Kang and Lim (2005) analyzed the effect of the payroll tax rate on saving, using the Household Income and Expenditure Survey from 1998 to 2002. Separate estimation on government employees and non-government employees showed larger estimates for non-government employees. They conclude that this implies the crowding-out effect is larger for government employees and less for non-government employees.

Nam (2008) examined the effect of a social security system on private saving with an overlapping generation model. He simulated the effect of a social security system on assets, income, consumption, saving and saving rates by age and earnings replacement ratio. The result implied that a social security system reduced average private saving rate by 19.59 % to 21.43 %. The paper also simulated the effect of government pension reform plan which includes the reduction of earnings replacement ratio

from 60% to 30%. The simulation result showed that the reduction of the earnings replacement ratio increased private capital stock by 2.3%, and increased total capital stock including government capital stock by 25.28%. The paper argued that the government pension reform plan reduced the size of crowding-out effect, and it may have increased aggregate saving by securing a national pension scheme.

III. SOCIAL SECURITY SYSTEM AND SAVING RATES IN KOREA

Funded by contributions that are equally shared between employees and employers, the Korean social security system can be classified as a partially funded defined-benefit system.² The social security system was implemented in 1988 following the enactment of the National Pension Act. Government officers, military personnel, and teachers had been covered by their own pension schemes since the 1960s, but the general public did not have pension plans beyond employer-based retirement allowances. Private pensions have an even shorter history, introduced only in 1994. Since its introduction, the social security system has experienced several changes and expansions. Table 1 briefly shows historical changes in the social security system. Expansion of the coverage and contribution rate of social security may induce a larger crowding-out effect.

Historical saving rates in Korea began to decline during the late 1980s. Figure 1 shows the aggregate saving rate from national accounts.³ Private saving rates move together with gross saving rates, as do individual saving rates. Park and Kim (2000) model savings rates as a piece-wise linear trend. Analyzing time-series aggregate data, they suggest that

² In terms of funding, if liabilities are allowed to exceed assets, the system is unfunded and classified as a pay as you go system. If the benefits are defined by the rules or formulas, the system is classified as a defined benefit system. The defined contribution system defines the benefit by individual contributions. For the Korean social security system, pension benefits are determined by a benefit schedule that roughly balances liabilities and assets. Some of the benefits, such as disabled and survivor benefits were actually paid out as soon as the program began, before revenues were collected. But generally, it is more appropriate to classify it as a partially funded system since old age pensions are close to those of a fully funded system.

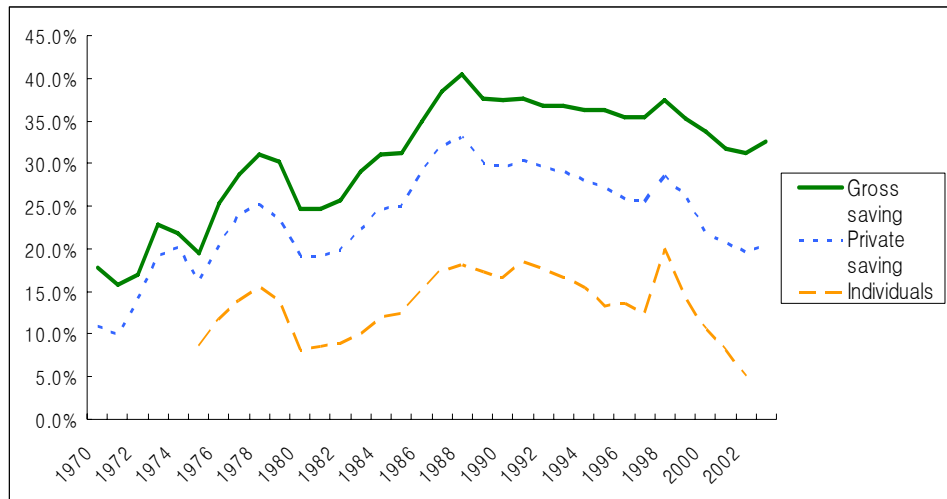
³ Previous studies also indicated that patterns of saving rates from micro-data sets do not differ substantially from those of macro data.

saving rates in Korea are a stationary time-series moving along the piecewise linear trend rather than a nonstationary random walk.

[Table 1] History of Social Security Law Changes

1960:	Implementation of Government Employees Pension Scheme
1963:	Implementation of Military Personnel Pension Scheme
1973:	Enactment of National Welfare Pension Act
1974:	Implementation of Private School Teachers Pension Scheme
1986:	Enactment of The National Pension Act
1988:	Implementation of The National Pension Act Coverage: employees in workplaces with more than 10 full-time employees Contribution rate: 3%.
1992:	Expansion of mandatory coverage to the employed in workplaces with 5 to 9 full-time employees
1993:	Increase in contribution rate to 6%
1995:	Expansion of mandatory coverage to the farmers, fishermen, and all residents in rural area
1998:	Increase in contribution rates to 9%
1999:	Expansion of mandatory coverage to residents in urban area.
2001:	Expansion of coverage to employees in workplaces with more than 1 full-time employees

[Figure 1] Saving Rates (1970-2003)



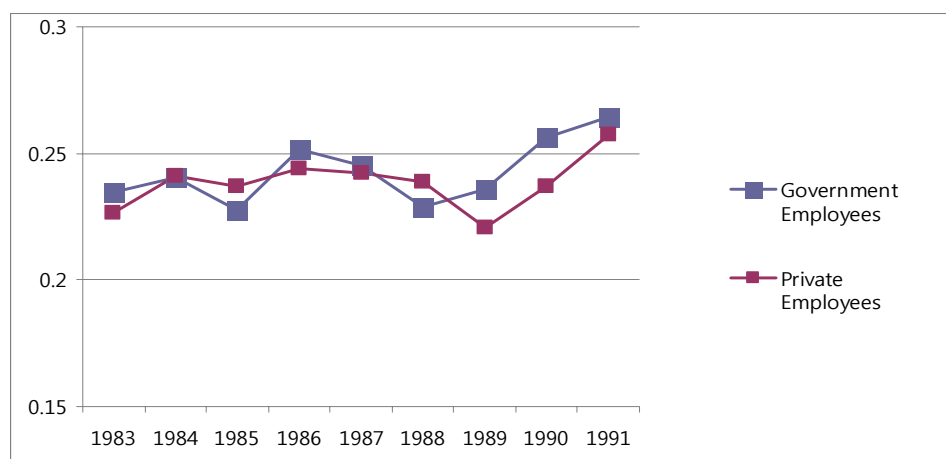
Source: Bank of Korea, National Account.

As for factors affecting the saving rates, previous studies consider liquidity constraints, housing market conditions, consumption patterns,

and demographic patterns as factors explaining the decline in saving rates in the 1990s. Park and Kim (2000) suggests that weaker liquidity constraints, savings for housing, changes in consumption and changes in demographic patterns may have caused the decline in saving rates in the 1990s. Park and Lee (1997) suggests changes in the fertility rate, changes in the costs of raising children and other demographic factors may have led to rapid increases in saving rates before then. Previous studies conclude that the pattern of saving rates is not fully explained by changes in age or income.

If is difficult to disentangle the effect on the social security system from changes in the saving rate from other macroeconomic changes. But, the quasi-experimental approach can help identify these effects separately, provided that there is no group- specific time trend in the saving rate. But the saving rates of a control group have a different time trend, then it is hard to identify a crowding-out effect with difference-in-difference estimation. Figure 2 shows that the time trend of government employees. (the control group) This issue in identification will be handled in the next chapter.

[Figure 2] Saving Rates of Treatment Group and Control Group



IV. DATA AND IDENTIFICATION

1. Data

This paper uses the Household Income and Expenditure Survey to analyze the effect of introducing the social security system on household saving rates. The Household Income and Expenditure Survey has surveyed about 5,200 households monthly, tabulating and releasing the data quarterly.⁴ The data represent households residing in cities, excluding fishermen, farmers, one-person households and households whose income and expenditures are difficult to calculate, such as households which run restaurants, inns or boarding houses, and households with two or more employees. The survey includes household type, household size, number of income-earners, sex, age, educational attainment, industry, occupation of head of household and spouse, items concerning other household members such as relationship to household head, sex, age, activity status, yearly household income and expenditure, type of living quarters, number of automobiles, etc. Table 2 presents the definition and summary statistics of the variables used in the analysis.

The data used in the analysis is household level data. The definition of income used in the paper is household disposable income, subtracting tax payment and social insurance payments from gross income which includes wages, business profits, interest income, dividends, and private and public transfer income. The saving rate is defined as the portion of household saving out of disposable income.⁵ Saving each portion is calculated by deducting household expenditure from disposable income. Household expenditure includes consumption on durable goods and services, other expenditure such as interest payment, and private transfer

⁴ The survey began from 1963, but household level data have been available only since 1982. For prior years, the survey provides only aggregate data for each questionnaire. The survey uses the census sample enumeration districts (ED's) as the primary sampling units and the segments as the secondary sampling units. Among the census sample ED's, 447 sample ED's were selected, leading to the self-weighting sample of households less than 5,200 households for earlier surveys. For example, about 3,700 households are surveyed in 1983 monthly survey, and 4,410 households are surveyed in the 1988 survey.

⁵ I dropped the observations of less than -100% of saving rates since it is non-sensible and it is doubtful whether respondents report their true income and consumption. I also dropped negative disposable income all making saving rates non-negative.

to acquaintances.

[Table 2] Variable Description and Summary Statistics

Variable Name	Description	Mean (1985-1987, 1989-1991)	
		Government Employees	Private Sector Employees
<i>Independent Variable</i>			
Saving rate	Household saving out of disposable income	0.246 (0.311)	0.239 (0.314)
<i>Dependent Variables</i>			
dtr	dummy variable for treatment group, D_j (1 =private sector employees, 0 = government employees)	0 (0)	1 (1)
dtryr	dummy variable for treatment year, D_t (1=after 1988, 0=before 1988)	0.526 (0.499)	0.505 (0.5)
dd	dummy variable for treatment year and treatment group, $D_j D_t$	0 (0)	0.505 (0.5)
Age	Age	38.66 (8.16)	34.32 (7.73)
Age2	age squared	1,561 (645)	1,238 (563)
Female	dummy variable for female (1 = female, 0 = male)	0.062 (0.24)	0.115 (0.318)
<2 yrs old	number of children who are less than 2 years old	0.25 (0.499)	0.312 (0.52)
Elementary school	number of children who attend elementary school	0.854 (0.994)	0.582 (0.856)
High school	number of children who attend high school	0.537 (0.833)	0.365 (0.714)
Supported elderly	number of the supported elderly	0.157 (0.43)	0.174 (0.456)
Home ownership	dummy variable for homeownership (1=owner, 0 = wol-sae, jeon-sae)	0.581 (0.493)	0.484 (0.499)
Rent	Dummy variable for 2 year lease deposit, jeon-sae (1= jeon-sae, 0= others)	0.309 (0.462)	0.347 (0.476)
Salary	wages	864,988 (495,275)	782,033 (562,770)
N		18,510	50,258

Notes: Summary statistics shown are based on monthly data.
Standard errors are presented in parenthesis.

2. Identification

To identify the effect of social security on household saving rates, this paper uses a quasi-experimental approach, using both time-series and cross-sectional variation. The introduction of the social security system in 1988 provides an exogenous time-series variation. Those who had previously been covered by their own pension program provide exogenous cross-sectional variations. For time-series variation, 1989 is chosen as the treatment year, and 1985-1987 are chosen as a control period. To see if the effect of treatment differs across time periods, I choose an alternative time span of 1983-1985 as a control period. I also use the treatment years of 1989-1991 and test the sensitivity of the results depending on the time span chosen.

For cross-sectional variation, private-sector employees who became eligible through their workplace after 1988 are selected as treatment group. Government employees who had had their own pension plan and were not affected by the national pension are selected as a control group for private-sector employees. Laborers, the self-employed and temporary workers are excluded in the analysis because they were not eligible for the national pension scheme in 1988. It is likely that they differ considerably from government employees and private-sector employees with respect to income, demographic characteristics and disposition to save. For both the treatment group and control group, I confine the sample to individuals who were under 55 years old in 1988. Those who were older than 55 in 1988, 56 in 1989, and 54 in 1987, etc. are not eligible for the national pension or for reduced pension benefits.

Ideally, treatment groups and control groups need to be similar so that the impact of the treatment event will not affect each group in systematically different ways. However, it is not easy to find an appropriate control group that is nearly random. One of the problems in identification for this study is that the treatment group and the control group cannot be considered as homogeneous groups. As seen in the summary statistics in Table 2, government employees are older, have higher salaries, older children and include more home-owners.

Saving rates of the two groups were not significantly different before 1988, but were significantly different after 1988. The hypothesis that the

saving rates of two groups are the same for the period 1982-1991 is rejected, while it is accepted before 1988. On average, government employees show higher saving rate than private employees. This finding is surprising because government employees who had been covered by their own pension plan may save less than private employees who had not been covered by national pension plan, all other things being equal. One possible explanation for this is that the propensity to save is higher for government employees than private-sector employees. Another possible explanation is that government employees have higher income on average. Since this paper defines the saving rate according to consumption expenditure. To handle this problem, I use a regression framework for difference-in-difference which controls for income, and other group-specific factors affecting saving rates.

Another problem in using government employees as a control group is that they may be differently affected by macroeconomic shock before the introduction of national pension. Figure 2 shows that the saving rate of the government employees may differently respond to macroeconomic shocks, at least before 1988. The saving rate of the private sector employees had been relatively constant before 1988, suggesting that private sector employees without a pension plan smoothed their consumption expenditure over time, while government employees did not. It is also possible that government employees responded to the amendment of government employee pension law in 1983, 1985, 1988 and 1991. These amendments, however, did not involve changes in the contribution rate or benefits, but mainly established the Government Employees Pension Services, the defined the period of services, and established a survivor's benefit. Regardless, the data show that there may be a group-specific time trend in the saving rate. To check the difference-in-difference estimates, I add group-specific time trend in the regression framework.

Other individual factors such as age, income, the number of children in different cohorts, the number of the supported elderly, and homeownership are considered as well. Household saving rates may differ by age group and income distribution. For example, different child care costs may affect household consumption patterns and saving rates.

Families who need to care for the elderly may have lower saving rates due to higher living costs. Home-owners may need fewer saving for housing purchase than renters.

With consideration of all these factors, the regression framework for difference-in-difference estimation (DID) can be written as follows:

$$S_{it} = \alpha + \alpha_1 D_t + \alpha_2 D_j + \beta D_j D_t + \delta X_{it} + \varepsilon_{it} \quad (1)$$

where S_{it} is saving rates of household i at time t , D_t is time dummy variables, D_j is treatment group dummy variables, X_{it} is a vector of individual characteristics of household i at time t . X_{it} includes salary, children under 2 years old, children 2-5 years old, children who attend elementary school, children who attend high school, number of the supported elderly, home ownership, and rental status.⁶ Educational attainment is not included because data for some earlier years is lacking. The coefficient of interest, β , is difference-in-difference estimator. Negative β implies that social security decreases saving rates. Table 2 presents the definition and summary statistics of the variables.

Savings by precautionary motive and bequest motive may also differ according to individual, income group, and age cohort. Higher-income groups may have higher propensity to bequest compared to lower-income groups. I consider saving due to precautionary motives and bequest motives to be individual characteristics that are not easily observed. Difference-in-difference estimation handles the problem of unobserved individual heterogeneity and the omitted variables issue.

Still other limitation in identification remains. Since the data does not convey information on firm size for private-sector employees, it is possible that private-sector employees may include ineligible employees whose workplace has fewer than 10 employees. This may underestimate the estimated crowding-out effect of a social security by adding those who were not affected by the introduction of social security. According to

⁶ Three general types of homeownership in Korea are homeowner, jeon-sae and wol-sae. Jeon-sae is most popular type of homeownership in Korea, similar to long-term lease with deposit. The deposit amount depends on school district and location, but generally about 20%~40% of the price of the house. Usual contract term is 2 years. Wol-sae literally means monthly rent, usually considered as the type of homeownership of relatively lower income household.

the first wave of the Korean Labor and Income Panel Study (KLIPS) in 1998, the percentage of the private employees of the firms that hired less than 10 workers and the self-employed younger than 55 was 28.26%. According to the Economically Active Population Survey, the self-employed consisted of 28.2%. Considering the fact that the treatment group in this paper does not include the self-employed, the size of the underestimation could be smaller than expected.

[Table 3] Difference-In-Difference Estimates of Impact on Saving

	Before national pension	After national pension	Time difference for groups
A.	1985-1987	1989	
Private Sector Employee (<55 yrs old)	0.242 (0.308) [0.286]	0.219 (0.324) [0.271]	-0.022 (0.447)
Government Employee (<55 yrs old)	0.241 (0.311) [0.290]	0.233 (0.314) [0.291]	-0.009 (0.442)
Group difference	0.001	-0.014	
Difference-in-difference		Mean:	-0.014 (0.629)
		Median:	-0.014
B.	1983-1985	1989	
Private Sector Employee (<55 yrs old)	0.239 (0.311) [0.280]	0.219 (0.324) [0.272]	-0.020 (0.449)
Government Employee (<55 yrs old)	0.237 (0.324) [0.293]	0.233 (0.314) [0.291]	-0.004 (0.451)
Group difference	0.002	-0.014	
Difference-in-difference		Mean:	-0.015 (0.636)
		Median:	-0.006

Notes: Standard errors are shown in parenthesis. Median is shown in [].

Time differences for groups are rounded to 3 digits. Difference-in-difference is not exactly the same as the differences between two groups' time differences due to rounding off.

V. ESTIMATED RESULTS

Table 3 presents the simple difference-in-difference estimates without controlling for individual characteristics. When choosing 1985-1987 as a control period, private sector employees reduced their saving rates by -2.2 percentage points. Government employees reduced their saving rates by -0.9 percentage point. The effect of the introduction of the national pension system on household saving is measured as -1.4 percentage points. When choosing the different time span of 1983-1985 as the control period, the impact on saving rates shows a similar magnitude of -1.5 percentage points. Median saving rates are also compared across groups and time spans, and analysis reveals that they do not differ from mean saving rates by any great magnitude. However, when the 1983-1985 period is considered, the median estimate of -0.6 percentage points, is markedly smaller than the mean estimate of -1.5 percentage points.

However, this simple difference-in-difference estimator may not take into account other individual factors affecting saving rates. Table 4 shows the regression estimates with additional individual characteristics using 1985-1987 as a control period, and Table 5 shows the regression estimates using 1983-1985 as a control period. In both tables, the first column presents estimates using 1989 as a treatment period, and the second two columns show the estimates using 1989-1990 and 1989-1991, respectively. Table 4 shows that the estimates for the second interaction term, β , range from -0.9 to -1.8 percentage points, and -0.9 to -1.5 percentage points in median regression. Table 5 shows that when 1983-1985 is used as control years, the estimates of interest range from -1.2 to -1.7 percentage points. Estimates from median regression are quite sensitive to control years chosen. When 1983-1985 is chosen as control years, the estimates are not statistically significant. As treatment years expand to include 1990 and 1991, the size of the estimated effects on savings tends to decrease. On average, the effect of the national pension on household saving is -1.4 percentage points.⁷ Considering the possibility that private-sector employees may include ineligible workers

⁷ The contribution rate of Korea's national pension was 3% for 1989-1991. In the sample, wages and salaries consist of 95% of disposable income. It implies that about 2.85% out of disposable income is workers' contribution to the national pension.

whose workplace does not meet the entitlement, the estimated results may underestimate actual effect on household saving.

[Table 4] Estimation Results (1985-1987 as control years)

	1985-1987, 1989		1985-1987, 1989-1990		1985-1987, 1989-1991	
	Mean Regression	Median Regression	Mean Regression	Median Regression	Mean Regression	Median Regression
dtr	-0.015*** (0.004)	-0.021*** (0.004)	-0.018*** (0.004)	-0.024*** (0.004)	-0.020*** (0.004)	-0.025*** (0.004)
dtryr	-0.073*** (0.006)	-0.063*** (0.007)	-0.076*** (0.005)	-0.061*** (0.006)	-0.078*** (0.005)	-0.065*** (0.004)
dd	-0.018** (0.007)	-0.015** (0.008)	-0.013** (0.006)	-0.014** (0.006)	-0.009* (0.005)	-0.009* (0.005)
age	-0.008*** (0.002)	-0.011*** (0.002)	-0.010*** (0.002)	-0.013*** (0.002)	-0.011*** (0.001)	-0.014*** (0.001)
age2	0.00004 (0.00003)	0.00007** (0.0003)	0.0001** (0.00002)	0.0001*** (0.00003)	0.0001*** (0.00002)	0.0001*** (0.00002)
female	-0.033*** (0.006)	-0.053*** (0.006)	-0.024*** (0.005)	-0.042*** (0.006)	-0.022*** (0.005)	-0.037*** (0.005)
<2 yrs old	0.0003 (0.003)	-0.007** (0.003)	0.0002 (0.003)	-0.007** (0.003)	0.001 (0.003)	-0.004 (0.003)
Elementary school	-0.007*** (0.002)	-0.011*** (0.002)	-0.007*** (0.002)	-0.011*** (0.002)	-0.009*** (0.002)	-0.011*** (0.002)
High school	-0.032*** (0.002)	-0.031*** (0.002)	-0.037*** (0.002)	-0.035*** (0.002)	-0.040*** (0.002)	-0.039*** (0.002)
Supported elderly	-0.025*** (0.003)	-0.027*** (0.003)	-0.025*** (0.003)	-0.028*** (0.003)	-0.022*** (0.003)	-0.024*** (0.003)
Home ownership	-0.0003 (0.004)	0.001 (0.004)	-0.003 (0.004)	0.004 (0.004)	-0.008** (0.003)	-0.0003 (0.003)
Rent	0.064*** (0.004)	0.060*** (0.005)	0.067*** (0.004)	0.067*** (0.004)	0.060*** (0.003)	0.063*** (0.003)
Salary	0.002*** (0.00004)	0.002 (0.00004)	0.002*** (0.00003)	0.002*** (0.00004)	0.002*** (0.00002)	0.002*** (0.00002)
Constant	0.349*** (0.035)	0.466*** (0.037)	0.402*** (0.031)	0.508*** (0.035)	0.436*** (0.027)	0.545*** (0.027)
N	45,255		57,049		68,732	
R ²	0.101		0.1037		0.1069	

Notes: The dtr represents treatment group dummy variable, dtryr represents treatment year dummy variables, and dd represents the interaction between treatment year and treatment group (difference-in-difference estimator).

Robust standard errors are presented in the parenthesis, using Huber/White/Sandwich estimator.

* <.1, ** <.05, *** <.001.

[Table 5] Estimation Results (1983-1985 as control years)

	1983-1985, 1989		1983-1985, 1989-1990		1983-1985, 1989-1991	
	Mean Regression	Median Regression	Mean Regression	Median Regression	Mean Regression	Median Regression
dtr	-0.018*** (0.004)	-0.034*** (0.004)	-0.021*** (0.004)	-0.037*** (0.005)	-0.023*** (0.004)	-0.038*** (0.004)
dtryr	-0.095*** (0.007)	-0.093*** (0.006)	-0.093*** (0.005)	-0.089*** (0.006)	-0.092*** (0.005)	-0.087*** (0.005)
dd	-0.017** (0.007)	-0.006 (0.007)	-0.012** (0.006)	-0.001 (0.007)	-0.008 (0.005)	0.001 (0.006)
age	-0.0004 (0.002)	-0.002 (0.002)	-0.005** (0.002)	-0.007*** (0.002)	-0.007*** (0.001)	-0.010*** (0.002)
age2	-0.00007** (0.00003)	-0.0001* (0.00002)	-0.00001 (0.00002)	0.00002 (0.0000003)	0.00003 (0.00002)	0.0001** (0.00002)
female	-0.036*** (0.006)	-0.033*** (0.006)	-0.025*** (0.005)	-0.029*** (0.006)	-0.022*** (0.005)	-0.026*** (0.005)
<2 yrs old	-0.0003 (0.003)	0.002 (0.003)	0.0002 (0.003)	0.0002 (0.003)	0.001 (0.003)	0.0001 (0.003)
Elementary school	-0.012*** (0.002)	-0.017*** (0.002)	-0.010*** (0.002)	-0.014*** (0.002)	-0.012*** (0.002)	-0.015*** (0.002)
High school	-0.025*** (0.002)	-0.025*** (0.002)	-0.033*** (0.002)	-0.033*** (0.002)	-0.038*** (0.002)	-0.039*** (0.002)
Supported elderly	-0.012*** (0.003)	-0.015*** (0.003)	-0.015*** (0.003)	-0.020*** (0.003)	-0.013*** (0.003)	-0.016*** (0.003)
Home ownership	-0.015*** (0.005)	-0.008* (0.005)	-0.015*** (0.003)	-0.0001 (0.005)	-0.017*** (0.004)	-0.007 (0.004)
Rent	0.063*** (0.005)	0.066*** (0.005)	-0.014*** (0.004)	0.073*** (0.005)	0.059*** (0.004)	0.065*** (0.004)
Salary	0.003*** (0.00004)	0.003*** (0.00004)	0.002*** (0.00003)	0.002*** (0.00004)	0.002*** (0.00003)	0.002*** (0.00003)
Constant	0.239*** (0.037)	0.315*** (0.036)	0.327*** (0.031)	0.430*** (0.035)	0.387*** (0.028)	0.492*** (0.030)
N	40,015		51,809		63,492	
R ²	0.1007		0.1028		0.1063	

Notes: The dtr represents treatment group dummy variable, dtryr represents treatment year dummy variables, and dd represents the interaction between treatment year and treatment group (difference-in-difference estimator).

Robust standard errors are presented in the parenthesis, using Huber/White/Sandwich estimator.

* <.1, ** <.05, *** <.001.

[Table 6] Alternative Difference-in-Difference Estimates with Group-Specific Time Trend

		dtr		dtryr		dd		group-specific trend
1985-1987, 1989	Mean	-0.015***	(0.004)	-0.073***	(0.006)	-0.018**	(0.007)	No
	Regression	-0.045**	(0.016)	-0.052***	(0.013)	-0.04**	(0.013)	Yes
	Median	-0.021***	(0.004)	-0.063***	(0.007)	-0.015**	(0.008)	No
	Regression	-0.048**	(0.016)	-0.044***	(0.013)	-0.034**	(0.014)	Yes
1985-1987, 1989-1990	Mean	-0.018***	(0.004)	-0.076***	(0.005)	-0.013**	(0.006)	No
	Regression	-0.058***	(0.014)	-0.044***	(0.013)	-0.044***	(0.013)	Yes
	Median	-0.024***	(0.004)	-0.061***	(0.006)	-0.014**	(0.006)	No
	Regression	-0.063***	(0.016)	-0.033**	(0.015)	-0.041**	(0.015)	Yes
1985-1987, 1989-1991	Mean	-0.020***	(0.004)	-0.078***	(0.005)	-0.009*	(0.005)	No
	Regression	-0.071***	(0.012)	-0.028**	(0.011)	-0.059***	(0.012)	Yes
	Median	-0.025***	(0.004)	-0.065***	(0.004)	-0.009*	(0.005)	No
	Regression	-0.076***	(0.011)	-0.016	(0.011)	-0.059***	(0.012)	Yes
1983-1985, 1989	Mean	-0.018***	(0.004)	-0.095***	(0.007)	-0.017**	(0.007)	No
	Regression	-0.035***	(0.010)	-0.053***	(0.022)	-0.06**	(0.022)	Yes
	Median	-0.034***	(0.004)	-0.093***	(0.006)	-0.006	(0.007)	No
	Regression	-0.061***	(0.010)	-0.033	(0.022)	-0.066**	(0.022)	Yes
1983-1985, 1989-1990	Mean	-0.021***	(0.004)	-0.093***	(0.005)	-0.012**	(0.006)	No
	Regression	-0.042***	(0.009)	-0.037*	(0.021)	-0.068***	(0.021)	Yes
	Median	-0.037***	(0.005)	-0.089***	(0.006)	-0.001	(0.007)	No
	Regression	-0.063***	(0.009)	-0.021	(0.023)	-0.07**	(0.023)	Yes
1983-1985, 1989-1991	Mean	-0.023***	(0.004)	-0.092***	(0.005)	-0.008	(0.005)	No
	Regression	-0.051***	(0.007)	-0.012	(0.018)	-0.089***	(0.018)	Yes
	Median	-0.038***	(0.004)	-0.087***	(0.005)	0.001	(0.006)	No
	Regression	-0.072***	(0.008)	0.007	(0.019)	-0.093***	(0.019)	Yes

Notes: Only the estimates for the variables of interest are shown. The estimates of other explanatory variables with controlling for group-specific time trend show similar patterns as those without controlling for group-specific time trends.

The dtr represents treatment group dummy variable, dtryr represents treatment year dummy variables, and dd represents the interaction between treatment year and treatment group (difference-in-difference estimator).

Robust standard errors are presented in the parenthesis, using Huber/White/Sandwich estimator.

<.1, ** <.05, *** <.001.

Estimates on treatment years (*dtryr*) and the treatment event (*dtr*) are all negative, indicating that the introduction of the national pension reduces household saving rates. Having a child is not statistically significant, while the signs show that it increases saving rates. Children who attend elementary school and high school decrease household saving rates. The effect is greater for older children than younger children. Home owners appear to save less, while renters save more. As in the previous studies using the Household Income and Expenditure survey, these estimates show the same effect of the costs of raising children and home ownership on saving rates.

Table 6 shows the difference-in-difference estimates with group-specific time trend. When group-specific time trend is included in the regression framework, the main implication for crowding-out effect of a social security remains intact. The magnitude of the crowding out effect, though, tends to getting larger with group-specific time trend. Most of the cases, the p-value for the difference-in-difference estimates are improved. The significance of the estimates of median regression and mean regression are improved, and the size of the estimates gets similar to the estimates of mean regression.

With 1985-1987 as the control years, the estimates are from -3.4 percentage point to -5.9 percentage point. With 1983-1985 as the control years, the estimates are from -6 percentage point to -9.3 percentage point. The crowding-out effect is getting larger as time passes after the introduction of a social security, and as time-series variation of the remote years is chosen. The best estimate is appeared to be 1985-1987 as control years and 1989-1991 as treatment years, which includes closer years for control and treatment years, and more than one years for treatment and control years. The mean regression and median regression gives the same estimates up to the three decimal points. The result implies that a social security decreases household saving rates by -5.9%.

The magnitude of crowding-out effect in this paper is much smaller than previous literature of approximately zero to -50 percentage point. The main reason for small crowding-out effect is that the paper estimates the crowding-out effect when a social security is introduced. Most of previous literature, in fact, estimated the effect of very mature social

security in the United States. Lim and Moon (2003) also found that crowding-out effect of national pension is considerably small, while that of special pension is 61.8%.

VI. CONCLUSIONS

This paper has examined how the introduction of a social security system in Korea has affected household saving rates using a quasi-experimental approach. The relatively recent introduction of a social security system in Korea provides an exogenous source of variations both in time-series and cross-section. The estimates show that the effect of the national pension plan on household saving ranges from -0.9 to -1.8 percentage points, and -1.4 percentage points on average. When the group-specific time trend is considered, the crowding-out effect is estimated as -3.4 percentage point to -9.3 percentage point, and -5.9 percentage point on average. It suggests that the social security system crowds out household saving. The crowding-out effect is smaller than literature of the United States, since it is estimated just after the introduction of a social security in Korea. As a social security system matures, the magnitude of the crowding-out effect might get larger. After the introduction of a social security, there had been many amendments of social security law, including expansion of social security to the general public and changes in contribution rate, etc. Future research topic can be explored, using various amendments of social security law in later years.

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